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CONTENTS OF VOLUME LXXII

INDEX

No separate index is included in the volume. Each number is indexed separately. Contents of the volume are listed in the beginning of the volume.

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Vol. 72

No. 296

THE DISPARID INADUNATE SUPERFAMILIES HOMOCRINACEA AND CINCINNATICRINACEA (ECHINODERMATA: CRINOIDEA), ORDOVICIAN-SILURIAN, NORTH AMERICA

By

J. Warn and H. L. Strimple

1977

Paleontological Research Institution
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May 31, 1977

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Ithaca, New York 14850, U.S.A.

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CONTENTS

TABLE

TEXT-FIGURES

THE DISPARID INADUNATE SUPERFAMILIES HOMOCRINACEA AND CINCINNATICRINACEA (ECHINODERMATA: CRINOIDEA), ORDOVICIAN-SILURIAN, NORTH AMERICA

J. Warn[1] and H. L. Strimple[2]

ABSTRACT

The discovery that *Heterocrinus heterodactylus* Hall, type species of *Heterocrinus* Hall, 1847, is unrecognizable necessitates new names for crinoid taxa formerly placed in *Heterocrinus* and in the superfamily *Heterocrinacea.* The new genus *Cincinnaticrinus* is erected to accommodate the new species *C. varibrachialus.* The new superfamily Cincinnaticrinacea essentially replaces the Heterocrinacea (*nom. trans.* Ubaghs, 1953, *ex* Heterocrinidae Zittel, 1879). Revision of this superfamily and the related Homocrinacea has enabled elimination of many superfluous taxa, the establishment of numerous lectotypes and lectoparatypes, more accurate geographic and stratigraphic ranges for the remaining species, and consistent diagnoses and descriptions of well-established taxa. The new family Cincinnaticrinidae (= Heterocrinidae Zittel, 1879) is divided into two new subfamilies, the Cincinnaticrininae (including *C. varibrachialus,* n. sp., *C. pentagonus* (Ulrich), *Dystactocrinus constrictus* (Hall), *Isotomocrinus tenuis* (Billings), *I. minutus* Kolata, *Ohiocrinus laxus* (Hall), and *O. brauni* Ulrich, and Atopocrininae (*A. priscus* Lane). The family Homocrinidae Kirk, 1914, is also divided into two new subfamilies, the Homocrininae (for *Homocrinus parvus* (Hall), *Ectenocrinus simplex* (Hall), *E. geniculatus* (Ulrich), *Apodasmocrinus punctatus* (Brower and Veinus), *A. daubei,* n.g., n. sp., *Ibexocrinus lepton* Lane, and *Sygcaulocrinus typus* Ulrich) and Daedalocrininae [containing only *Daedalocrinus bellevillensis* (Billings)]. Possible phylogenies and the paleoecology of the included species are discussed; it is concluded that crinoids with lichenocrinid-type bases were probably effectively eleutherozoic.

INTRODUCTION

Current concepts of the disparid inadunate crinoid families Heterocrinidae and Homocrinidae (elevated to superfamilies by Ubaghs, 1953) date essentially from Ulrich (1925). The forthcoming crinoid section of the Treatise on Invertebrate Paleontology will include few changes: the Treatise will incorporate two new genera, *Atopocrinus* (a heterocrinid) and *Ibexocrinus* (a homocrinid), described by Lane (1970) and placed by him in those families; and the Treatise will characterize the genus *Heterocrinus* as having isotomous rather than heterotomous branching, as it was defined by Ulrich (1925, p. 84) and others (Wachsmuth and Springer, 1886, p. 207; Wachsmuth, 1900, p. 152; Grabau and Shimer, 1910, p. 502; Springer, 1911, p. 27; Springer, 1913, p. 212; Moore and Laudon, 1944, p. 149; and Warn, 1973, p. 12). Ulrich (1925) apparently based his study on small numbers of specimens (for some species, on from one to a few). Modern treatment, with examination of large numbers of specimens and attention to intraspecific variation, appears necessary.

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Additionally major nomenclatural changes are needed because *Heterocrinus heterodactylus* (type species of *Heterocrinus*) is unrecognizable and the name must be restricted to Hall's (1847) type specimens (from New York strata). Thus, new names must be given to taxa from strata in and around Cincinnati, Ohio, formerly attributed to *Heterocrinus* and *H. heterodactylus* (the authors choose the new names *Cincinnaticrinus* and *C. varibrachialus* for these taxa); and, because *Heterocrinus* is the type genus of the familial taxa Heterocrinidae and Heterocrinacea, new names must also be applied to these taxa (designated respectively, Cincinnaticrinidae and Cincinnaticrinacea herein).

Study of Cincinnaticrinacea and Homocrinacea has been particularly facilitated by taking advantage of the large collections of these crinoids at the University of Cincinnati. Type species of six (*Heterocrinus, Atyphocrinus, Dystactocrinus, Ohiocrinus, Ectenocrinus,* and *Drymocrinus*) of the 11 genera placed by Ulrich (1925) in the Heterocrinidae and Homocrinidae have been reported to occur in Cincinnatian strata in and around Cincinnati, Ohio, and they are well represented in existing collections. Of the remaining five genera, two were first described from the Hull Limestone, Kirkfield, Ontario, (*Isotomocrinus* and *Daedalocrinus*), one (*Sygcaulocrinus*) from the Fort Atkinson Member of the Maquoketa Formation of Iowa, one (*Columbicrinus*) from the Lebanon Limestone of Tennessee, and one (*Homocrinus*) from the Rochester Shale of New York. The Kopf Collection at Cincinnati is one of the finest North American echinoderm collections and contains hundreds of Kirkfield crinoids. Thus, large numbers of cincinnaticrinids and homocrinids are housed in the University of Cincinnati Geology Museum and in other Cincinnati area museums. Finally, large pockets of *Cincinnaticrinus varibrachialus* (type species of *Cincinnaticrinus*) and *Ectenocrinus simplex* (type species of *Ectenocrinus*) have recently been discovered in the area.

Most of this work has been drawn from Warn's Ph.D. dissertation (University of Cincinnati, 1974) entitled "The disparid crinoid superfamilies Homocrinacea (Ord.-Sil.) and Cincinnaticrinacea (Ord.)". Incorporation of subsequently published data and interpretations have been made by Strimple. The authors, however, concur and share responsibility for the entire study.

ACKNOWLEDGMENTS

The authors thank Kenneth E. Caster, University of Cincinnati, who allowed the senior author free use of his personal library and gave advice on preparation of the manuscript. Thanks are also due R. A. Davis, who offered suggestions on taxonomy and nomenclature; E. A. Dalvé, who draughted Text-figures 2 and 13; K. L. Derstler, J. F. Gastright, and W. H. White for donation, or loan, of specimens for study; and the following individuals and their respective institutions for loan of specimens: R. L. Batten and N. D. Newell, American Museum of Natural History; R. P. S. Jefferies and H. G. Owen, British Museum (Natural History); E. S. Richardson, Field Museum of Natural History; T. E. Bolton, Geological Survey of Canada; J. H. Marak and J. K. Pope, Department of Geology, Miami University; B. H. Kummel, Museum of Comparative Zoology, Harvard University; B. M. Bell, New York State Museum; S. M. Bergström, Orton Museum, Ohio State University; J. S. Lawless and K. A. Waage, Peabody Museum of Natural History, Yale University; John Monteith, Royal Ontario Museum; F. J. Collier, P. M. Kier, and Thomas Phelan, United States National Museum; and R. A. Davis, University of Cincinnati Geology Museum. We also thank Mrs. Olive Daube, Sam Daube, and Jim Manton, manager of the Daube Ranch Company, for allowing access to the exposure from which *Apodasmocrinus daubei*, n.g., n. sp. is described. We are indebted to Mr. T. J. Frest, The University of Iowa, for assistance in incorporating current data from published and unpublished studies as well as for editing assistance. The final typescript was prepared by Mrs. Jan Thein, The University of Iowa. Finally, a NDEA summer research grant (1972) to the senior author made possible, in part, necessary travel and purchase of supplies.

REPOSITORIES

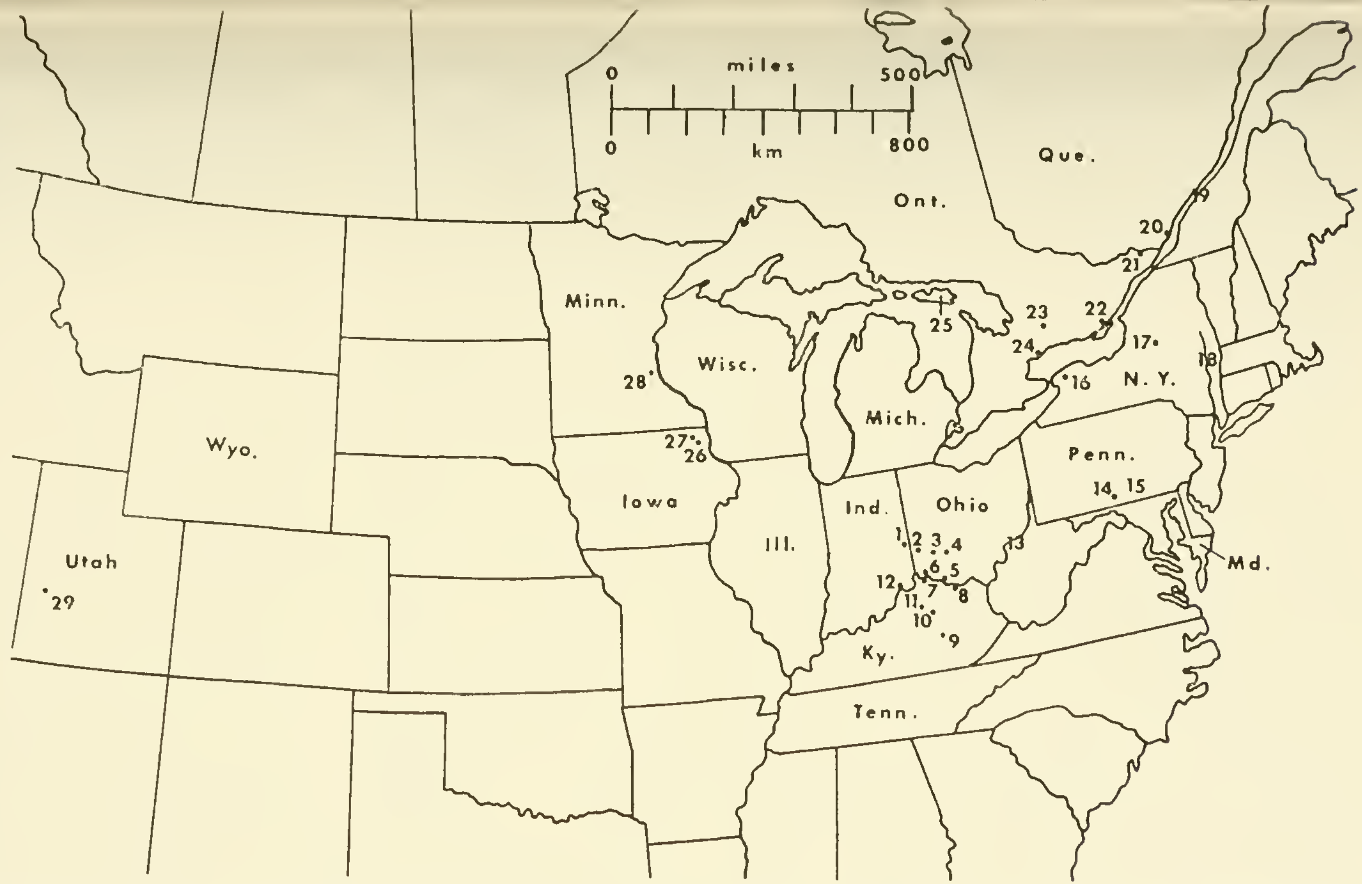
Specimens referred to in this work are listed by catalogue numbers with the respository names abbreviated as follows:

AMNH	American Museum of Natural History, New York, New York
BM(NH)	British Museum (Natural History), London, England
CFM	Field Museum of Natural History, Chicago, Illinois, (numbers preceded by UC denote specimens in the University of Chicago Walker Museum Collection)
GSC	Geological Survey of Canada, Ottawa, Ontario
HM	Hunterian Museum (Geology), The University, Glasgow, Scotland

MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
MU	Geology Museum, Department of Geology, Miami University, Oxford, Ohio
NYSM	New York State Museum, Albany, New York
OM	Orton Museum, Department of Geology, Ohio State University, Columbus, Ohio
ROM	Royal Ontario Museum, Toronto, Ontario
SUI	Geology Department, The University of Iowa, Iowa City, Iowa
UCGM	University of Cincinnati Geology Museum, Department of Geology, Cincinnati, Ohio, (numbers preceded by K denote specimens in the Kopf Collection)
UI	Geology Department, University of Illinois, Urbana, Illinois
UM	Geology Department, University of Minnesota, Minneapolis, Minnesota
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C., (numbers preceded by S. denote specimens in the Springer Collection)
UMMP	University of Michigan, Museum of Paleontology, Ann Arbor, Michigan
YMP	Peabody Museum of Natural History, Yale University, New Haven, Connecticut

STRATIGRAPHY

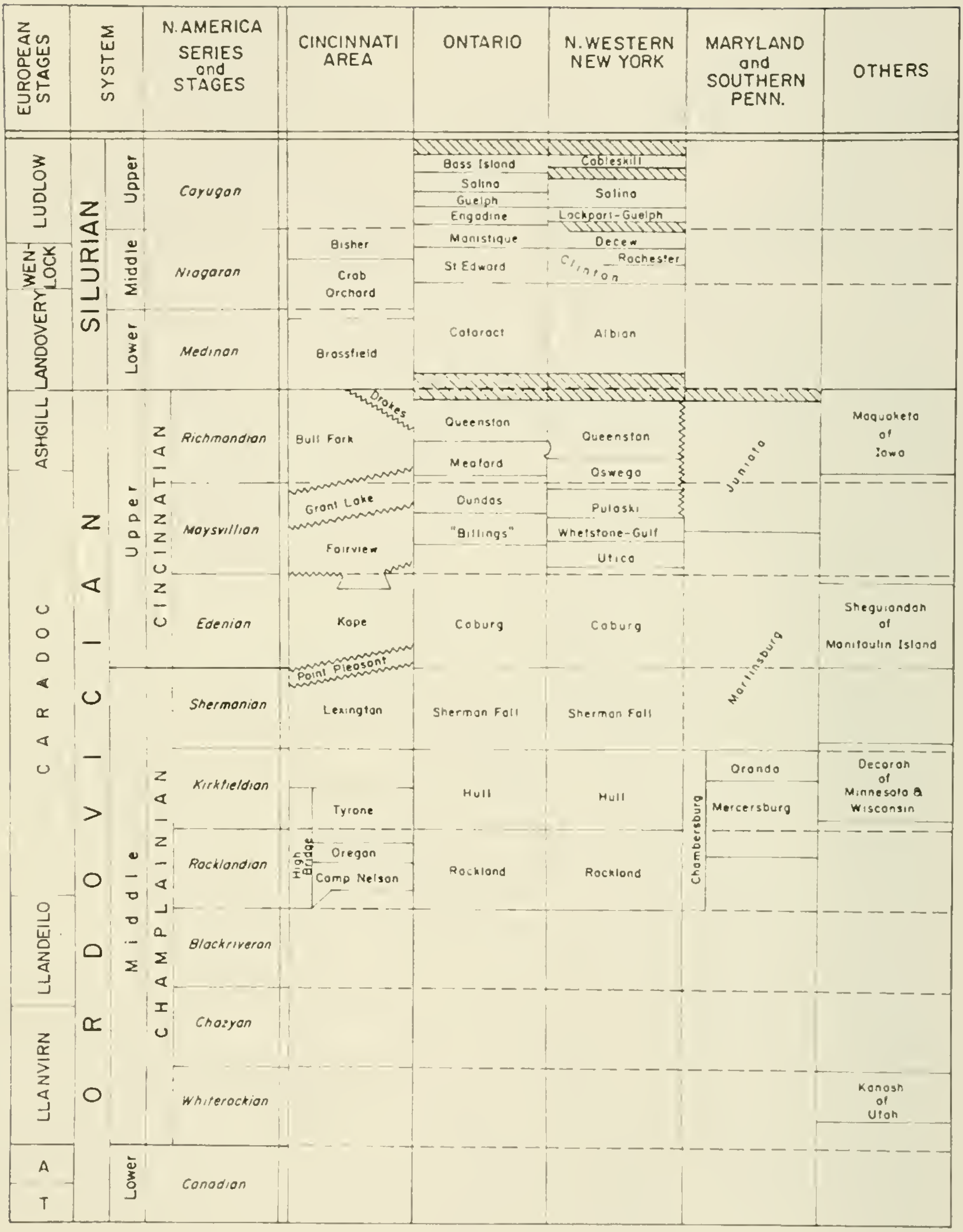
Cincinnaticrinacea and Homocrinacea range from Whiterockian to Niagaran strata from western North America (Utah and Wyoming) to eastern North America (New York and Quebec). Various members of the two superfamilies occur in the Kanosh Shale of Utah (Whiterockian); the Decorah Shale, St. Paul, Minnesota (Kirkfieldian); the Hull beds, Kirkfield, Ontario (Kirkfieldian); the Hull (Kirkfieldian?), Sherman Fall (Shermanian?), and Coburg (Edenian?) beds of Ottawa and Montreal; the Whetstone Gulf Formation of northwestern New York (Edenian?); the Sheguiandah Formation of the Manitoulin Island area of Canada (Edenian); the Edenian and Maysvillian (upper) portion of the Martinsburg Formation of Maryland and southern Pennsylvania; the Maquoketa Formation of Iowa (Richmondian?); and the Rochester Shale near Lockport, New York (Niagaran),— Text-figure 1 is a map that shows the location of cities and towns referred to in the text. No attempt, beyond Text-figure 2 and references under the respective occurrences of taxa, will be made to discuss these strata. However, seven of the thirteen cincinnaticrinacean and homocrinacean species recognized here occur in Cincinnatian strata in the southwestern Ohio-southeastern Indiana-northern Kentucky area, and Cincinnatian stratigraphy and stratigraphic nomenclature deserves attention.



Text-fig. 1. Cities and states referred to in text (excluding Oklahoma, Virginia and Tennessee).

Numbers represent the following:

1. Richmond, Indiana
2. Oxford, Ohio
3. Lebanon, Ohio
4. Wilmington, Ohio
5. Point Pleasant, Ohio
6. Cincinnati, Ohio
7. Ludlow, Covington, and Newport, Kentucky
8. Maysville, Kentucky
9. Preachersville, Kentucky
10. Lexington, Kentucky
11. Frankfurt, Kentucky
12. Madison, Indiana
13. Ohio River
14. Ft. Loudon, Pennsylvania
15. Swatara Gap, Pennsylvania
16. Lockport, New York
17. Trenton Falls, New York
18. Hudson River
19. St. Lawrence River
20. Montreal, Quebec
21. Ottawa, Ontario
22. Belleville, Ontario
23. Kirkfield, Ontario
24. Toronto, Ontario
25. Manitoulin Island
26. Clermont, Iowa
27. Fort Atkinson, Iowa
28. St. Paul, Minnesota
29. Ibex, Utah



Text-fig. 2. Correlation of Ordovician and Silurian time-stratigraphic standards of North America and Europe and pertinent rock units of geographic areas where crinoids studied herein occur. Areas with diagonal lines = strata representing that time missing, blank areas = strata unexposed or considered not pertinent by the authors. T = Tremadoc, and A = Arenig. Although all rock units are time-transgressive, only those that have been demonstrated to be so are so illustrated; others are bounded by straight lines. (From Twenhofel, *et al.*, 1954, with modification from Weiss and Sweet, 1964; Peck, 1966; Sweet and Bergström, 1971.)

HISTORICAL SURVEY OF CINCINNATIAN STRATIGRAPHY

In 1829, Vanuxem (p. 256) correlated Cincinnatian rocks of Ohio and Kentucky (and perhaps Champlainian strata of Kentucky) with strata at Trenton Falls, New York. Hall (1842, p. 61) proposed age equivalence of shales at Newport, Kentucky, (directly across the Ohio River from Cincinnati) with the New York Utica and the underlying limestone exposed in the Ohio River only at low-water with the Trenton of New York. In 1843, Hall referred strata at Cincinnati to the Hudson River Group. The term "Hudson River" was used by Mather, Emmons, Vanuxem, and other early New York geologists mainly for rocks of Late Ordovician age exposed in the Hudson River Valley, New York. Hall also correlated a body of underlying strata (containing *Triarthrus eatoni* — *T. becki* of older literature) with the New York Utica and the lowermost strata exposed at Cincinnati with the New York Trenton (with reservation). Thus, from 1843 to 1865 the name Hudson River Group was widely used for strata at Cincinnati.

In 1859, Mather (p. 6) used the name "Cincinnati limestone" in passing for strata at Cincinnati. First usage of Cincinnati as a stratigraphic term, however, is usually attributed to Meek and Worthen (1865, p. 155, and in reports on the geology of Illinois — Worthen, 1866; Meek and Worthen, 1868), who suggested that the name Cincinnati Group be substituted for Hudson River Group, because the strata at Cincinnati and the New York Hudson River Group are of different age. Orton (1873, p. 369) proposed that it is "probable that the lowermost beds of Cincinnati are the proper equivalent of the Utica Slate [of New York]." Orton (1873) divided the Cincinnati Group into five lithic units (in ascending order): Point Pleasant beds; River Quarry beds; Middle or Eden shales; Hill Quarry beds; and Lebanon beds.

The River Quarry beds, Eden shales, and Hill Quarry beds, all named for strata exposed in the immediate vicinity of Cincinnati, were lumped together by Orton as the Cincinnati beds. The name Point Pleasant was used for strata exposed some distance upriver from Cincinnati (the town Point Pleasant is situated about 25 miles, about 40 km, upriver from downtown Cincinnati), while the name Lebanon was applied to strata outcropping on top of the Ohio River hills nowhere closer than 20 miles (about 32 km) from Cincinnati. Orton defined the units as follows (refer to Text-fig. 3):

			thickness	description
Cincinnati group	Lebanon beds		300' (92m)	predominatly limestones (shales: limestone somewhat higher than 1:1 in the lower portion and somewhat lower than 1:1 in the higher portion) lying between the highest stratum of the Cincinnati hills and the lowest Silurian (Brassfield) beds and outcropping no closer than 20 miles (32 km) from Cincinnati
	Cincinnati beds	Hill Quarry beds	125-150' (38-46m)	shale and limestone about equal (ratios of less than 5 or 6:1 and approaching 1:1); outcropping just below the tops of the hills at Cincinnati; extensively quarried
		Eden shales	250' (76m)	predominatly shale (shale to limestone ratios of about 4:1 and up to 10:1); named for exposures in Eden Park in Cincinnati
		River Quarry beds	50' (15m)	4-8" (10-20 cm) thick limestones, commonly with rippled surfaces, made up of crinoid parts; sh:ls = 4:1; quarried in Cincinnati
	Point Pleasant beds		50' (15m)	thick (16-18"--41-46 cm), barren limestones and shales outcropping in the north bank of the Ohio River at Point Pleasant, Ohio

Text-fig. 3. Orton's (1873) rock-stratigraphic classification of the Cincinnati Group. All ratios are shale to limestone.

1) Cincinnati Group — 750 to 800 feet (about 230 to 245 m) of alternating beds of blue "clay" (shale or mudstone) and blue-gray limestone outcropping in and around Cincinnati, Ohio, and including the Point Pleasant beds, Cincinnati beds, and Lebanon beds;
2) Point Pleasant beds — lowest 50 feet (about 15 m) of the Cincinnati Group with lighter-colored, essentially barren limestones and shales and thicker (16 to 18 inches — about 41 to 46 cm) limestones than overlying beds and outcropping in the north bank of the Ohio River about 25 miles (about 40 km) east of Cincinnati;
3) Cincinnati beds — 425 to 450 feet (about 130 to 137 m) of the Cincinnati Group beginning at low-water of the Ohio River in Cincinnati and extending to the tops of the hills, having a shale to limestone ratio of at least 5:3, and including the River Quarry beds, Eden shales, and Hill Quarry beds;
4) River Quarry beds — 50 feet (about 15 m) of firm and compact limestones (commonly with rippled surfaces) of about 4 to 8 inches (about 10 to 20 cm) thickness (but sometimes up to 2 feet — about 60 cm), made up almost entirely of crinoid columns alternating with thicker shales, with a shale to limestone ratio of 4:1 and quarried in the Cincinnati area;
5) Eden shales — 250 feet (about 76 m) of predominantly shale (with a shale to limestone ratio of at least 4:1 and as high as 10:1) named for exposures in Eden Park;
6) Hill Quarry beds — 125 to 150 feet (about 38 to 46 m) of more limy rock (with shale to limestone ratios of less than 5 or 6:1 and approaching 1:1) outcropping just below the tops of the hills at Cincinnati and extensively quarried;
7) Lebanon beds — about 300 feet (about 92 m) of predominantly limy rock (shale to limestone somewhat higher than 1:1 in the lower portion and somewhat lower than 1:1 in the higher portion) lying between the highest stratum of the Cincinnati hills and the lowermost Silurian beds and outcropping no closer than 20 miles (about 32 km) from Cincinnati (with good exposures at Madison and Richmond, Indiana, and Oxford and Lebanon, Ohio.)

Orton (1873) represents the first good lithostratigraphic study of Cincinnatian strata at Cincinnati (for much of the classical period of American geology, lithologies at Cincinnati were overshadowed by the abundance of fossils in the strata).

U. P. James (1879) reconsidered correlation of Cincinnati and New York strata. He reported that of 500 species in strata at Cincinnati only about 100 occur in the Trenton, Utica, and Hudson River of New York; of that 100, 65 are confined to the Trenton, 18 to Utica and Hudson River, and 17 are shared by all three. James concluded that Trenton would be a better designation than previously used Hudson River but opted for Cincinnati Group because of the obvious faunal dissimilarity of local strata to that of New York.

In 1881, S. A. Miller (pp. 268-269; 283-287) presented a new correlation of Cincinnati and New York strata: the River Quarry beds with the upper part of the Trenton Group, the Eden shales with the Utica Group; and the Hill Quarry and Lebanon beds with the Hudson River Group. The names Trenton, Utica, and Hudson River unfortunately came to be used in place of Orton's lithic names.

In 1891, J. F. James recognized a problem that has only recently (Weiss *et al.,* 1965, pp. 18-19) been resolved. James compared the beds exposed at Point Pleasant, Ohio (= Orton's Point Pleasant beds), with those exposed during low-water in the Ohio River at Ludlow, Kentucky (= Orton's River Quarry beds), and found no difference. This is the earliest implication that Orton (1873) had given different names to two bodies of rock (which Orton thought were distinct) that are now known to be portions of one unit, the Point Pleasant Formation.

Winchell and Ulrich (1897, pp. ci-cv) used the term "Cincinnati Period" for rocks occupying a position between Trenton (including Point Pleasant beds) and the Silurian Brassfield Formation and rejected associations of the Hill Quarry and Lebanon beds with the New York Hudson River Group. Rather, they correlated the Hill Quarry beds with the Lorraine Group of New York and Ontario. They then replaced Hudson River with Lorraine, and, because Lebanon was preoccupied (Safford, 1851, pp. 353-355, had used Lebanon for part of the Stones River Group in Tennessee), replaced Lebanon with Richmond. Thus, the names Trenton, Utica, Lorraine, and Richmond came to be used for units at Cincinnati that were essentially equal to Orton's Point Pleasant beds (and River Quarry beds), Eden shales, Hill Quarry beds, and Lebanon beds. Clarke and Schuchert (1899, pp. 876-877) dropped usage of Hudson River even for New York strata in favor of Cincinnatian, with the divisions Utica (= Orton's Eden shales), Lorraine (= Orton's Hill Quarry beds), and Richmond (= Orton's Lebanon beds) for the North American Upper Ordovician, and the name Hudson River finally ceased to be applied to strata at Cincinnati.

Nickles (1902, pp. 56-98) equated Orton's Point Pleasant beds and River Quarry beds and subdivided the Utica, Lorraine, and Richmond at Cincinnati into a number of faunal zones (mainly on the basis of maximum abundance of various species of brachiopods and Bryozoa). Foerste (1905) discarded New York nomenclature altogether for use in the Cincinnati area and divided strata at Cincinnati into Point Pleasant beds (= Orton's Point Pleasant and River Quarry beds), Eden (= Orton's Eden shales), Maysville (a new name for Orton's Hill Quarry beds and lowermost Lebanon beds), and Richmond (= the remainder of the Lebanon beds). Foerste described the Fulton beds as the lowermost 4 or 5 feet (about 1.2 or 1.5 m) of shales of the Eden containing the trilobite *Triarthrus eatoni* (Foerste called it *T. becki*). Bassler (1906, pp. 8-10) moved the Maysville-Richmond boundary to equal that of Orton's Hill Quarry-Lebanon boundary, correlated the Fulton beds with the New York Utica, and gave geographical names of local derivation to Nickles' bryozoan zones, which he treated as members.

Foerste (1914a, p. 251) concluded that beds of the "Lorraine of New York show much greater affinities with the . . . Lorraine . . . of Quebec than with any part of the Cincinnatian . . . of Ohio. . . ." Fenneman (1916), in anticipation of the Ulrich and Bassler USGS Cincinnati Folio, used Cynthiana in place of Point Pleasant, divided the Eden into Utica below and Latonia above, and used Nickles' (1902) divisions (with Bassler's 1906 names) of the Maysvillian and Richmond. The Ulrich and Bassler Cincinnati Folio, intended as the much needed standard for future work in the Cincinnati area, was unfortunately never published (the USGS refused to accept Ulrich and Bassler's location of the Ordovician-Silurian boundary at the base of the Richmond, and Ulrich and Bassler were unrelenting in their position, K. E. Caster, personal communication, October 1973). In fact, the incomplete manuscript became lost for some time and was discovered among Bassler's effects after his death (in 1961). The manuscript is available in the open file of the USGS library, Washington, D.C.

In 1925, Wilmarth (p. 86) pointed out that the USGS was at that time employing the term Cincinnatian Series with the same limits as those given by Winchell and Ulrich (1897) and Clark and Schuchert (1899). Caster, Dalvé, and Pope (1955, text-fig. 3) restricted the name Eden to use as a stadial term (this had come to be its common usage) and replaced Eden with Latonia as the lithic name (Text-fig. 4). In 1959, Sweet, *et al.* (pp. 1030-1032) revived Eden as a formational name; but Weiss and Sweet (1964) objected to use of Eden as both a rock-stratigraphic unit and a time-stratigraphic unit and replaced Eden Formation with Kope Formation (they restricted the name Eden to use as a stadial division).

Weiss, *et al.* (1965) discussed Orton's (1873) Point Pleasant, River Quarry, and Eden beds. They concluded that Orton's River Quarry beds are not a different unit from Orton's Point Pleasant beds and that the entire mass of sub-Eden supra-Lexington limestones and shales in the Ohio River Valley should be called Point Pleasant (p. 19). Whether to use Cynthiana (with Point Pleasant as a member) or the older term Point Pleasant as the name of this formation was raised as a problem needing solution (p. 21). They, however, used Eden as a lithic name, rejected Fulton as a rock unit (they said that what earlier workers referred to as Fulton is really the *Triarthrus eatoni* zone), and rejected the rock names Bassler (1906) had given to Nickles' (1902) faunal zones for their biostratigraphic rather than lithostratigraphic nature (pp. 25-28).

Peck (1966) confronted with a Cincinnati stratigraphic nomenclature rife with lithic names for faunal units, practically began anew in the Maysville, Kentucky, area. Peck, using Weiss and Sweet's (1964) Kope Formation and accepting the Fairview Formation as a valid lithic unit, defined two new units, the Grant Lake Limestone (overlying the Fairview) and the overlying Bull Fork Formation. In addition, at Maysville, Peck found the Preachersville Member of the Drakes Formation (described by Weir, *et al.*, 1965), which apparently does not occur in the immediate vicinity of Cincinnati or on the west side of the Cincinnati Arch.

Anstey and Fowler (1969) opined that Eden should be retained as a rock-stratigraphic name and that Kope should be disregarded. Their reasoning was that Eden could no longer be used as a stadial name because of overlap with the New York Trentonian and thus was available for use as a rock name. Sweet and Bergström (1971), after illustrating this overlap (they showed that the upper part of the Trenton Group is the same age as Edenian and Maysvillian strata in the Cincinnati area), rejected Trentonian and Coburgian in favor of the older stadial names Edenian (Orton, 1873), Maysvillian (Foerste, 1905), and Richmondian (Winchell and Ulrich, 1897). Because Eden is a valid stadial name, Sweet and Bergström reinstated Kope as a rock name to avoid confusion of dual usage of Eden (as both a stadial and formational name).

The present state of stratigraphic nomenclature in the Cincinnati, Ohio, area, as synthesized from the proceeding works, will be summarized in the following section. It is essentially the nomenclature used by the United States and Kentucky Geological Surveys jointly mapping Middle and Upper Ordovician strata in Kentucky and by the majority of Ohio and Kentucky students of Cincinnatian stratigraphy:

ROCK-STRATIGRAPHIC UNITS IN THE CINCINNATI AREA

The name Cincinnati Group was first used by Meek and Worthen (1865, p. 155) for blue-gray and gray limestones and shales outcropping in and around Cincinnati, Ohio. Although the fossils of the Cincinnati area had been the subject of considerable study during the early and middle 1800's, the strata's lithologies and relationships were without detailed description until Orton (1873). Orton divided the Cincinnati Group into five lithic units (in ascending order): Point Pleasant beds (exposed at Point Pleasant, Ohio), River Quarry beds (in and along the Ohio River at Cincinnati), Eden shales (outcropping in Eden Park, Cincinnati), Hill Quarry beds (at the tops of the Cincinnati hills), and Lebanon beds (exposed at Lebanon, Ohio). The Point Pleasant beds and River Quarry beds have been shown (James, 1891; Nickles, 1902, pp. 56-58; Foerste, 1905, p. 151; Weiss, *et al.*, 1965, p. 19) to be parts of the same lithic unit, the Point Pleasant Formation. The lithic unit named Eden shales by Orton [replaced by Kope Formation (Weiss and Sweet, 1964)]; Fairview Formation (Bassler, 1906) and Grant Lake Limestone (Peck, 1966) have essentially been substituted for Orton's Hill Quarry beds; and most of Orton's Lebanon beds are now called the Bull Fork Formation (Peck, 1966). Beds comprising the Point Pleasant Formation were removed from the Cincinnati Group by Hall (1842, p. 61), Miller, *et al.* (1879, pp. 193-194), and Orton (1888, p. 5). Thus, the Cincinnati Group presently contains the Kope Formation, Fairview Formation, Grant Lake Limestone, and Bull Fork Formation. Stratigraphers tend not to use the name Cincinnati as a rock-stratigraphic unit. Rather, they reserve the name Cincinnati for time-stratigraphic nomenclature and avoid dual usage.

The Point Pleasant Formation, named for strata at Point Pleasant, Ohio, by Orton (1873), is the lowest unit exposed in the Cincinnati region. According to Weiss, *et al.* (1965), it consists of thin and medium-bedded, light to dark gray, fossiliferous, biogenic limestones parted by gray shales and mudstones. Limestone and shale each make up about 50% of the unit; the mean clastic ratio (limestone: shale and mudstone) calculated for successive 0.9 m units is 1.0. Thickness ranges from a few feet (about a meter) to nearly 70 feet (about 21 m). The unit is believed to be Shermanian (and partly Edenian upriver from Cincinnati) in the Ohio River Valley.

The Kope Formation, named for exposures in Kope Hollow near Levanna, Ohio, by Weiss and Sweet (1964), conformably overlies the Point Pleasant Formation and consists of lenses and discontinuous thin-bedded, gray and bluish gray, highly fossiliferous, biogenic limestones (up to about a foot thick — about 30 cm thick) and thicker sequences of gray, bluish gray, and greenish gray, less fossiliferous shales and mudstones. The Kope is made up of 75% (or more) shale and mudstone and 25% (or less) limestone; the mean clastic ratio for 0.9 m units is 3.25. Thickness ranges from 150 to 270 feet (about 46 to 82 m). The Kope is Edenian in the immediate area of Cincinnati, but the upper part becomes Maysvillian to the east and southwest away from Cincinnati. The Point Pleasant-Kope boundary is gradational and can be observed with certainty only where a number of feet (a few meters) of strata on either side of the boundary are exposed. The contact is placed at the base of the lowest series (at least 15 feet — about 5.0 m thick) of Kope mudrocks that lie on the uppermost limestone of the Point Pleasant Formation.

The Fairview Formation, named for exposures in and around Fairview Park, Cincinnati, by Bassler (1906), conformably overlies the Kope and, as described by Peck (1966), consists of alternating sequences of thin to medium-bedded, gray, biogenic limestones and partings and thin beds of gray mudstones and shales. The Fairview is composed of 50 to 60% limestone and 40 to 50% mudstone and shale; the mean clastic ratio calculated for 0.9 m intervals is 0.5. Thickness ranges from about 80 to 115 feet (about 24 to 35 m). The Fairview is essentially Maysvillian, but in some areas the lowermost part is Edenian. The Kope-Fairview contact is somewhat tenuous except in a few outcrops; it is marked at the base of the first thick (over 8 inches or about 20 cm) limestone that is succeeded by limestone in significantly more abundance than mudrock and that overlies the highest series (at least 1.5 feet, about 0.5 m) of Kope mudrock. In some areas the Fairview becomes more limy near the top, so that a fairly thick sequence must be observed to pick the contact with certainty.

The Grant Lake Limestone, first described by Peck (1966) from exposures along Kentucky Route 1449 northeast of Grant Lake near Maysville, Kentucky, conformably overlies the Fairview and consists of irregularly thin-bedded, rubbly, fossiliferous, gray limestones alternating with irregular partings and thin beds of fossiliferous, gray shales and mudstones. The Grant Lake is made up of 70 to 90% limestone and has a thickness of 100 to 120 feet (about 30 to 37 m). The age of the Grant Lake in and around its type area is Maysvillian but has not been established elsewhere with certainty. The Fairview-Grant Lake contact is placed at the base of the lowest sequence of irregularly bedded argillaceous Grant Lake Limestones; the boundary is often transitional, but even when not transitional, it is inconspicuous.

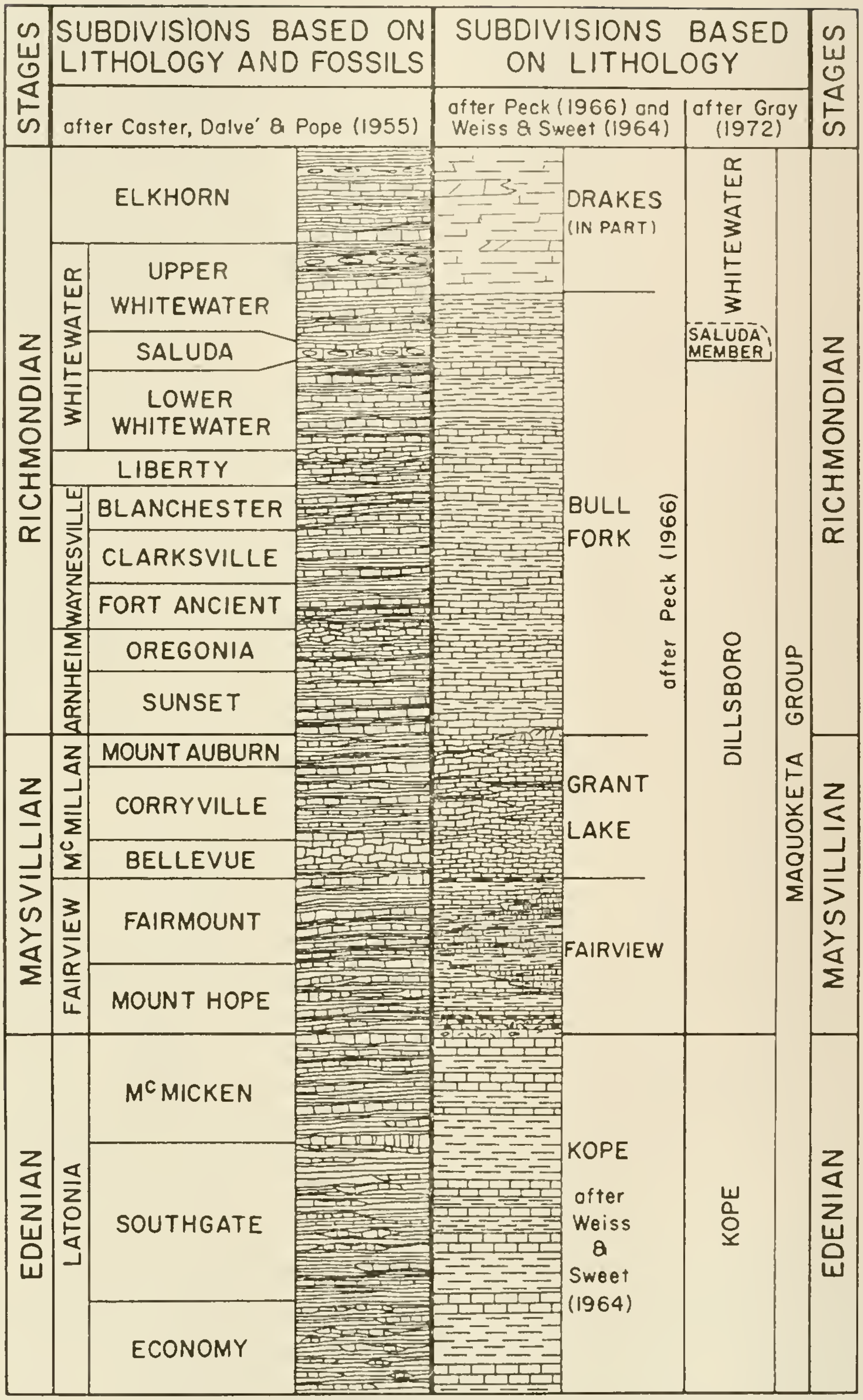
The Bull Fork Formation, named by Peck (1966) for Bull Fork Creek near Plumville (which is near Maysville), Kentucky, and described from exposures along Kentucky Route 1443 near Springdale (also near Maysville), Kentucky, conformably overlies the Grant Lake Limestone. It is composed of alternating thin to medium-bedded, gray, bluish gray, and greenish gray, fossiliferous, sometimes argillaceous limestones and gray and greenish gray, fossiliferous shales and mudstones. Clastic ratios (shale and mudstone: limestone) increase from about 1:4 near the base to 4:1 near the top. The Richmondian Bull Fork is about 200 feet (about 61 m) thick in its type area and thins southward. The Grant Lake-Bull Fork contact is usually transitional and is placed at the base of the lowest sequence of rubbly, argillaceous Grant Lake Limestones.

The Preachersville Member of the Drakes Formation was named by Weir, *et al.* (1965) for outcrops along Kentucky Route 39 about 2 miles (about 3.3 km) southeast of Preachersville, Kentucky. In the Ohio Valley the Preachersville occurs only along the east side of the Cincinnati Arch (actually the Preachersville occurs around the east side of the Arch from near Dayton, Ohio, in the north to south of Lexington, Kentucky,) where it conformably overlies the Bull Fork and consists of green and reddish purple, calcareous to dolomitic, essentially barren mudstones and thin, gray to brown, essentially barren, dolomitic limestones and dolomites. Mudstone comprises about 90% of the unit. Thickness in the Maysville area ranges from 25 to 30 feet (about 8 to 9 m) and increases southward. In the Ohio Valley, the Preachersville is apparently Richmondian. The Preachersville and Bull Fork lithologies are transitional and the Bull Fork-Preachersville contact is placed at the top of the highest fossiliferous Bull Fork Limestone. The boundary between the Preachersville and the overlying Silurian Brassfield Formation may be conformable and transitional locally. It is placed at the base of the lowest sequence of thicker bedded, brown Brassfield dolomites and dolomitic limestones. In most areas, however, the Brassfield rests unconformably on the Preachersville, the Whitewater (as used by Gray, 1972), or the Bull Fork.

TIME-STRATIGRAPHIC UNITS IN THE CINCINNATI AREA

Since Winchell and Ulrich (1897) and Clarke and Schuchert (1899), the Cincinnatian Series has been used as the North American Late Ordovician time-stratigraphic unit; and, since Foerste (1905) and Cumings (1908), the names Edenian, Maysvillian, and Richmondian have been used as Cincinnatian stadial divisions. Although two Cincinnatian stages have names derived from localities outside Ohio (Maysvillian was named for Maysville, Kentucky, while Richmondian was named for Richmond, Indiana), according to Sweet and Bergström (1971, pp. 614-616) all have their reference sections in southwestern Ohio as established in Orton's (1873) report. The Edenian reference section is without doubt in southwestern Ohio. Orton's unit Eden shales (Edenian Stage) was named for exposures in Eden Park, Cincinnati, Ohio. However, location of Maysvillian and Richmondian reference sections in southwestern Ohio is less demonstrable.

When Foerste (1905, p. 150) used the name Maysville, he did so for strata at Cincinnati; but Foerste's Maysville section may have been at Maysville, Kentucky: ". . . the name Maysville is here suggested for the strata at Cincinnati hitherto identified as Lorraine. Along the railroad south of Maysville, Kentucky, from the first cut a little over a mile from town to the overhead bridge a mile north of Summit a magnificent series of exposures gives a complete section of all the subdivisions of the Maysville division. . . ." The Richmond reference section is a similar case. Winchell and Ulrich (1897, p. ciii) first used the name: "Resting on the Lorraine [around Cincinnati, Ohio] there is a series of alternating thin bedded shales and limestones and in some localities finally a sandstone, in all quite 350 feet thick in southwestern Ohio and southeastern Indiana. Almost the entire series is excellently exposed at Richmond, Indiana, so that the name Richmond group which we propose to apply to the series is eminently appropriate.* [with the following footnote from the bottom of page ciii] Prof. Orton's [1873] name "Lebanon" would have been adopted had his name not been used before for a division of the Trenton by Prof. Safford [1851]. The Richmond exposures besides are larger and more characteristic of the group than those near Lebanon, Ohio. As well, although Winchell and Ulrich's Richmond group is nearly equivalent to Orton's Lebanon beds, Foerste's Maysville is markedly different from Orton's Hill Quarry beds. The difference, simplified, is that Orton included strata that was later called Arnheim (a name used by Foerste, 1905, in place of Nickles' preoccupied Warren, Text-fig. 4) in the Richmond, while Foerste agreed with Nickles in including the Arnheim in the Maysville. Whatever the valid reference sections for the Maysvillian and Richmondian Stages, reference sections have come to be exposures



Text-fig. 4. Cincinnatian stratigraphy of the Cincinnati area (from a University of Cincinnati Geology Museum display).

	1	2	3	4	5	6	7	8	9	10
Cincinnaticrinus										Ci
Dystactocrinus (=Atyphocrinus)					He	He	He	He	He	Ci
Isotomocrinus					He	He	He	He	He	Ci
Ohiocrinus	He	He	He	He	He	He	He	He	He	Ci
Atopocrinus									He	Ci
Homocrinus	Cy	De	Cy	Ho	Ho	Ho	Ho	Ho	Ho	Ho
Ectenocrinus	He	He	He	He	Ho	He	Ho	Ho	Ho	Ho
Ibexocrinus									Ho	Ho
Sygcaulocrinus					Ho	Ho	Ho	Ho	Ho	Ho
Daedalocrinus					Ho	Ho	Ho	Ho	Ho	Ho
Apodasmocrinus										Ho

Table 1. Historical summary of the classification of members of the Cincinnaticrinacea and Homocrinacea. Column headings are: 1) Wachsmuth and Springer (1886), 2) Bather (1900), 3) Springer (1913), 4) Jaekel (1918), 5) Ulrich (1925), 6) Bassler (1938), 7) Moore and Laudon (1943), 8) Moore (1962), 9) Moore, Lane and Strimple *in* Moore and Strimple, 1973 and 10) herein. Abbreviations for families are: He—Heterocrinidae, Ho—Homocrinidae, Cy—Cyathocrinidae, De—Dendrocrinidae, and Ci—Cincinnaticrinidae.

in southwestern Ohio, the bluffs along Clifton Avenue and in Bellevue and Fairview Parks, Cincinnati (in the case of Maysvillian), and exposures in railroad and highway cuts around and some distance south of Lebanon, Ohio, (in the case of Richmondian).

The Cincinnatian stadial reference sections need study. Ranges of species should be firmly established in the reference sections with extrapolation away from Cincinnati; thus far, only conodonts have received adequate modern biostratigraphic attention. The following organisms have been used as indices for Cincinnatian stages. Although the authors have chosen organisms that are considered most trustworthy by modern workers, the list is at best a poor one (perhaps except for conodonts).

ORGANISMS AS INDICES OF CINCINNATIAN STAGES

CONODONTS

According to Kohut and Sweet (1968, p. 1460), an association typical of Edenian and older strata is *Cyrtoniodus flexuosus* (Branson and Mehl), *Drepanodus suberectus* (Branson and Mehl), *Ozarkodina tenuis* (Branson and Mehl), *Phragmodus undatus* (Branson and Mehl), and *Plectodina furcata furcata* (Hinde). The combination of *Ambalodus, Keislognathus, Sagittodontus,* probably *Prioniodus,* and *Scolopodus,* and perhaps *Eoligonodina* (genera more characteristic of the Anglo-Scandinavian-Appalachian province) marks early Edenian time; the combination of *Phragmodus undatus, Dichognathus,* and *Belodina* is late Edenian and early Maysvillian, while that combination without *Belodina* is late Maysvillian or early Richmondian (Sweet, *et al.,* 1959, p. 1038). This significance of *Belodina* was affirmed by Pulse and Sweet (1960, p. 245), who reported that all strata with *Belodina* are Maysvillian or older. In addition, Pulse and Sweet (1960, pp. 243-246) submitted that *Trichonodella angulata* Sweet, Turco, Warner and Wilkie and *T. subundulata* Sweet, Turco, Warner and Wilkie are not known from rocks older than Edenian and that *Prioniodina delecta* (Stauffer) and *T. tenuis* (Branson and Mehl) are Edenian and Maysvillian. According to Branson, *et al.* (1951, p. 4), *Zygognathus, Rhipidognathus,* and abundance and variety of *Paltodus* species marks Richmondian.

GRAPTOLITES

Graptolites fall short of the abundance and variety of most other groups in strata around Cincinnati. *Climacograptus typicalis* Hall, long thought to be a good Edenian indicator, is now known from both younger and older strata (Pulse and Sweet, 1960, p. 239; Berry, 1960), although *Orthograptus truncatus richmondensis* Ruedemann is apparently limited to Richmondian rock (Berry, 1966).

CORALS

No corals are known from Edenian or Maysvillian strata around Cincinnati but a few corals have been found in the Kope Formation at Newport, Kentucky, and are presently under study (Richard S. Laub, personal communication, October 1973). Corals are abundant in Richmondian strata; Browne (1964; 1965) reported that *Favistella alveolata* Goldfuss, *Foerstephyllum vacuum* (Foerste), *Tetradium approximatum* Ulrich, *Calapoecia huronensis* Billings, *Aulacera, Grewingkia rustica* (Billings), *G. divaricans* (Nicholson), and *Saffordophyllum floweri* Browne are common in Richmondian strata. In addition, *Paleofavosites* is Richmondian and younger.

BRACHIOPODS

Resserella emacerata (Hall) (? = *Onniella*) was reported (Caster, Dalvé, and Pope, 1955, text-fig. 3) to be Edenian; *Platystrophia hopensis* is Maysvillian (Weiss, *et al.*, 1965, pp. 36-37); *Rhynchotrema dentatum* (Hall), *Leptaena richmondensis* Foerste (? = *Kiaeromena*), *Resserella meeki* (Miller) (? = *Onniella*), *Strophomena planumbona* (Hall) (? = *S. rugosa*), and *Lepidocyclus capax* (Conrad) are apparently Richmondian (Caster, Dalvé, and Pope, 1955, text-fig. 3).

BRYOZOA

Constellaria florida Ulrich and *Escharopora falciformis* (Nicholson) are reported to be Maysvillian (Caster, Dalvé, and Pope, 1955, text-fig. 3; Weiss, *et al.*, 1965, pp. 36-37).

TRILOBITES

Cryptolithus tesselatus Green appears to be early Maysvillian or older (Sweet, *et al.*, 1959; Pulse and Sweet, 1960), while *Triarthrus eatoni* (Hall) has been used as an index of earliest Edenian as well as the nominate species of the faunal zone named Fulton by Foerste (1905, p. 150; Weiss, *et al.*, 1965, pp. 26-28), although Caster, Dalvé, and Pope (1955, text-fig. 3; pl. 2, fig. 17) reported that *T. eatoni* also occurs at a higher (younger) horizon.

CRINOIDS

The common occurrence of crinoids in pockets makes them only occasionally useful in correlation. However, the abundance of pockets in strata around Cincinnati increases their value in local correlation, where *Ectenocrinus geniculatus* (Ulrich) is earliest Edenian, *Cincinnaticrinus varibrachialus,* n.sp. is Edenian and Maysvillian, *Ohiocrinus* (although rare) is known only from Maysvillian strata, and *C. pentgonus* (Ulrich) is Maysvillian and Richmondian. On a broader scale, *Cincinnaticrinus* is relatively widespread (southwestern Ohio, northern Kentucky, southeastern Indiana, northwestern New York, southern Pennsylvania, and Maryland) and limited to Cincinnatian strata, while *Isotomocrinus* and *Daedalocrinus,* although less widespread (Ontario, Quebec, New York, Illinois, Minnesota, and possibly Tennessee for the former and Ontario for the latter), are confined to late Champlainian strata (Kirkfieldian to Shermanian).

SYSTEMATIC PALEONTOLOGY

Class CRINOIDEA Miller, 1821

Subclass INADUNATA Wachsmuth and Springer, 1885

Diagnosis. — Crinoids with plates of the dorsal cup joined firmly together by close suture, with a subtegminal mouth, and with arms free above the radials (hereafter abbreviated RR) or, in some members, above the first primibrachials ($IBrr_1$) or second primibrachials ($IBrr_2$).

Discussion. — The documented range of the Inadunata is from the Ordovician to the Triassic although Sprinkle (1973, pp. 177-183, pls. 42-43) described an apparent crinoid (*Echmatocrinus;* subclass and order undetermined) from the Burgess Shale (Middle Cambrian) of British Columbia which may well be an inadunate. They are abundant in Paleozoic strata, but only one family (Erisocrinidae) occurs in strata later than Permian. Moore and Laudon (1943) divided inadunates into two orders, the monocyclic Disparata [equivalent to Bather's (1899a) Monocyclica Inadunata] with 14 families, and the dicyclic Cladoidea [equivalent to Bather's (1899a) Dicyclica Inadunata] with 39 families. Moore (1952) changed the ordinal names Disparata and Cladoidea to Disparida and Cladida and elevated part of the Disparida, the Hybocrinidae, to ordinal level. Knapp (1969) segregated cladids with downflaring IBB (infrabasals)into his new inadunate order, Declinida; however, the order has not been accepted by subsequent authors. Comprehensive and relatively contemporary discussions of inadunates appear in Moore and Laudon (1943, pp. 21-64) and Moore (1962).

Order DISPARIDA Moore and Laudon, 1943

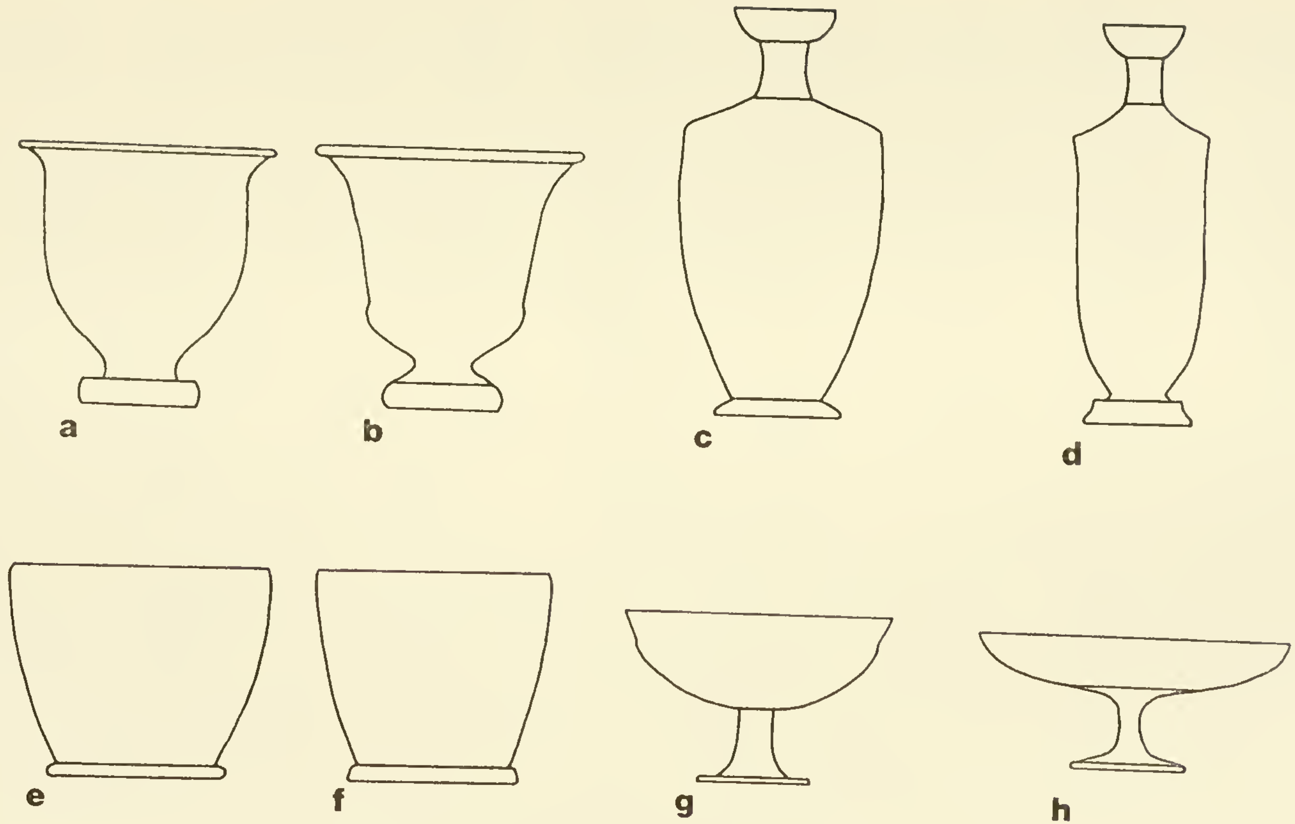
(*nom. correg.* Moore, 1952, p. 613

ex Disparata Moore & Laudon, 1943, p. 24)

Diagnosis. — Monocyclic inadunates with conical cup and an armlike anal series on or branching off the C ray.

Discussion. — Disparids are characterized by structural dissimilarity among the five rays of individuals and among corresponding rays of different families. Moore and Laudon (1943, pp. 24-29) envisioned two general groupings: a homosynbathocrinid stock and a hybocrinid stock. The hybocrinid stock, consisting of one family, the Hybocrinidae, with a "bowl-shaped" (krateriform, *i.e.,* shaped like a Greek krater, Text-fig 5) dorsal cup with unbranched arms distinctly narrower than the underlying RR, was made by Moore (1952) into the new order Hybocrinida. The homo-synbathocrinid stock, or Disparida as Moore (1952) viewed it, included the remaining 13 monocyclic families and was characterized by a steeply conical lekythosiform to skyphosiform (Text-fig. 5) dorsal cup, an armlike anal sac on or branching off the C ray, and wide branched arms that articulate along the entire distal edge of the RR. Disparids range from Ordovician to Permian.

Members of four disparid families (the Cincinnaticrinidae, Homocrinidae, Anomalocrinidae, and Iocrinidae) occur in Cincinnatian strata in the Cincinnati, Ohio, area; but only the closely related Cincinnaticrinidae and Homocrinidae are discussed here. The Iocrinidae, while in need of modern treatment, are only distantly related to other Cincinnatian disparid families. Nothing new can be added to knowledge of the Anomalocrinidae at this time, and anomalocrinids are discussed only in passing. The Homocrinidae and Anomalocrinidae do not closely resemble one another but the Cincinnaticrinidae show similarities to both the Homocrinidae and



Text-fig. 5. Shape of Greek vases. A-bell krater, b-kalyx krater, c-d—lekythos, e-f—skyphos, and g-h—kylix. All handles have been removed to emphasize shape of the "cup" of the vase as it compares with dorsal cup shape in crinoids. A dorsal cup shaped like a or b is krateriform, like c or d lekythosiform, like e or f skyphosiform, or like g or h kylixiform. Vase shapes are from Caskey (1922).

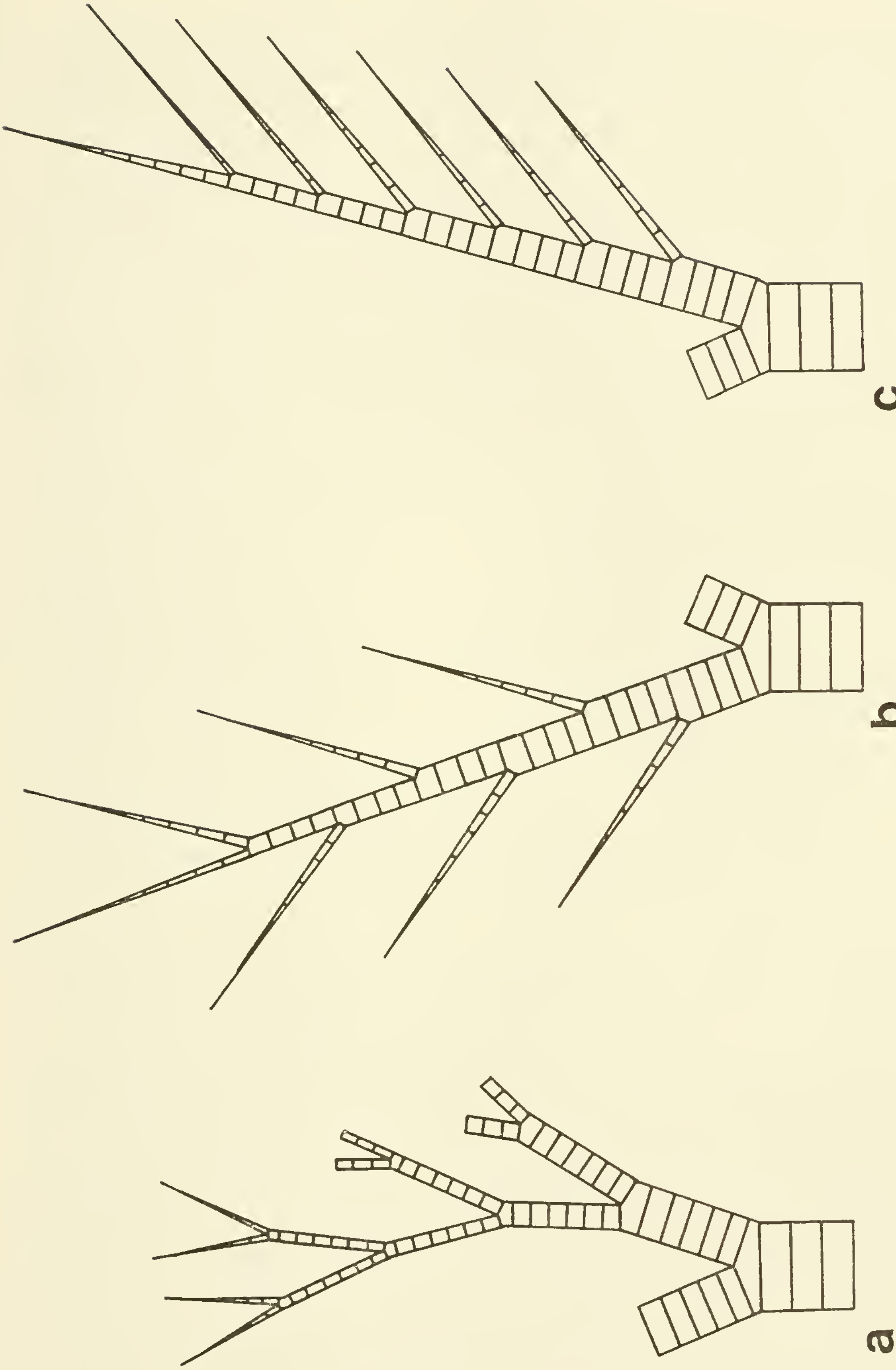
the Anomalocrinidae in addition to the ordinal characters. Table 1 is a historical summary of classification of these crinoids.

Superfamily **CINCINNATICRINACEA**, new superfamily

Diagnosis. — Disparid inadunate crinoids with a conical dorsal cup having undivided RR in three rays (A, B, and D rays) and compound RR in two rays (C and E rays).

Description. — The cincinnaticrinacean dorsal cup has five symmetrically pentagonal, sub-hexagonal, or hexagonal BB (basals) of nearly equal size and shape. Both the compound and the fused RR are inverted pentagons (with slight modification in the C and D rays of members of the Cincinnaticrininae); compound RR are typically divided about equally into a pentagonal iR below and a quadrilateral sR above. The five rays bifurcate isotomously to form ten arms, after which branching is isotomous or alternately heterotomous. No arm cover plates are known, and they may have been absent. The arms are commonly folded tightly together making observation of the food grooves difficult except in fortuitously broken or disarticulated specimens, but scrutiny of exposed food grooves and end-on examination of broken arms in numerous specimens has not disclosed the existence of cover plates. In adults, at least, the column is quinquepartite, with each columnal composed of five radially disposed fused plates or pentameres.

Discussion. — The superfamily Cincinnaticrinacea is erected essentially to replace Heterocrinacea [Zittel's (1879) family elevated to superfamilial status by Ubaghs, 1953], because the type genus of the latter (*Heterocrinus*) is unrecognizable. Four previously described genera, *Dystactocrinus, Isotomocrinus, Ohiocrinus,* and *Atopocrinus,* are available for selection as type genus. *Dystactocrinus* and *Ohiocrinus* are rejected because they are rare and their morphology is not well known. *Atopocrinus* and *Isotomocrinus* are less typical of the superfamily than *Cincinnaticrinus* (*Atopocrinus* has a brachianal and multipinnulate Brr, while *Isotomocrinus* is the only completely isotomously branching member of a dominantly heterotomously branching group). *Columbicrinus* is not adequately preserved for consideration or identification in our judgement. *Cincinnaticrinus* is selected because it is most typical of the superfamily and most common and widespread of the five included genera.



Text-fig. 6. Types of arm branching. Each drawing (all stylized) represents one ray with an isotomous branch to form two arms, only one of which is fully illustrated. a-isotomous, b-alternating heterotomous, c-exotomous; b and c are forms of heterotomous arm branching.

Zittel (1879, pp. 343, 358-359) included in his family Heterocrinidae *Heterocrinus* Hall, *Graphiocrinus* de Köninck, *Erisocrinus* Meek and Worthen, *Philocrinus* de Köninck, and *Stemmatocrinus* Trautschold. These are forms with fairly simple, monocyclic or dicyclic, dorsal cups with five BB (or five BB and five IBB) and five RR supporting long, branched or simple, arms. Wachsmuth and Springer (1886, pp. 127-128) removed dicyclic forms, leaving only *Heterocrinus,* which they split into *Stenocrinus* Wachsmuth and Springer (= *Heterocrinus* Hall), and *Heterocrinus* Hall, Wachsmuth and Springer. They also placed *Iocrinus* Hall in the family. Bather (1893, p. 35) added *Anomalocrinus* Meek and Worthen (Wachsmuth and Springer, 1886, p. 135 had used *Anomalocrinus* as nominate genus of their new family Anomalocrinidae) and *Herptocrinus* Salter (= *Myelodactylus* Hall).

Ulrich (1925) established the modern concept of the Heterocrinidae as monocyclic inadunates, generally with conical cup, having two compound and three fused RR. He transferred *Ectenocrinus* to the Homocrinidae (to which he added his new genera *Daedalocrinus, Drymocrinus,* and *Sygcaulocrinus*), reinstated the Anomalocrinidae with *Anomalocrinus* and his new genus *Geraocrinus* (the latter was included with reservation), and removed *Iocrinus.* To the previously established heterocrinid genera, *Heterocrinus* and *Ohiocrinus,* Ulrich added his new genera *Atyphocrinus, Columbicrinus, Dystactocrinus,* and *Isotomocrinus.*

Bassler (1938, pp. 16-17) placed a number of other genera in the family, but of these additions only the European genera *Caleidocrinus* Waagen and Jahn and *Ristnacrinus* Öpik were accepted as heterocrinids by Moore and Laudon (1943, p. 31). Moore and Laudon (1944, p. 149) included *Lichenocrinus,* an *omnium gatherum* for multi-plated discoidal Ordovician crinoid bases containing, among other things, the juvenile holdfast of *Heterocrinus.* Ramsbottom (1961, p. 39) removed *Caleidocrinus* to the Iocrinidae, a move with which Moore (1962, p. 39) agreed. Moore (1962, p. 35) transferred *Ristnacrinus* to the Eustenocrinidae. Lane (1970, p. 14) expanded the concept of the family somewhat with addition of his new genus *Atopocrinus*: *Atopocrinus* became the only member of the Heterocrinidae with the anal series branching off the C ray IBr_1, termed brachianal by Moore, 1962.

Although Ulrich's (1925) concept of the Heterocrinidae is accepted by us, nomenclatural and taxonomic changes are needed. This is evident from comments of other authors: Ramsbottom (1961), for example, was unable to assign some supposed British heterocrinids to a definite genus: "Following the brief revision of the Ordovician Heterocrinidae given by Ulrich (1925) it is now difficult to determine generically many species which would formerly have been assigned to *Heterocrinus*. . . ." (*op. cit.*, p. 10). It is evident that many cincinnaticrinacean genera and species need clearer delineation. In this paper *Heterocrinus* is shown to be unrecognizable, and a new genus, *Cincinnaticrinus*, is erected to include the Cincinnati area species formerly referred to *Heterocrinus*. *Atyphocrinus* is considered a junior synonym of *Dystactocrinus*. *Columbicrinus*, while exhibiting cincinnaticrinacean cup features, is unrecognizable because the holotype of the type species, *C. crassus*, is an incomplete specimen lacking most of the arms and all of the stem (Pl. 2, figs. 6-7). The only known specimen is from the Lebanon Limestone of central Tennessee. Thus, the new superfamily Cincinnaticrinacea contains *Cincinnaticrinus*, n. gen., *Atopocrinus* Lane, 1970; *Dystactocrinus* Ulrich, 1925; *Isotomocrinus* Ulrich, 1925; and *Ohiocrinus* Wachsmuth and Springer, 1886.

The Cincinnaticrinacea show some similarities to the Homocrinacea and Anomalocrinacea. Cincinnaticrinacea and Anomalocrinacea both have two compound RR (in the C and E rays) and three fused RR (in the A, B, and D rays) and, except for *Atopocrinus*, similar placement of anal X. However, they have divergent cup shapes (Cincinnaticrinacea have conical cups, while Anomalocrinacea have krateriform cups), dissimilar arms (Cincinnaticrinacea have subcircular arms as wide as the underlying RR, while Anomalocrinids have nearly round arms significantly narrower than the underlying RR), and different modes of arm branching. Cincinnaticrinacea have isotomous and alternating heterotomous arms, while Anomalocrinacea have endotomous and alternating endotomous-exotomous arms (Text-fig. 5).

The arms of cincinnaticrinaceans are usually found folded tightly together. This may have been due to a detrimental influx of sediment and consequent contraction of muscles during catastrophic death or to relaxation of muscles with ligamental folding of the arms after death. The former alternative is most probable: existing crinoids have muscles to close the arms and ligaments to open them (Hyman, 1955, p. 60). Lane and Macurda (1975) confirmed the existence of muscular articulations in one upper Paleozoic inadunate (*Aesiocrinus*). However, some Paleozoic crinoids may have had only ligaments in the arms (Van Sant, 1964, p. 40), probably for closing them. Extension was initiated by the water-vascular system.

Cincinnaticrinacea and Homocrinacea are similar in cup shape, arm size and shape, and placement of anal X (except for *Atopocrinus*), but Homocrinacea have three compound RR (in the B, C, and E rays) and only two fused RR (in the A and D rays). The homocrinids *Ectenocrinus* and *Sygcaulocrinus* have similar branching (alternating heterotomous), but *Ectenocrinus* has a tripartite rather than quinquepartite column. *Daedalocrinus* has a similar column but dissimilar branching (endotomous as opposed to isotomous and alternating heterotomous). Moore and Laudon (1943, p. 25) envisioned a closer affinity for heterocrinids (Cincinnaticrinacea) and homocrinids (Homocrinacea) than for heterocrinids and anomalocrinids (Anomalocrinacea) and suggested that the Heterocrinidae developed from the Homocrinidae or their immediate forerunners. Whether one judges the cincinnaticrinacean-anomalocrinacean or cincinnaticrinacean-homocrinacean relationship to be closer depends largely on which characters (*e.g.* cup and arm shape, branching, number of fused versus compound RR, or column features) are assumed to be of greatest evolutionary significance. The cladid Ottawacrinacea are also similar to the Cincinnaticrinacea, but because ottawacrinaceans are dicyclic, the two superfamilies are best regarded as homeomorphs.

Cincinnaticrinaceans occur in Whiterockian to Richmondian rocks of western, mideastern, and eastern North America. They have been found throughout Cincinnatian strata in the tristate Ohio-Kentucky-Indiana area (around Cincinnati); in Edenian rocks of northwestern New York, southern Pennsylvania, and Maryland; in Kirkfieldian rocks of Minnesota, Wisconsin, and Illinois; in Kirkfieldian to Shermanian strata of mideastern Canada; and in Whiterockian strata of Utah. Kolata (1975, 1976) reported cincinnaticrinaceans in middle Upper Ordovician strata (? Maysvillian) of Illinois and Wyoming. In addition, Ulrich (1925) reported heterocrinids (cincinnaticrinaceans) from Black Riverian rocks of Tennessee (Lebanon Limestone), Wisconsin (probably from the Decorah Shale, apparently Kirkfieldian in large part), and Pennsylvania (Text-fig. 1).

Ramsbottom (1961, p. 10, pl. 3, fig. 8; pl. 6, fig. 5) reported heterocrinids from Ashgillian strata of Scotland and Ireland; however, the crinoids do not appear to us to be cincinnaticrinaceans, and are not considered herein.

Family **CINCINNATICRINIDAE,** new family

Because this is the only family of the Cincinnaticrinacea, familial characters are the same as for the superfamily. Two new subfamilies are erected herein. The subfamily Cincinnaticrininae comprises those forms which Ulrich (1925) included in his family Heterocrinidae: the Cincinnati forms of *Heterocrinus* (*i.e.*, *Cincinnaticrinus*), *Dystactocrinus, Isotomocrinus,* and *Ohiocrinus*. The subfamily Atopocrininae is erected to accommodate *Atopocrinus,* which is morphologically, and presumably phylogenetically, distinct from other cincinnaticrinids.

Subfamily **CINCINNATICRININAE,** new subfamily

Diagnosis. — Cincinnaticrinidae with a lekythosiform (steeply conical) dorsal cup; equal-sized compound RR (in the C and E rays) somewhat taller than the equal-sized fused RR (in the A, B, and D rays); and an armlike anal series resting on the truncated left corner of the C ray sR.

Description. — Cincinnaticrininae with RR, both fused and compound, that are taller than broad. The distal left corner of the C ray sR and the distal right corner of the D ray R are truncated to accommodate anal X (the first anal plate), which is an inverted pentagon equal in size to or larger than adjacent Brr. In some species anal X enters more deeply into the cup; the proximal point of the pentagon reaches the line of junction of the sR and iR of the C ray. The two or three (minimally) successive anal tube plates are quadrilateral and appear armlike. Thecal plates as preserved are usually smooth, but different areas in various specimens are finely nodose, so that all ossicles may have had nodose surfaces.

Each of the five RR supports a series of quadrilateral IBrr. IBr_1 is the largest; it articulates with the underlying R along its entire proximal surface. The $IBrr_1$ are fixed, *i.e.*, united with the RR by immobile (synarthal?) suture, and functioned as part of the calyx. The uppermost IBr in each ray is a pentagonal axillary, bearing upon its upper sloping sides two equal-sized arms (to form a total of ten arms) made up of IIBrr, all but the last quadrilateral. The last is a pentagonal axillary. The number of Brr in each arm division is variable in members of the Cincinnaticrininae, both among different rays in single individuals and among the equivalent rays in different individuals. Branching on and beyond the IIBr axillaries varies among the genera of the Cincinnaticrininae but can be a useful taxonomic discriminant.

The column is long (probably up to about a meter), but no complete specimens have been found. Therefore, column length, nature of the column away from the calyx, and nature of attachment (if any in adults) are matters for conjecture. However, relatively good evidence exists for the column and its ontogeny for *Cincinnaticrinus varibrachialus* (new herein), and the column features of other heterocrinids are probably similar. The column is pentapartite and pentagonal, with the points of the pentagon disposed radially, although pentagonality can be shrouded by secondary overgrowth to produce a round appearance. The articular surfaces of each columnal are petaloid, with five petal-shaped articular facets, one facet per pentamere. The axial canal is small but conspicuous, star-shaped or pentagonal, with interradial points or angles.

Discussion. — Distribution of the subfamily Cincinnaticrininae is the same as for the superfamily Cincinnaticrinacea except for deletion of Whiterockian strata in Utah.

In the following generic and specific synonymies, references that duplicate earlier illustrations or descriptions are listed with the earlier work from which the information was borrowed. For example, Cumings (1908) and Bassler (1919) borrowed Meek's (1873) illustrations of *Heterocrinus heterodactylus* Hall for use in their works. The illustrations in such references are listed under the original source in the synonymy.

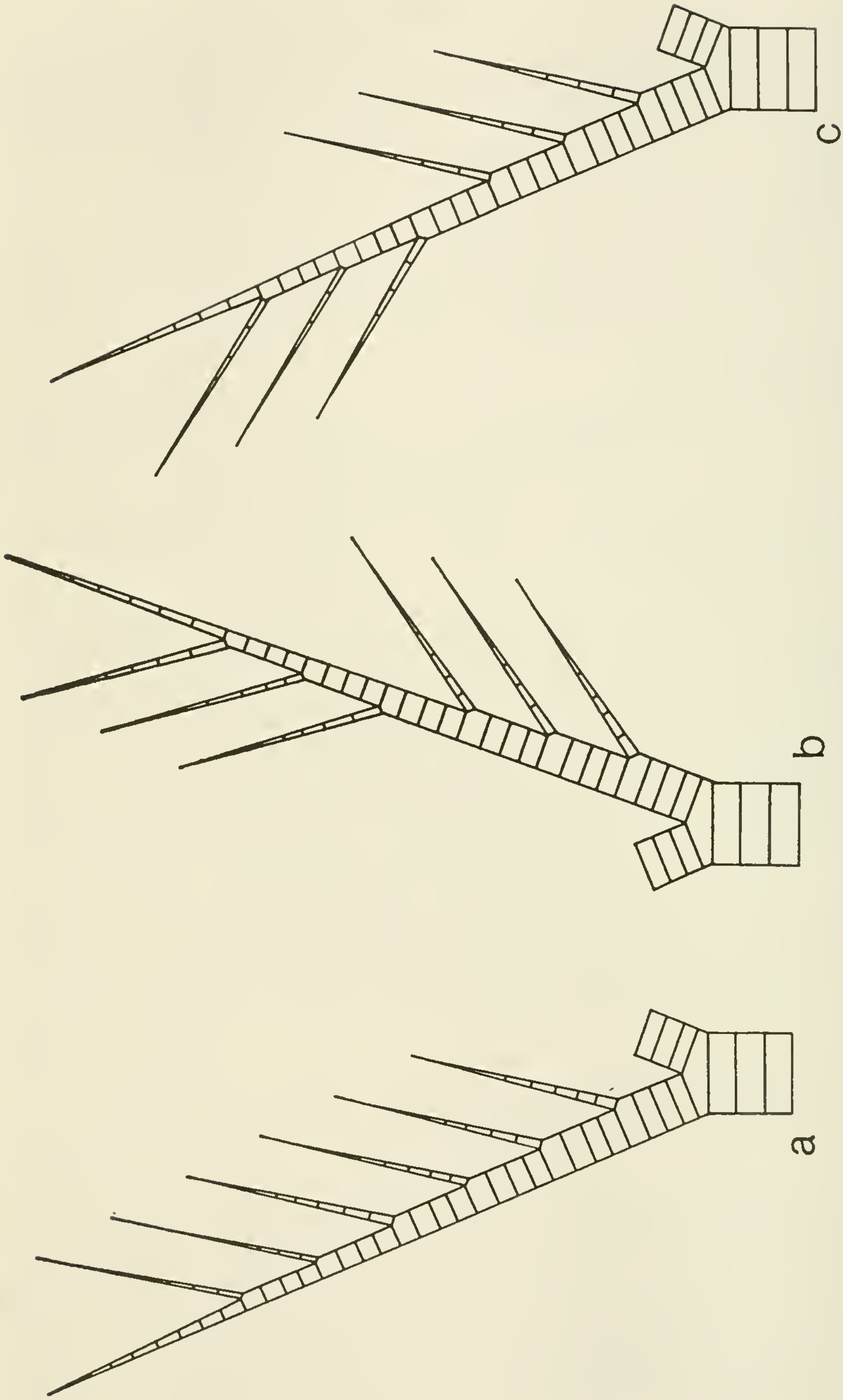
Genus **CINCINNATICRINUS**, new genus

1866. *Heterocrinus* Hall, Hall, p. 41; Hall, 1872, p. 210 (*partim*); Meek, 1873, p. 1 (*partim*); Wachsmuth & Springer, 1880, p. 68 (*partim*); Springer, 1911, p. 27; Ulrich, 1925, p. 83; Fritz, 1925, p. 10 (*partim*); Moore & Laudon, 1944, p. 149; Moore, 1962, p. 13, text-fig. 5-3; Warn, 1973, p. 12 (*partim*).
1886. *Stenocrinus* Wachsmuth & Springer, p. 207 (*partim*).

Type species. — *Cincinnaticrinus varibrachialus* Warn and Strimple, n. sp., from Edenian and Maysvillian strata of the Cincinnati area, northwestern New York, northern Maryland, and southern Pennsylvania.

Diagnosis. — Cincinnaticrininae with a short, straight anal tube made up of three to five facing plates; ten arms exhibiting alternating heterotomous branching; equidimensional (height = width) pentagonal BB; and height of $IBrr_1$ less than three-fourths the height of the fused RR.

Description. — *Cincinnaticrinus* has the features of the subfamily Cincinnaticrininae with some generic additions. The $IBrr_1$ are shaped like upright, truncated cones, while the $IBrr_2$ are inverted, truncated cones. Thus, the junction of the $IBrr_1$ and $IBrr_2$ forms a constriction in the crown that marks the position of the tegmen, above which the arms become free. This constriction appears to have been a plane of weakness that resulted in loss and occasional regeneration of arms. The tegmen of *Cincinnaticrinus* (probably of *C. pentagonus*) was described by Ulrich (1925, p. 84) as ". . . gently convex, its middle on a plane with, or slightly beneath the top of, the fixed primibrachs. It is composed of a large polygonal central plate around which are many much smaller, loosely fitting plates. The smaller plates arch over the arm furrows, at least three rows being required to cover them. On the posterior side the small plates of the tegmen pass, evidently without break or change, into the anterior wall of the ventral sac." Although Ulrich was correct in saying that the tegmen is located just proximal to the distal edges of the $IBrr_1$ (the fixed Brr), tegmen morphology appears to be quite different from what Ulrich described; it is more similar to the description of Wachsmuth and Springer (1886, p. 207) as ". . . five comparatively large interradial pieces enclosing a small oral plate. . . ." The tegmen (Text-fig. 8; Pl. 3, figs. 4-5) is actually made up of five relatively large, finely nodose (Ulrich evidently inter-



Text-fig. 7. Types of heterotomous arm branching. As in preceeding figure drawings stylized, represent one ray with an isotomous branch, only one-half ray fully illustrated. a-endotomous, b-alternating exotomous-endotomous, and c-alternating endotomous-exotomous.

preted each node as a plate), interradial plates, or orals (OO), that have their outer edges curved down into the spaces between adjacent $IBrr_1$ and their inner, adjoining edges upturned to form gabled passageways over the subtegmenal portions of the ambulacra. Three gabled passageways (one anterior, two lateral) radiate from a central point (presumably over the mouth) to the food grooves of the A, C, and D ray $IBrr_1$; the two lateral (C and D ray) passageways bifurcate near their distal ends and send off two posterior passageways to the B and E ray $IBrr_1$. The CD interray O is apparently porous and served the function of a sieve plate; it gives off numerous small plates from its outer edge that continue up the back of the XX. Although the tegmen morphology is known only from *Cincinnaticrinus* it is probably similar in other cincinnaticrinids.

The anal structure is armlike, apparently tubular throughout its length, although Ulrich (1925, p. 91) reported that it had been observed in only one of hundreds of specimens; this author has seen a maximum of only five anal plates in any of over a thousand specimens. It appears that the anal tube is made up of armlike series of three to five facing plates (XX) backed by numerous small polygonal plates given off from the tegmen. Whether or not the numerous small plates that back the XX continue beyond, or distal to, the XX (as in *Ohiocrinus*) is uncertain, although it is likely they do not.

The pattern of arm branching in *Cincinnaticrinus,* after initial division of the five rays (isotomous as in all Cincinnaticrinacea) to form ten arms, is alternating heterotomous. The first of the heterotomous divisions (on the IIBr axillaries) produces a large arm as the inner branch and a smaller arm, or armlet, away from the ray; the second division (on the IIIBr axillaries) has the arm on the outside and the armlet on the inside; the third has the arm on the inside and the armlet on the outside. The armlets commonly remain simple, but bifurcating armlets have been observed in a few specimens.

The XX and Brr, after initial formation as tall, narrow rectangles, grow faster laterally (marginally) than vertically (perradially). Thus, young (small, calyx height of about 2.5 mm or less) *Cincinnaticrinus* have tall XX and Brr, while older (larger, calyx height of about 2.8 mm or more) *Cincinnaticrinus* have broad IBrr but tall IVBrr and nearly square XX, with gradation in the Brr from broad to tall away from the dorsal cup. In young *Cincinnaticrinus,* the arms are so narrow that they appear to be isotomously branched (Pl. 3, fig. 11). Arms, when initially formed, may really be isotomously branched, but with ageing heterotomy becomes increasingly distinct.

Sharply V-shaped grooves (food grooves) with narrow flattened bottoms (Pl. 3, fig. 7) extend down the inner surfaces of the Brr — two converging to one at each axillary (Pl. 3, fig. 7). These grooves deepen gradually proximally, until they reach the RR, where they shallow rapidly, after passing beneath the tegmen, and disappear about one-fourth the way down the RR.

Occurrence. — Edenian to Richmondian. *Cincinnaticrinus* is known from the Kope, Fairview, Grant Lake, and Bull Fork Formations of the Cincinnati, Ohio, area, from the Whetstone Gulf Formation of northwestern New York; and from the upper part of the Martinsburg Formation of southern Pennsylvania and Maryland.

Discussion. — In 1847 James Hall erected the new genus *Heterocrinus* to include the three new species *H. heterodactylus* (p. 279), *H. simplex* (p. 280), and *H. ? gracilis* (p. 280). Hall did not designate a type species, nor did he refer to any of the three species as typical (he did, however, emphasize that *H. gracilis* deserved only provisional placement under the genus). Hall had a concept of the genus *Heterocrinus* that allowed considerable variation; this likely was his reason in choosing *heteros* (Greek for different or changed) for the name of the genus. In including the heterocrinid *H. heterodactylus* with the homocrinid *H. simplex* (now type species of *Ectenocrinus*), Hall created a problem that was to be a source of confusion until Ulrich's (1925) revision of the Heterocrinidae. Some paleontologists embraced Hall's concept and included forms with three compound and two fused RR (*e.g., Heterocrinus simplex*) and forms with two compound and three fused RR (*e.g., H. heterodactylus*), while others limited the genus to forms like *H. simplex.* Confusion over the type species compounded the problem.

In 1866 (pp. 4-6) Hall described three more species of *Heterocrinus* and compared one of them to *H. simplex.* Wachsmuth and Springer (1880, p. 69) enumerated known species of *Heterocrinus* and listed *H. heterodactylus* as the type species. Later (1886, pp. 205-208) these authors recognized that the differences between *H.*

heterodactylus and *H. simplex* are greater than specific differences, and they redefined *Heterocrinus*. Of the 11 species which they placed in *Heterocrinus* in 1880, in 1885 they transferred *H. heterodactylus,* along with four other species, to the new genus *Stenocrinus* with *H. heterodactylus* as type species; they left *H. simplex* and one other species in *Heterocrinus* (with *H. simplex* as type species); two species were transferred to *Calceocrinus* and the remaining two species were assigned to the new genus *Ohiocrinus*. Wachsmuth and Springer's ideas concerning *Stenocrinus* and *Heterocrinus* were not accepted by S. A. Miller (1889), who erected the genus *Ectenocrinus* with *H. simplex* as type species (p. 242) and listed *H. heterodactylus* as type species of *Heterocrinus* (p. 252). Springer (1911) recognized that Wachsmuth and he had mistakenly substituted *Heterocrinus simplex* as the type species of *Heterocrinus* in place of *H. heterodactylus,* the valid type species: "But through some misunderstanding of types the name *Heterocrinus* was assigned by us [Wachsmuth and Springer, 1885] to the wrong set of species, *H. heterodactylus* being Hall's type of that genus; therefore, *Stenocrinus* must go into synonymy. *Heterocrinus* must be retained for the *H. heterodactylus* group. . . ." (Springer, 1911, p. 27).

Hall, although he did not designate a type species, may have felt that *H. simplex* was typical of *Heterocrinus* (in succeeding descriptions of new *Heterocrinus* species, he referred to *H. simplex* but not to *H. heterodactylus*); but if, in naming *H. heterodactylus,* Hall had in mind the concept of what we now call virtual tautonymy, he probably considered *H. heterodactylus* as typical. Whatever may have been Hall's original views, they were not documented and are, therefore, not pertinent. When Wachsmuth and Springer (1880), possibly applying the convention of page priority or the tautonymic concept (or perhaps having communicated with Hall), listed *H. heterodactylus* as the type species of *Heterocrinus,* they established *H. heterodactylus* as the type species by subsequent designation (Warn, 1973, pp. 10-11). Problems, however, do not end here.

Although the genus *Heterocrinus* Hall, 1847 and two of its species, *H. heterodactylus* Hall, 1847 (the valid type species of *Heterocrinus*) and *H. juvenis* Hall, 1866, have come to be relatively common names, Hall's original descriptions, figures, and type material do not make these taxa recognizable. Modern understanding of these taxa in large part dates from Meek (1873) and Ulrich (1925), who figured new material and described it in detail. *H. juvenis* is unrecognizable for reasons discussed under *Cincinnaticrinus pentagonus* (conceptually similar to Meek's, 1973, *H. juvenis*). *H. heterodactylus,* the valid type species of *Heterocrinus,* is unrecognizable because neither Hall's (1847) figures (and description) nor any type material (Pl. 1, figs. 1-6) shows branching beyond the isotomous branches on the IBr axillaries. Meek (1873) recognized this problem when he (p. 13) considered specimens from around Cincinnati referred to *H. heterodactylus* by Hall (1847): "This is the western form that has always been referred to *H. heterodactylus,* of Hall; but as the original typical specimen of that species did not show whether or not its arms bifurcate above the division on the last primary radial, . . . its identity with that species can scarcely be established beyond doubt." The names *Heterocrinus* and *H. heterodactylus* must at present be restricted to Hall's (1847) type material. The new name *Cincinnaticrinus* is used here for the concept of *Heterocrinus* put forth by Meek (1873), Ulrich (1925), and subsequent workers, *i.e.,* a monocyclic inadunate with three fused and two compound RR, a short, straight, armlike anal tube, and alternating heterotomous branching beyond the isotomous branch on the IBr axillaries. *Cincinnaticrinus varibrachialus,* the new name for Meek's (1873) and subsequent workers' concept of *H. heterodactylus,* is discussed later.

Cincinnaticrinus appears to differ from *Ohiocrinus* mainly with respect to the anal sac. Both *Ohiocrinus* and *Cincinnaticrinus* have an anal tube that is an armlike branch of about four plates off the C ray sR. In *Cincinnaticrinus* the XX are backed by small polygonal plates given off from the tegmen to form a short narrow tube; the four (or five) XX of *Ohiocrinus* have a backing of small polygonal plates which extends away from the XX (rather than closing around the back to form a tube) and beyond (distal to) the XX as a high, inflated, polyplated coil with wide whorls. For a time the authors thought the differences to be preservational (*i.e.,* that *Ohiocrinus* were well-preserved *Cincinnaticrinus*); but so many well-preserved *Cincinnaticrinus,* all lacking coiled anal sacs, have been examined that it now appears the two are distinct.

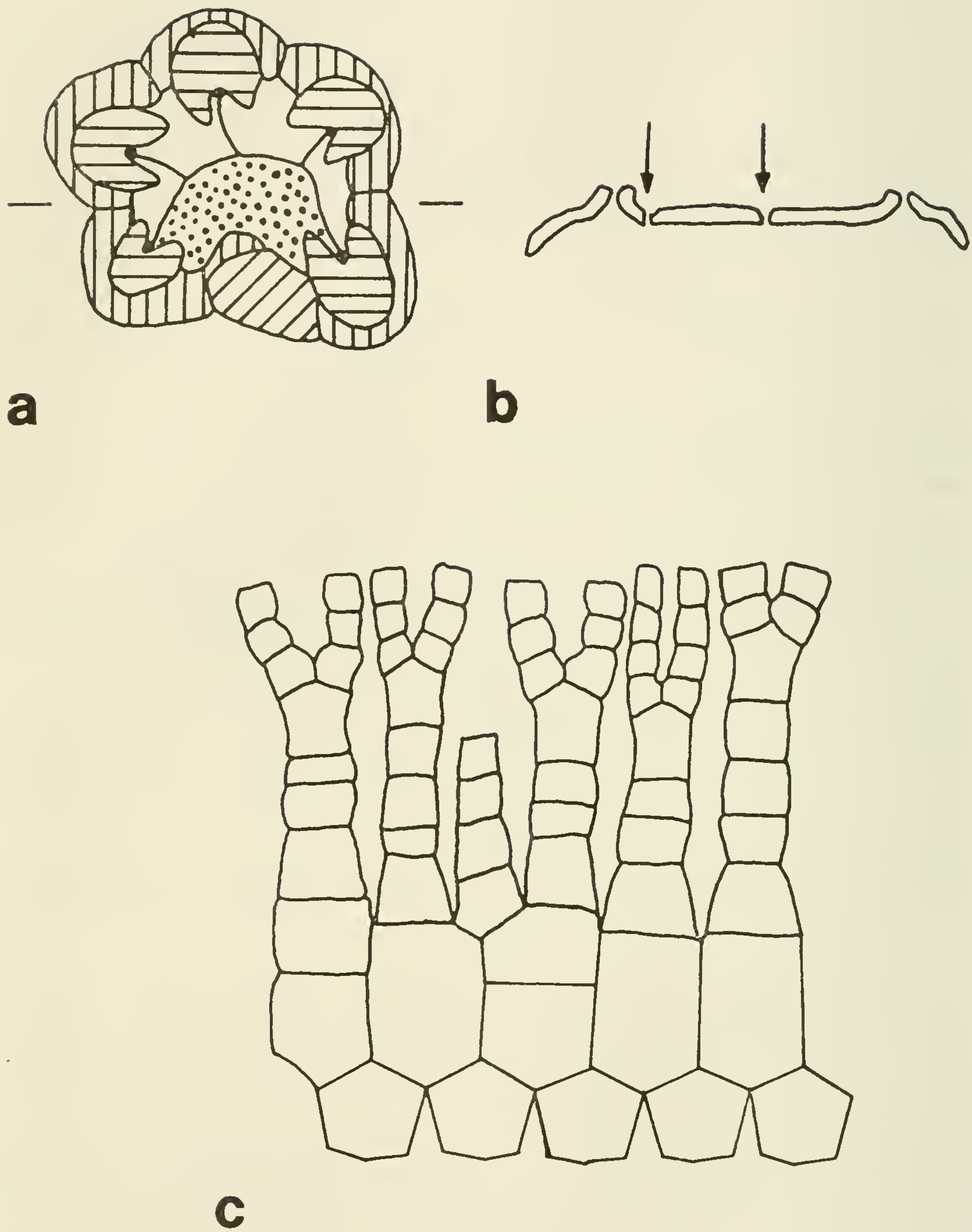
Cincinnaticrinus probably evolved from an earlier cincinnaticrinid. The step from *Isotomocrinus* to *Cincinnaticrinus* is simply one of making isotomous arms heterotomous (isotomous to heterotomous is a common evolutionary trend in crinoids, Moore and Laudon, 1943, p. 10) and shortening the anal tube somewhat. *Cincinnaticrinus* and *Ohiocrinus* are certainly similar; it is easier to derive *Ohiocrinus* from *Cincinnaticrinus* with coiling and elongation of the polyplated anal sac and elongation of the arms than to do the reverse, although *Ohiocrius* could be an independent offshoot from *Isotomocrinus* (the arms of *O. brauni* are nearly isotomous). *Dystactocrinus* is also like *Cincinnaticrinus,* from which it probably evolved. Evolution of *Cincinnaticrinus* to *Dystactocrinus* requires only regularization of branching (constancy in number of Brr in each division series in single specimens and among different individuals is apparently an evolutionary endpoint in cincinnaticrinids), broadening of BB, and enlargement of $IBrr_1$.

Cincinnaticrinus is known from thousands of specimens (all but a handful from in and around Cincinnati, Ohio,) and is easily the best known of cincinnaticrinids. Two species, *C. varibrachialus* (new herein) and *C. pentagonus* (Ulrich), 1882, are recognized. *Heterocrinus isodactylus* Miller, 1875, may belong to *Cincinnaticrinus* but must, at present, be restricted to its holotype. *Heterocrinus isodactylus* Miller may be conspecific with *Cincinnaticrinus pentagonus,* but Miller's drawing and description are poor and hardly allow this to be suggested with much authority.

There appears to be a trend in *Cincinnaticrinus* toward thicker columns through time. *C. varibrachialus* has a column with a relatively consistent width (proximal column diameter is about half distal cup diameter) through Edenian and into Maysvillian time. Maysvillian *C. pentagonus* (with columns having proximal column diameter somewhat smaller than distal cup diameter), however, give way to even broader columned forms in Richmondian time (Richmondian *C. pentagonus* have columns with proximal diameter about equal to distal cup diameter).

Cincinnaticrinus varibrachialus, new species Pls. 3-5; Text-fig. 8

1873. *Heterocrinus heterodactylus* Hall, Meek, p. 12, pl. 1, figs. 1a-b; Cumings, 1908, pl. 3, figs. 5, 5a; Bassler, 1919, pl. 53, figs. 5-6; Ulrich, 1925, p. 83, text-fig. 3a; Moore & Laudon, 1944, pl. 52, fig. 11.



Text-fig. 8. *Cincinnaticrinus varibrachialus*. a & b—tegmen; c—plate diagram. a—oral view, a drawing of UCGM 40575L (×15); rays are lettered A, B, C, D, and E, scoring is vertical on the RR, horizontal on the $IBrr_1$, and diagonal on X; OO are unmarked (except, on the CD interray O, dots which represent pores): b, crosssection of the OO (×30) in the plane marked by the two lateral lines in figure a; OO are upturned where they join, presumably over the five ambulacra, and have their outer edges turned down between the $IBrr_1$; the two arrows point to funnel-shaped (in cross-section) pores in the CD interray O; c — exploded diagram of *Cincinnaticrinus varibrachialus*.

1925. *Heterocrinus difficilis* Ulrich *in* Ruedeman, p. 76.
1973. *Heterocrinus tenuis* Billings, Warn, p. 10, pl. 1, figs. 2-19 (*non* fig. 1).

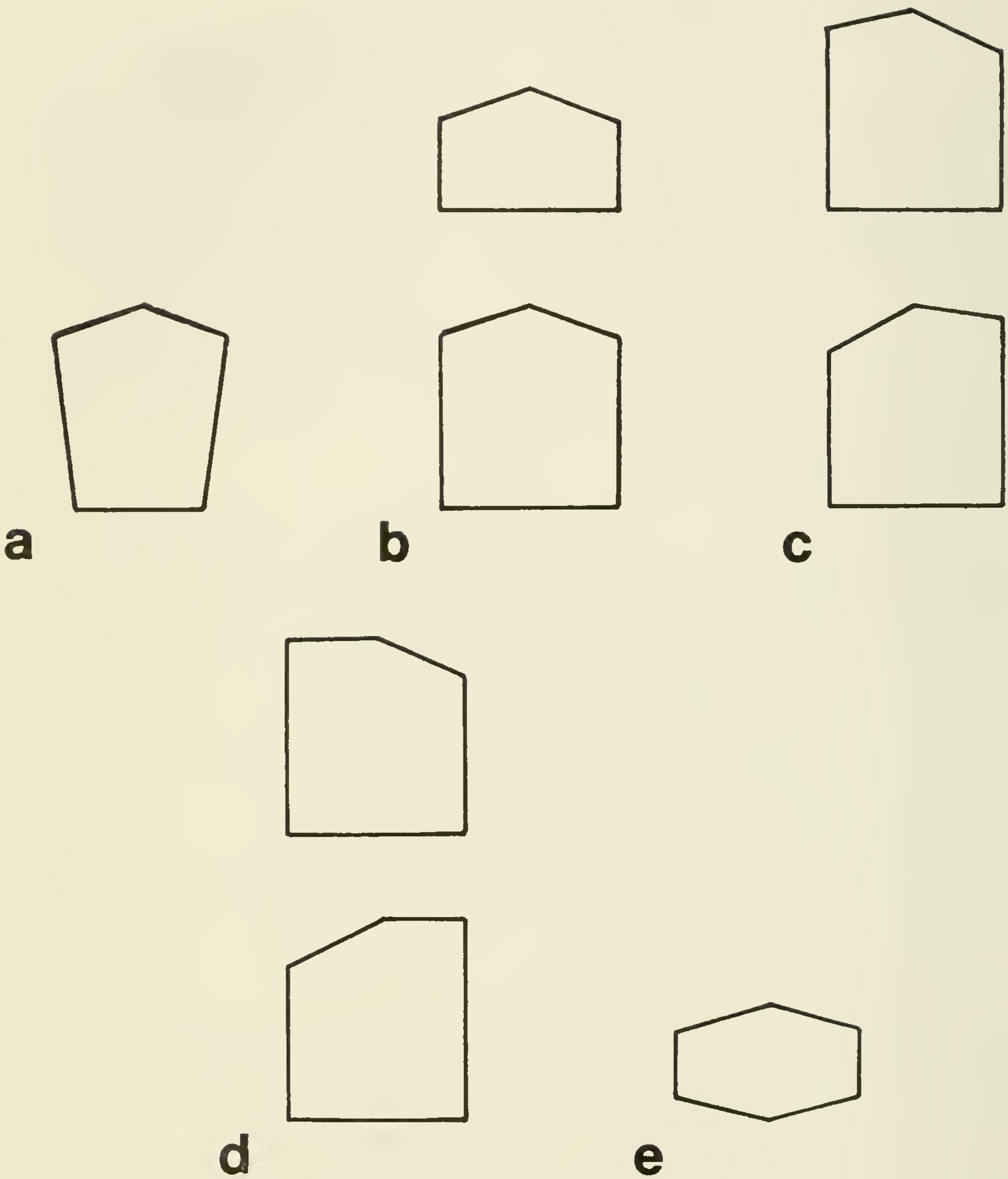
Primary type material. — The holotype is here designated UCGM 3871 (the specimen illustrated by Meek, 1873, pl. 1, figs. 1a-b as *Heterocrinus heterodactylus*?). Paratypes are here designated UCGM 40497, 40500, 40502, 40531, 40555, 40556, and 405751. All primary types are from Edenian strata in the Cincinnati, Ohio, area.

Diagnosis. — *Cincinnaticrinus* with steeply conical (lekythosiform) cup and narrow column, so that in uncrushed specimens distal cup diameter is at least 1.4 times as great as proximal cup (or proximal column) diameter.

Description.—*C. varibrachialus,* in addition to generic and higher characters, has BB (Text-fig. 9) and RR that expand distally and make the dorsal cup conical. This is more obvious in juveniles, which have globular calyces. With growth, the angle formed by the edges of the cup (in lateral view) decreases as the sides of the BB and RR approach a parallel condition (compare Pl. 5, figs. 1-2 and 12-13). No new cup plates are added during ontogeny (that is, during that part of the ontogeny that is known), and shapes and relative size ratios of cup ossicles change little, other than widening of the bottoms of the BB and RR. Thus, the smallest (youngest) and largest (oldest) crinoids have dorsal cups that are nearly identical except for size.

Cincinnaticrinus varibrachialus, with two to seven IBrr (commonly three, four, or five), three to seven IIBrr (four or five is most common), and four to six IIIBrr (commonly four or five), has arms that are more variable than in any other cincinnaticrinid aside from *Isotomocrinus tenuis.* Ramules given off at heterotomous branches usually remain simple and have more plates, but bifurcating ramules have been observed in a few specimens. Warn (1973) described small (smaller than adjacent Brr) doubly convex (marquise) plates occurring in some specimens at various places in the arms (in the IBr series most commonly between IBr_1 and IBr_2, Pl. 3, fig. 3).

No complete *Cincinnaticrinus varibrachialus* specimens (holdfast, column, and crown or calyx) are known. However, that juveniles (and possibly adults) have an obscurely polyplated, inverted

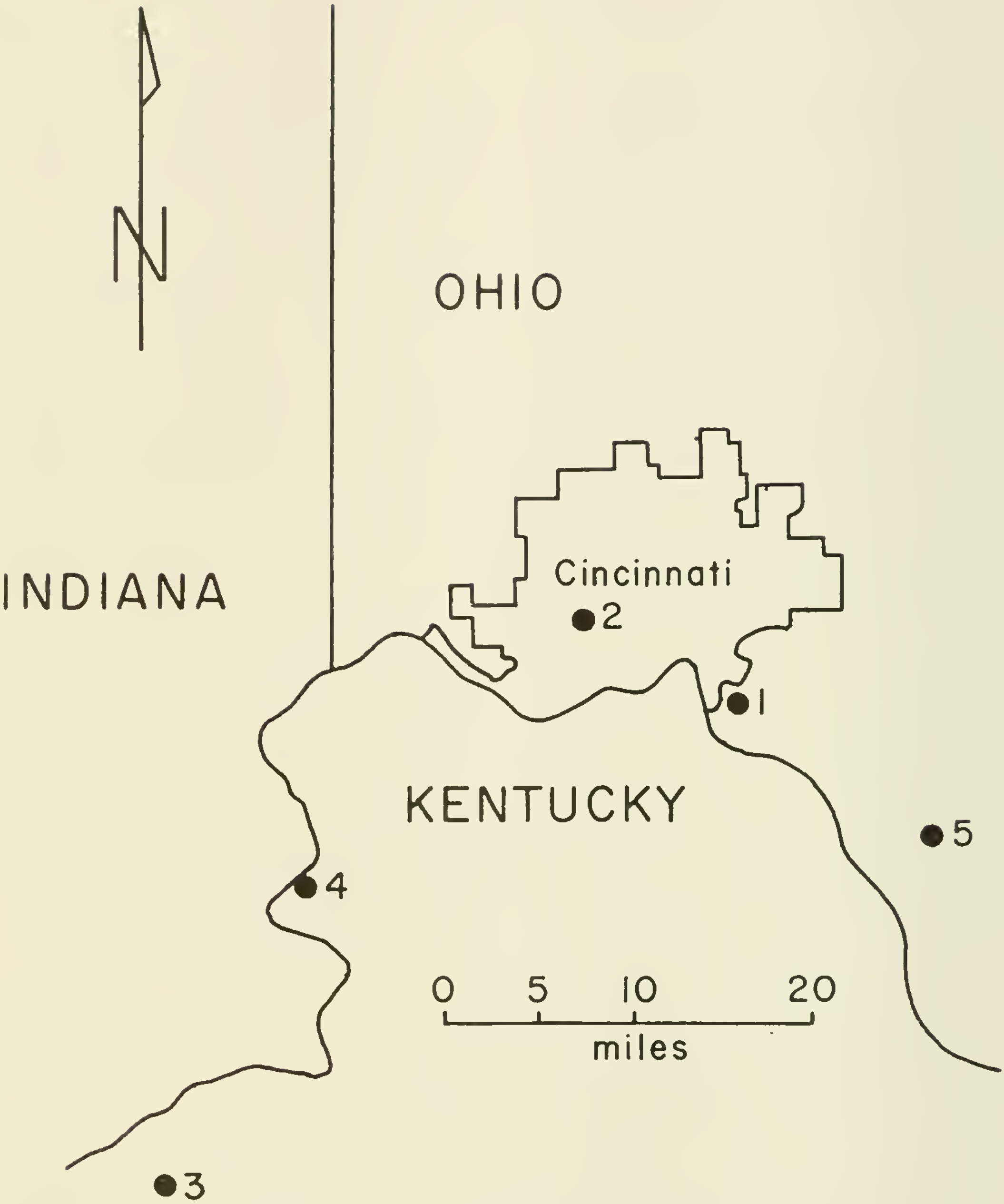


Text-fig. 9. Five general basal plate shapes in cincinnaticrinaceans and homocrinaceans.
a—distally expanding, symmetrically pentagonal (*Cincinnaticrinus varibrachialus, Isotomocrinus tenuis, Atopocrinus priscus,* and *Homocrinus parvus*). b—parallel-sided, symmetrically pentagonal (*C. pentagonus, Ohiocrinus laxus*—also e in some members, *O. brauni, Daedalocrinus bellevillensis, Ectenocrinus simplex, E. geniculatus,* and *Sygcaulocrinus typus* — in the case of the last three, only the AB interray B). c—asymmetrically pentagonal with one steeply sloping and one gently sloping upper side (*S. typus* — all but the AB interray B). d—asymmetrically pentagonal with one steeply sloping and one horizontal upper side (*E. simplex* and *E. geniculatus* — in both, all but the AB interray B). e—symmetrically hexagonal (*Dystactocrinus constrictus* and occasionally *O. laxus*.

saucer-like (lichenocrinid) basal attachment is fairly certain (and has been known for some time, see discussion). In collecting localities 1, 2, and 4 (Text-figure 10) *C. varibrachialus* calyces and crowns and lichenocrinid bases and columns have been found in abundant association. As well, an ontogenetic sequence from lichenocrinid to cincinnaticrinid column is evident among separate columns and in single columns collected from these, and other, pockets.

Juvenile *C. varibrachialus* holdfasts (Pl. 5, figs. 15-16) are roughly circular discs, usually attached to such foreign objects as adult *C. varibrachialus* columns, other adult crinoid columns, brachiopods, bryozoans, trilobites, pelecypods, or phosphate nodules. They range in diameter from less than one mm to about five mm, with most having a diameter of about two or two and one-half mm. They have a convex, obscurely polyplated, upper wall (roof) and a large flat plate as the lower wall (floor). When the inhabited substrate is not flat, concomitant changes in shape occur, *e.g.*, when encrusting crinoid columns they curl around the column (Pl. 5, fig. 16). The lichenocrinid column protrudes from a central depression or crater in the roof. Internally, five primary lamellae extend from the periphery of the holdfast and meet at the center. These lamellae rest upright on the floor. Second, third, and fourth order lamellae are inserted serially between the primary lamellae and may or may not reach the center. The lamellae (Pl. 5, fig. 15) appear to support the roof. (For detailed information on lichenocrinid bases in general, affinities unknown, see Faber, 1929).

Juvenile *Cincinnaticrinus varibrachialus* columns (lichenocrinid columns — Pl. 3, figs. 3, 10) show an interesting morphologic (and apparently ontogenetic) sequence. They are composed distally (*i.e.*, adjacent to the base) of five vertical series of hexagonal plates with the plates of each series alternating with laterally adjacent plates (*i.e.*, plates of adjacent series) to form zigzag sutures between series (Text-fig. 11). These grade proximally into a section with alternating plates that abut, so that a straight suture is formed between series (Text-fig. 11). Farther proximally, abutting plates come to lie in parallel planes to form circlets of five plates (Text-fig. 11). Each circlet has one plate from each of the five series. Transition to the cincinnaticrinid column occurs with gradation into columnals by fusion of the five plates (pentameres). Thus, the most proximal



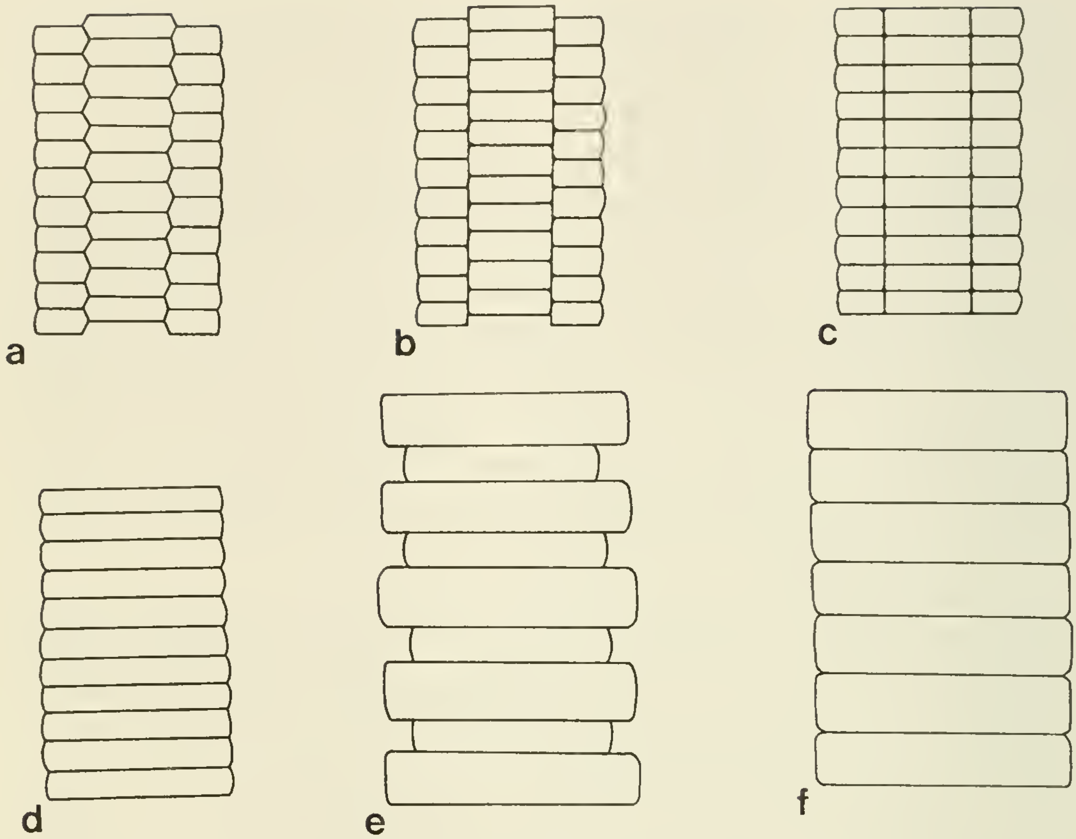
Text-fig. 10. Localities of *Cincinnaticrinus varibrachialus* collected in connection with this study. Numbers refer to localities described in text.

(youngest) part of the juvenile column (= distal and oldest of adult ?) is round with equal-sized columnals (Text-fig. 11), each made up of five pentameres.

The adult *Cincinnaticrinus varibrachialus* column is either pentagonal proximally grading distally into terete, or round throughout. The proximal pentagonal part can be made up of two sets of columnals: larger, more rounded columnals and smaller, markedly pentagonal columnals inserted between the larger columnals. Each columnal is composed of five fused plates with each plate forming a point in the pentagonal columnals. With secondary secretion of stereom (seemingly a normal feature of column aging), the column becomes round, but the former pentagonal column can be seen inside the round sheath in cross-section.

Occurrence. — Edenian and Maysvillian from the Kope and Fairview Formations around Cincinnati, Ohio; the Whetstone Gulf Formation of northwestern New York; and the Martinsburg Formation in Maryland and southern Pennsylvania. Ruedemann (1925, p. 70) briefly described a *Cincinnaticrinus* from zone I of the Whetstone Gulf as *Heterocrinus difficilis.* This species was to be further described later, but never was, by E. O. Ulrich: it is considered here to be a junior synonym of *C. varibrachialus.* The authors have found *C. varibrachialus* only in the Kope Formation, in which crinoids are fairly common, weathering more easily out of the predominantly shaley unit than from the more limy Fairview above. The dominantly calcareous Fairview ("Hill Quarry beds") is less propitious for well-preserved cincinnaticrinids. However, during the 1800's and early 1900's dozens of quarries were operating in the Cincinnati area and more good Fairview exposures were available. Fortunately, area museums have specimens from the "Hill Quarry beds" (Fairview Formation) collected around the turn of the century.

Discussion. — *Cincinnaticrinus varibrachialus* is erected to house the taxon that Meek (1873) and Ulrich (1925) made known as *Heterocrinus heterodactylus. H. heterodactylus* must be considered as unrecognizable, because Hall's (1847) type material (AMNH 1116/1, Pl. 1, figs. 4-6; AMNH 1116/2, Pl. 1, fig. 3; AMNH 1116/3, Pl. 1, figs. 1-2), illustrations (Hall, 1847, pl. 76, figs. 1a-o), and description (Hall, 1847, p. 279) do not demonstrate the nature of the arm branching.

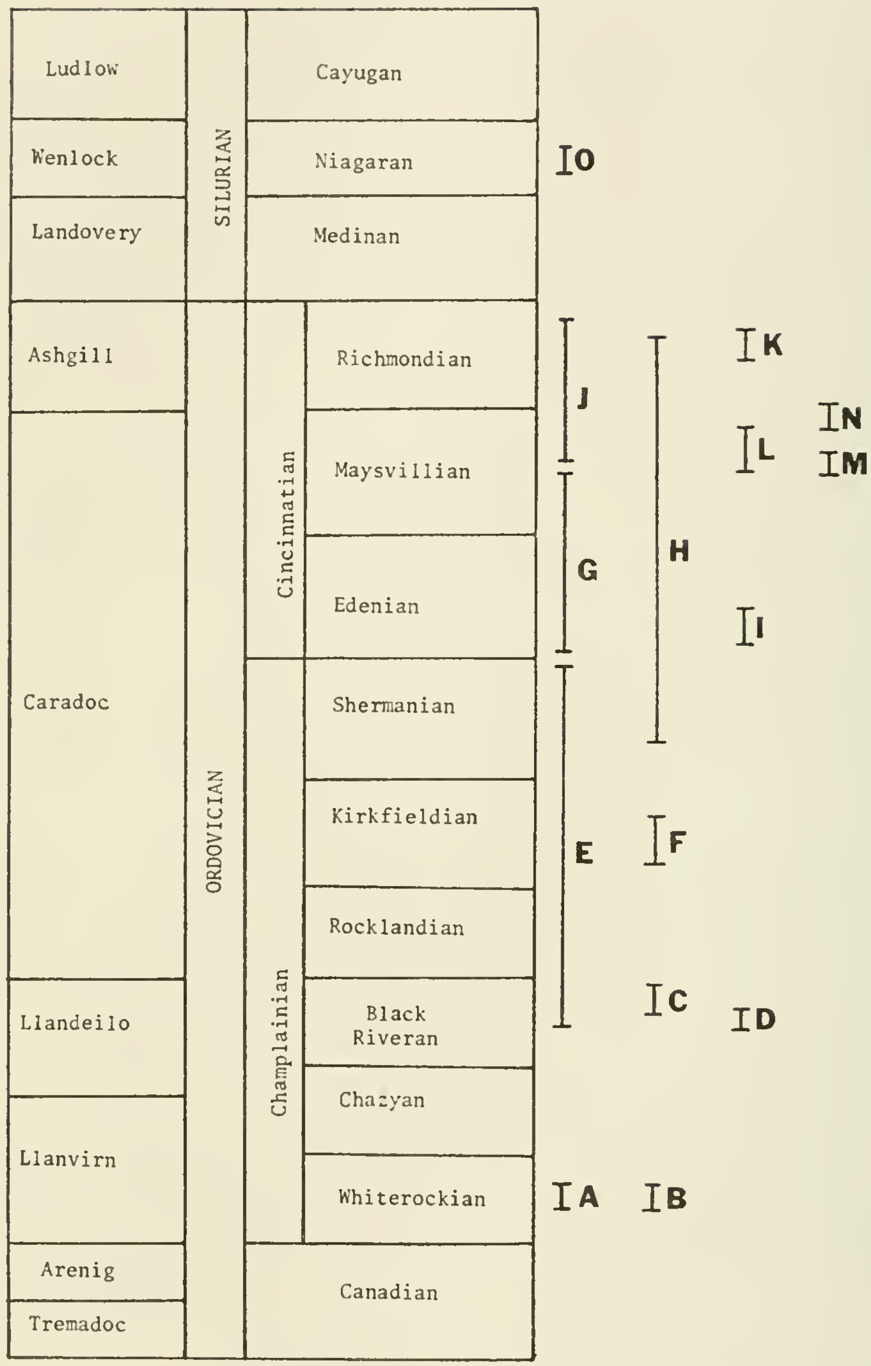


Text-fig. 11. Ontogeny of the *Cincinnaticrinus varibrachialus* column. a, b, c and d are portions of the juvenile column viewed progressively more proximally; a is the most distal portion (*i.e.*, nearest the holdfast) and is composed of five vertical series of hexagonal plates with the plates of each series alternating with laterally adjacent plates to form zigzag sutures between series; these grade proximally into a section (b) with alternating plates that abut, so that a straight suture is formed between series; farther proximally, abutting plates come to lie in parallel planes to form circlets of five plates (c) still farther proximally the circlets of five plates fuse to form pentapartite columnals (d) e and f are portions of the adult column; the oldest portion of the adult (f) is round with equal-sized columnals, which are apparently first secreted as pentagonal columnals and become round with secondary secretion of stereom; this grades proximally into a portion (e) with larger, more rounded columnals (in some specimens an additional proximal portion is made up of equal-sized pentagonal columnals).

The trivial name *varibrachialus* is chosen to describe the variability in number of Brr per division series that is characteristic of the species. Originally the word "brachial" was used as an adjective to denote arm ossicles (*e.g.*, brachial plates or ossicles; primibrachial plates or ossicles). More recently, the word "brachial" has come to be widely used in an abbreviated sense as a noun to denote arm ossicles (*e.g.*, brachials, primibrachials); and abbreviation is often carried even further (*e.g.*, brachs, primibrachs). The trivial name *varibrachialus*, chosen for its descriptiveness, is somewhat awkward, in that it represents latinization of an anglicized Latin word. However, it is chosen over the original Latin *brachialis* because the latter would give the name too much breadth of meaning (*varibrachialis* would mean simply arm variation). The trivial name *varibrachialus* is more appropriate to denote variation in number of Brr per division series, as typifies the arms of this species.

Great variability in number of IBrr (and higher Br series), both in single individuals and among different individuals, appears to be a feature unique to cincinnaticrinids. Warn (1973) interpreted the smaller marquise-shaped Brr as intercalates and judged intercalation of Brr to sufficiently explain the brachial variability in *Cincinnaticrinus varibrachialus*. In that paper, 61 different IBr arrangements were reported from a single pocket of 72 crowns (specimens with all five IBr series still intact), 116 partial crowns (one to four IBr series), and 219 calyces (no complete IBr series). Similiar variation and variation in additional populations has since been found. Kesling and Strimple (1971) reported, in *Eutaxocrinus wideneri* (a flexible crinoid), IBr and IIBr variation (considered mutation by Kesling and Strimple) from a basic plan of two IBrr per ray and three or four IIBrr per arm; in cincinnaticrinids, however, variation within limits (*e.g.*, two to seven IBrr for *Cincinnaticrinus varibrachialus*) seems to be the rule, rather than an exception.

Lichenocrinus was described by Hall (1866, p. 9) for what the authors herein have referred to as lichenocrinid bases. Hall thought these to be the "bodies" of parasitic crinoids because of their consistent attachment to other organisms. Meek (1871, 1872b, 1872c) and Sardeson (1899, p. 275) theorized that *Lichenocrinus* might actually represent basal attachments of crinoids. Schuchert (1904, p. 268) stated more definitely that *Lichenocrinus* are bases of



Text-fig. 12. Ranges of cincinnaticrinacean and homocrinacean species. European stages are on the left of the column; North American series and stages are on the right. A—*Ibexocrinus lepton*, B—*Atopocrinus priscus*, C—*Apodasmocrinus daubei*, *A. punctatus;* D—*Isotomocrinus minutus;* E—*I. tenuis;* F—*Daedalocrinus bellevillensis;* G—*Cincinnaticrinus varibrachialus;* H—*Ecterocrinus simplex;* I—*E. geniculatus;* J—*Cincinnaticrinus pentagonus;* K—*Sygcaulocrinus typus;* L—*Dystactocrinus constrictus;* M—*Ohiocrinus laxus; O. brauni;* N—*Ectenocrinus* sp. indet.; O—*Homocrinus parvus.*

crinoids. Springer (1917, p. 11) reported the affinity of *Heterocrinus* and lichenocrinid bases but cited no evidence, "This curious disc-like body [lichenocrinid base] . . . is now known to be the encrusting root of a very small crinoid of the *Heterocrinus* type." Perhaps Springer was referring to material sent to him for description by an amateur collector, George M. Austin, in 1903 (see below). Foerste (1925, pp. 102-103) alluded to complete juvenile heterocrinids with lichenocrinid bases and column in the USNM collection. Unfortunately, Foerste could not discern the plate arrangement of the calyx, and the authors have not been able to locate the specimens (perhaps Foerste, too, was referring to the Austin material, see below). Bassler (1928) indicated that George M. Austin, from Wilmington, Ohio, had discovered evidence for the lichenocrinid-heterocrinid affinity in 1898 and had (in 1903) communicated his discovery to Frank Springer for description, which Springer never did. Faber (1929, pp. 455-456) reported that in 1898 he, G. Ashman, and A. Albers found three tiny crinoids complete with lichenocrinid bases. According to Faber, these specimens were never illustrated or described and disappeared, along with part of Albers' collection, just before Albers' death. Fenton (1929) discussed Austin's 1898 material (USNM 89862a-f, the material that Springer was to have described) in detail. Reexamination of this material confirms Fenton's observation that some heterocrinids (cincinnaticrinids) and some lichenocrinids represent different parts of the same organism. USNM 89862a-f consists of 20 lichenocrinid bases attached to *Rafinesquina,* an *Isotelus* fragment, and trepostome bryozoan fragments associated with lichenocrinid columns and three juvenile *Cincinnaticrinus* sp. cf. *C. pentagonus* crowns from Richmondian strata near Clarksville, Ohio. One of these crowns appears to have been attached to one of the lichenocrinid columns; only a 0.8 mm long furrow, presumably the result of loss of a portion of the column from the slab, separates the crown from the column.

While earlier workers' evidence, as well as recent observations [herein and by Weaver (1976)] indicates a lichenocrinid base-juvenile *Cincinnaticrinus varibrachialus* (and probably *C. pentagonus*) affinity, resolution of the matter of priority of *Lichenocrinus* as a generic name is delayed until more information, hopefully from discovery of complete specimens, is available. Considerable morphologic variation in lichenocrinid bases suggest that juveniles of a variety of Cincinnatian crinoids have lichenocrinid holdfasts. One such association involving *Isotomocrinus* has been discussed by Kolata (1975, p. 27).

Miller (1874) described the axial changes in the *Heterocrinus heterodactylus* (*C. varibrachialus*) column through much of its length but said nothing of the lichenocrinid nature of the distal (juvenile) column and base. Bather (1891, pp. 400-401, text-fig. 5; 1900, p. 89, text-fig. 3) described a similar distal-proximal columnar gradation for the cladid *Botryocrinus decadactylus* from the Wenlock Limestone.

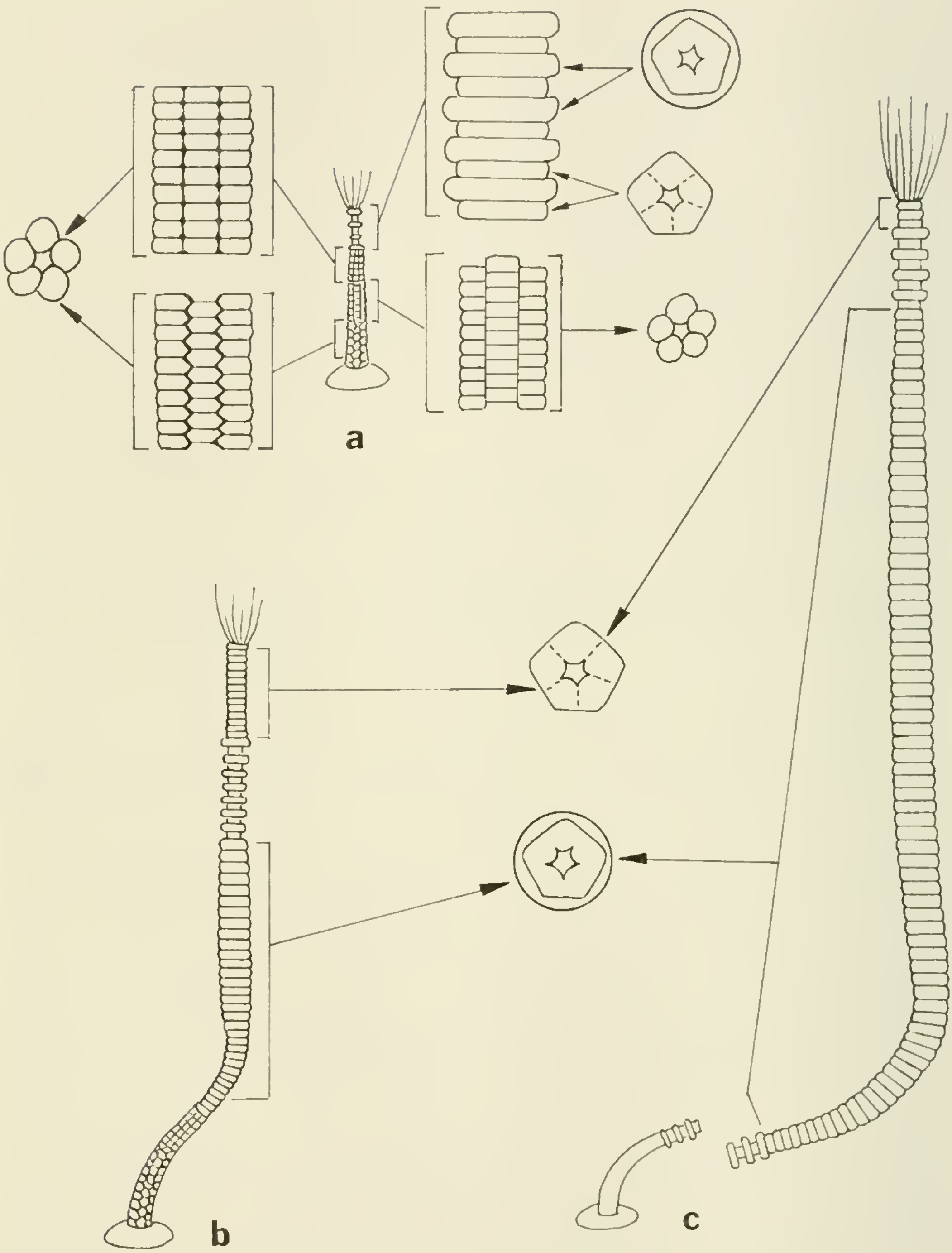
It appears that in adults new columnals are added both at the base of the calyx and intercalated serially for a short distance distally between older columnals. Columnals are, in both cases, first added as five discrete radial plates which fuse to form pentagonal columnals. Older columnals become round with secondary secretion of stereom. Addition of new columnals could cease at some stage in ontogeny; if this occurs all columnals eventually would become round. Thus, most adult columnals have a proximal section made up of pentagonal columnals, grading distally into a series of pentagonal columnals alternating with larger rounded columnals, and finally into a distal region of round columnals only. Some columns (of younger crinoids?) are pentagonal for proportionally greater distances, while others (of older crinoids?) are round throughout their observed length. This is in apparent agreement with "Jackson's law" (Jackson, 1896; 1899), which is essentially: In organisms possessing organs which grow by the serial addition of parts, the ontogeny of the organ tends to rehearse its phylogeny.

Warn (1974) described swellings, which he interpreted as myzostome galls, in columns of *Heterocrinus juvenis* (= *Cincinnaticrinus pentagonus*, herein). The authors have seen similar galls in columns of *C. varibrachialus* and *Ectenocrinus simplex*. These have recently been reinterpreted as annelids (*Phosphannulus*) by Welch (1976).

The rarity of complete juvenile *C. varibrachialus* is probably a result of breakage of the fragile column during or after death, either before burial or during exposure and subsequent collecting. However, the association of lichenocrinid bases with juvenile *C. varibrachialus* crowns is pervasive. No complete adult specimens (*i.e.,* none with holdfasts) and no associations of large crowns and holdfasts are known. This may be due to post-mortem transport and differential deposition of crowns and proximal parts of the columns apart from the holdfasts and distal parts of the columns as hypothesized by Brett (1976) for supposed *Caryocrinites* roots. Conversely, considerable evidence suggests that adults were eleutherozoic. The delicate, attenuated "lichenocrinid" distal column would seem to have been inadequate to support the adults upright during life and would have easily broken in currents, if not autotomized as a matter of course in normal development (Text-fig. 13). As well, occasionally sections of *Cincinnaticrinus* columns are found with a single rounded, apparently abraded, end. It is unlikely that delicate *Cincinnaticrinus* crowns could be differentially transported for any great distance, and it is likely significant that despite the genus' abundance no association of adult crowns and holdfasts has yet been observed. Thus we believe that the genus was effectively eleutherozoic as an adult. A similar conclusion was reached by Weaver (*op. cit.*).

Warn (1973, p. 13, table 1) noted that various species of *Heterocrinus* described during the classical period of paleontology were characterized as having different IBr arrangements. The brachial arrangements of any of these species would fit into the normal intraspecific variation of any large population of *C. varibrachialus*. It is probable that *H. exilis* Hall, 1866, *H. exiguus* Meek, 1872a, *H. propinquus* Meek, 1873, and *C. varibrachialus* (new herein) are conspecific. However, type material for *H. exiguus* and *H. propinquus* has not been located; *H. exilis* is apparently based on a juvenile of questionable affinity. Because of the unavailability or inadequacy of type material we prefer to restrict these names to the types rather than to synonymize them. Similar reasoning, plus the inadequate nature of the existing figures and descriptions, precludes referring this taxon (*C. varibrachialus*) to one of the earlier described species.

It is not surprising that such workers as Hall, Meek, and Ulrich assumed intraspecific constancy in number of IBrr per ray. Variability in number of IBrr has seldom been documented for fossil crinoids with the exception of cincinnaticrinids and one anomalous population of *Eutaxocrinus wideneri* (Kesling & Strimple, 1971). Indeed, all Recent comatulids (non-stalked crinoids) have either two



Text-fig. 13. Ontogenetic change in the life habit of *Cincinnaticrinus varibrachialus*.
a—attached juvenile with polyplated (lichenocrinid) column and holdfast. b—attached adult with expanded, "adult" column proximal to the thin, juvenile (lichenocrinid) column. c—adult breaks free (whether because of increased current activity or autotomization is unknown) at the attenuated juvenile column and thereafter lives unattached.

or four IBrr per ray, although in Hyman's (1955, p. 92) opinion, the generic allocation of existing pentacrinites (stalked crinoids) is in a state of confusion largely because of the use of number of Brr in each division series as a taxobasis.

Cincinnaticrinus varibrachialus probably evolved from *Isotomocrinus tenuis* (Billings) by reduction of the anal tube and by transformation of isotomous to alternating heterotomous branching. In other respects the two genera and species are similar. *C. varibrachialus* seems to have given rise to *C. pentagonus*. Such evolution would have encompassed widening of the column and proximal calyx and initiation of the trend toward regularization of branching, which in cincinnaticrinids culminates in *Dystactocrinus constrictus*.

Cincinnaticrinus pentagonus (Ulrich), 1882 Pl. 6

1873. *Heterocrinus juvenis* Hall, Meek, p. 10, pl. 1, figs. 3a-c; Cumings, 1908, pl. 3, figs. 3, 3a-b; Ulrich, 1925, text-fig. 4c; Warn, 1974, pl. 1, figs. 1, 9.
1882. *Heterocrinus pentagonus* Ulrich, p. 176, pl. 5, figs. 10, 10a.

Primary type material. — YPM 24801 and 24802 are syntypes of *H. pentagonus* Ulrich, 1882. YPM 24801 is herein designated lectotype and YPM 24802 lectoparatype of *H. pentagonus*. Both are Maysvillian and are from Cincinnati, Ohio.

Diagnosis. — *Cincinnaticrinus* with cylindrical dorsal cup and wide column, so that in uncrushed specimens distal cup diameter is less than 1.4 times as great as proximal cup (or proximal column) diameter.

Description. — *C. pentagonus* has parallel-sided pentagonal BB (Text-fig. 8) and large, distally tapering $IBrr_1$ (although the $IBrr_1$ are less than three-fourths as tall as the fused RR). The dorsal cup is hardly wider than the proximal column, and the arms, when folded (as is nearly always the case), continue nearly straight from the calyx, so that crowns attached to sections of column are not conspicuous features as in other cincinnaticrinids (and as in most crinoids), where the crowns are obvious expansions at the ends of the columns. As in *Cincinnaticrinus varibrachialus,* no new cup plates are added during the known part of ontogeny, and the smallest and largest *C. pentagonus* dorsal cups are nearly identical but for size.

Brachial variability in *C. pentagonus* seems to be somewhat smaller than in *C. varibrachialus,* although it is less well known; a peculiarity of *C. pentagonus* is that specimens are seldom found with arms above the $IBrr_1$, the fixed IBrr. *C. pentagonus* seems to vary little (three to five IBrr) around a basic plan of four IBrr per ray. Variability beyond the IBr series is poorly known. The column of *C. pentagonus* is like that of *C. varibrachialus* but broader and with a greater propensity for roundness.

Occurrence. — Maysvillian and Richmondian. *C. pentagonus* is known from the Fairview, Grant Lake, and Bull Fork Formations of the Cincinnati, Ohio, area. *Heterocrinus juvenis* Hall, Meek (= *C. pentagonus*) was reported by Meek (1873, p. 12) from the ". . . upper part of the Cincinnati group near Lebanon, Ohio" (Richmondian). Ulrich (1882, p. 176) described *H. pentagonus* ". . . from the Cincinnati group at Cincinnati about 375 feet [about 115 m] above low-water mark in the Ohio river": the Fairview outcrops at that elevation in Cincinnati.

Discussion. — The name *Cincinnaticrinus pentagonus* (n. comb.) is applied to crinoids Meek (1873) called *Heterocrinus juvenis* Hall, 1866. Just what Hall's concept of *H. juvenis* was is unfortunately unclear, in large part because of questionable type material. Hall described *H. juvenis* in 1866 but did not illustrate it until 1871. Whitfield and Hovey (1898, pp. 24-25) listed AMNH 1173/1 as the holotype of *H. juvenis* and the specimen figured by Hall (1871, pl. 1, figs. 9-10; 1872, pl. 5, figs. 9-10). However, the specimen which presently carries this American Museum number and label is neither that figured by Hall nor that described by Whitfield and Hovey as the type. The holotype was reported by Whitfield and Hovey (1898, pp. 24-25) to have been a free calyx, and Hall's (1871; 1872) figures are two views of a free calyx, but AMNH 1173/1 is a specimen imbedded in a slab (pl. 2, fig. 5). Further, Hall's (1871, 1872) figures and (1866; 1872) description are of a juvenile with diameters of distal calyx and proximal column nearly equal (this feature is a specific character of *C. pentagonus*), while AMNH 1173/1 is probably (the specimen is far from complete) a juvenile *C. varibrachialus* with distal cup diameter nearly twice that of the column (or proximal cup). Hall's original specimen has evidently been lost or misplaced.

Division of *Cincinnaticrinus* into two species may be somewhat artificial, because there is convergence of distal cup diameter to proximal cup (and proximal column) diameter ratios in the two. Examination of large numbers of both taxa has established the following: 1) young (small — cup height of about 2.5 mm or less) *Cincinnaticrinus pentagonus* have ratios equal to about 1.2, while young (similarly sized) *C. varibrachialus* have ratios of about 2.0; 2) with age, the column and proximal cup of both broaden relative to the distal cup, but the column of *C. varibrachialus* widens proportionally more than that of *C. pentagonus* so that with increasing size (age) *C. varibrachialus* ratios become smaller faster; 3) *Cincinnaticrinus* populations with ratios of about 0.9 to 1.3 appear to be segregated from populations with ratios of about 1.5 to 2.2 (the former group appears to be Maysvillian and Richmondian, while the latter is Edenian and Maysvillian). Choice of 1.4 as the major differentiating feature of the two species is somewhat arbitrary; this figure was chosen because it is the number (expressed to the nearest tenth) that falls closest to the midpoint between the highest observed ratio (to the nearest tenth) in populations clustering around 1 and the lowest observed ratio (to the nearest tenth) in populations clustering around 2. Specific identification of individual specimens of *Cincinnaticrinus* on this basis is frequently problematic, because it requires measurement of uncrushed (nearly round in oral or aboral view) dorsal cups. Such preservation is uncommon, but the problem is not without solution. In general, the distal cup is flattened more than the proximal cup and column, with increase (apparent) in ratios. One can, by averaging the shortest and longest diameters in each of the two planes of measurement, convert an apparent ratio (from a distorted specimen) to an approximation of the "real" ratio that is probably close enough to be useful.

Cincinnaticrinus pentagonus likely evolved from *C. varibrachialus* with broadening of the column (presumably a response to increased current activity) and proximal cup and reduction in number of IBrr. A similar evolutionary trend may occur in *Ectenocrinus* (see below). *C. pentagonus* probably gave rise to *Dystactocrinus constrictus* with increased regularization in number of IBrr, broadening of BB, and enlargement of $IBrr_1$.

Genus **DYSTACTOCRINUS** Ulrich, 1925

1925. *Dystactocrinus* Ulrich, p. 87; Moore & Laudon, 1943, p. 14, text-fig. 1; Moore & Laudon, 1944, p. 149; Moore, 1962, p. 13, text-fig. 5—1a-b (1b is a copy of Hall, 1871, pl. 1, fig. 13 as *Heterocrinus constrictus*).
1925. *Atyphocrinus* Ulrich, p. 85; Moore, 1962, p. 13, text-fig. 5—6a-c (6b-c are from Ulrich, 1925, text-fig. 4a-b as *Atyphocrinus corryvillensis*).

Type species. — *Heterocrinus constrictus* Hall, 1871 from Maysvillian strata at Cincinnati, by original designation of Ulrich (1925, p. 87).

Diagnosis. — Cincinnaticrininae with an anal tube evidently like that of *Cincinnaticrinus;* with ten arms exhibiting alternating heterotomous branching; with $IBrr_1$ large, nearly the same size as the fused RR (width of $IBrr_1$ is nearly equal to that of the fused RR; height is three-fourths or more the height of the fused RR); and with distinctly hexagonal BB, noticeably broader than tall (Text-fig. 9e).

Description. — In addition to familial and higher characters, *Dystactocrinus* has markedly hexagonal BB, three-fourths or less as tall as wide. In general, plates of the dorsal cup tend to be shorter and broader than in other cincinnaticrinids. The $IBrr_1$ are large, rectangular in plan view (actually, the $IBrr_1$ are tumescent and, thus, are shaped like a barrel cut longitudinally in half), and about the same size as the fused RR. A constriction occurs in the crown in the plane of the distal ends of the $IBrr_1$.

The arms are broader than in other cincinnaticrinids, while the armlets are narrow (about the same as in other cincinnaticrinids), so that the arm to armlet width ratio is high and is a striking feature evident even from cursory examination. *Dystactocrinus* has only two or three IBrr per ray and three or four IIBrr per arm, with armlets beyond the IIBr axillaries branching off every third or fourth Br. The proportionally small size of the armlets and the extent of regularization of branching (not attained by other cincinnaticrinids) gives the arms the near appearance of pinnulation. In reality, there is gradation in crinoids from heterotomous branching to "pinnulation," with armlets in the former becoming pinnules in the latter. Use of the term pinnulation, while descriptive in some cases, emphasizes differences between some related forms which are actually slight and clouds phylogentic relationships, *e.g.*, armlets of *Cincinnaticrinus,* with heterotomous branching, are certainly homologues of "pinnules" in closely related *Ectenocrinus,* said to be pinnulated, and the use of different terms for such similar branching is unfortunate.

The broadness of the arms of *Dystactocrinus* prohibits them from being folded into a tight bundle (as in other cincinnaticrinids) and causes the crown to be expanded distally. This distal crown expansion emphasizes the constriction at the bottom of the free arms (at the articulation of the $IBrr_1$ and $IBrr_2$) — thus, Hall's specific name. The column of *Dystactocrinus* is like that of *Cincinnaticrinus varibrachialus* but with a greater tendency toward completely round columnals.

Occurrence. — Maysvillian (?Kirkfieldian, Shermanian, or Edenian, and Maysvillian). *Dystactocrinus* (monospecific) is known from only a few specimens from the Fairview and Grant Lake Formations of Cincinnati and environs. Hall (1872, p. 211) described *D. constrictus* (as *Heterocrinus constrictus*) from a single specimen from limestone of the "Hudson-river group" at Cincinnati; Meek (1873, p. 4) reported that Hall's specimen had been found about 100 feet below the tops of the hills at Cincinnati and that another species, *H. compactus* (a junior synonym of *D. constrictus*) occurs at the same level (Fairview Formation). Ulrich (1925, p. 85) described *Atyphocrinus corryvillensis* (a junior synonym of *D. constrictus*) from the Corryville member of the McMillan Formation at Cincinnati (= Grant Lake Limestone).

Ulrich (1925, p. 88) alluded to two undescribed species of *Dystactocrinus,* each represented by a single specimen, from older strata, one from the "Trenton limestone" at Ottawa, Ontario, (= Hull-Kirkfieldian, Sherman Fall-Shermanian, or Coburg beds-Edenian?), and another from the "Cynthiana limestone" at West Covington, Kentucky, (= Point Pleasant Formation). The Point Pleasant at Cincinnati is Shermanian and the "Trenton limestone" of New York and Canada has been shown to be Edenian and Maysvillian (Sweet and Bergström, 1971).

Discussion. — *Dystactocrinus* probably evolved from *Cincin-*

naticrinus by enlargement of $IBrr_1$, broadening and/or shortening of BB, reduction in number of IBrr, and regularization of branching. The genus gave rise to no known successors. The arm characters suggest that *Dystactocrinus* is a cincinnaticrinacean homeomorph of the homocrinacean genus *Apodasmocrinus*.

Dystactocrinus constrictus (Hall), 1871 Pl. 7

1871. *Heterocrinus constrictus* Hall, pl. 1, figs. 13-14; Hall, 1872, p. 210, pl. 5, figs. 13-14; Meek, 1973, p. 3, pl. 1, figs. 10a-b; Ulrich, 1925, p. 87, text-fig. 6a; Moore, 1962, pl. 1, figs. 1a-b.
1873. *Heterocrinus constrictus* var. *compactus* Meek, p. 4, pl. 1, fig. 11.
1925. *Atyphocrinus corryvillensis* Ulrich, p. 85, text-figs. 4a-b.
1925. *Dystactocrinus constrictus* (Hall), Ulrich, p. 87, text-figs. 6b-e, p. 88.
1944. *Dystactocrinus constrictus* (Hall), Moore & Laudon, pl. 52, fig. 11.

Primary type material. — MCZ 2165 (Hall, 1871, pl. 1, figs. 13-14 and herein, Pl. 7, figs. 5-7) from Maysvillian strata at Cincinnati is the holotype of *H. constrictus* Hall, 1871.

Because *D. constrictus* is at present the only known species of *Dystactocrinus*, the specific diagnosis, description, and occurrence are the same as for the genus.

Discussion. — *D. constrictus*, while having numerous features in common with *Cincinnaticrinus varibrachialus*, differs from it in having wider cup plates, a tendency to reduce IBrr from four or five to two or three, arms which branch on every third or fourth IIIBr and higher, and a marked contrast in width of the arms and armlets. In the last three of these four respects, *Dystactocrinus constrictus* is more like the Cincinnatian homocrinid *Ectenocrinus simplex*. It is, however, certainly a cincinnaticrinid and shows closer relation to *Cincinnaticrinus pentagonus*, which also tends, as compared to *C. varibrachialus*, to broaden cup plates and to reduce IBrr from four or five to three or four. In addition, both *C. pentagonus* and *D. constrictus* have broad columns. It appears that *C. pentagonus* gave rise to *D. constrictus*.

Ohiocrinus exilis Foerste, 1914b (p. 125, pl. 1, fig. 7) has armlets that are markedly smaller than the arms and may be conspecific with *D. constrictus*, but the holotype (USNM 78718, pl. 2, fig. 2), and only known specimen, consists only of arms, and assignment to *D. constrictus* is uncertain.

Genus **ISOTOMOCRINUS** Ulrich, 1925

1925. *Isotomocrinus* Ulrich, p. 86; Moore & Laudon, 1944, p. 149; Moore, 1962, p. 13, text-fig. 5-2; Kolata, 1975, p. 26.

Type species.—*Isotomocrinus typus* Ulrich, 1925 by original designation (1925, p. 87): this species is a junior synonym of *Heterocrinus tenuis* Billings, 1857.

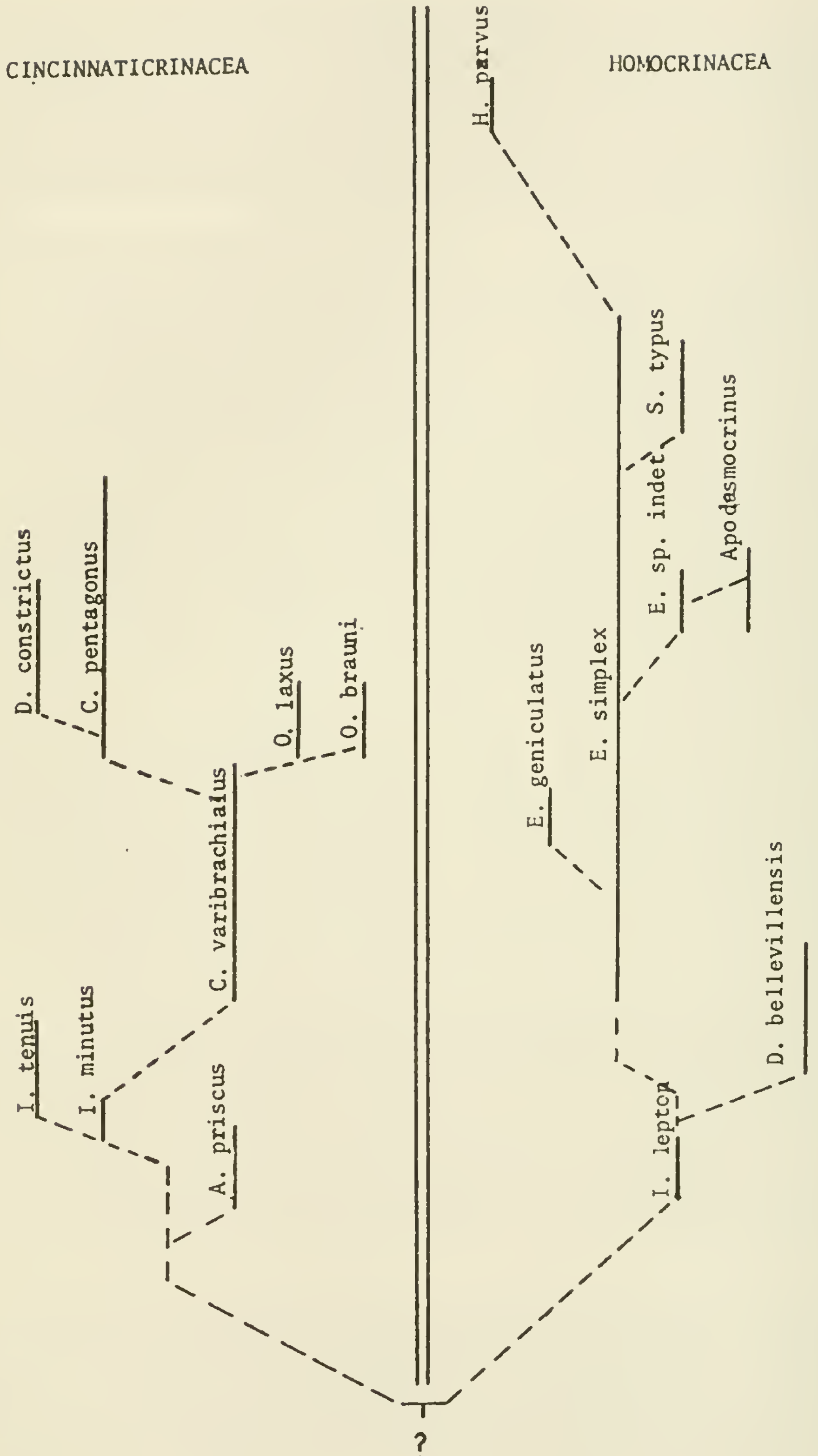
Diagnosis.—Cincinnaticrininae with isotomous arm branching.

Description.—*Isotomocrinus* has the general features of the subfamily and, aside from its isotomous arm branching and anal sac, is like *Cincinnaticrinus*. The anal sac is tubular, as in *Cincinnaticrinus*, but is somewhat broader and much longer and composed of more facing plates (at least seven or eight). The sides of the dorsal cup (in lateral view) form the largest angle of all Cincinnaticrininae; this is a product of distally expanding BB (as in *C. varibrachialus*) and RR. *Isotomocrinus* has C and D ray RR that are wider than in other cincinnaticrinids and wider than other RR (in the A, B, and E rays) in single specimens.

The $IBrr_1$ taper more and the $IBrr_2$ expand less, if at all, than in other cincinnaticrinids, which makes for proportionally narrower arms. The arms are long with few branches. There are two to six IBrr per ray and four to nine IIBrr (and higher series) per arm. Brachial variability seems to be similar to that in *Cincinnaticrinus varibrachialus*, both for individuals and for the genus (and species) in general.

The column is pentaparitite with interradial pentameres and with a pentagonal lumen having radially disposed points. The column is pentagonal near the cup and becomes gradually more rounded distally. There appear to be two sets of columnals of different size alternating in position proximally, but only one size distally. Distal columnals evidently become similar in size and shape with secondary overgrowth.

Occurrence.—Kirkfieldian (? Blackriverian to Kirkfieldian, Shermanian, or Edenian; Rocklandian to Kirkfieldian, Shermanian, or Edenian; Kirkfieldian to Shermanian or Edenian). *Isotomocrinus* is known from the Hull beds of Kirkfield, Ontario; Hull, Sherman Fall, and/or Coburg beds of Ottawa and Montreal; the "Trenton limestone" at Trenton Falls, New York; the Decorah shale, St. Paul, Minnesota, (UM 9274); and the Dunleith and Grand



Text-fig. 14. Phylogeny of the Cincinnaticrinacea and Homocrinacea.

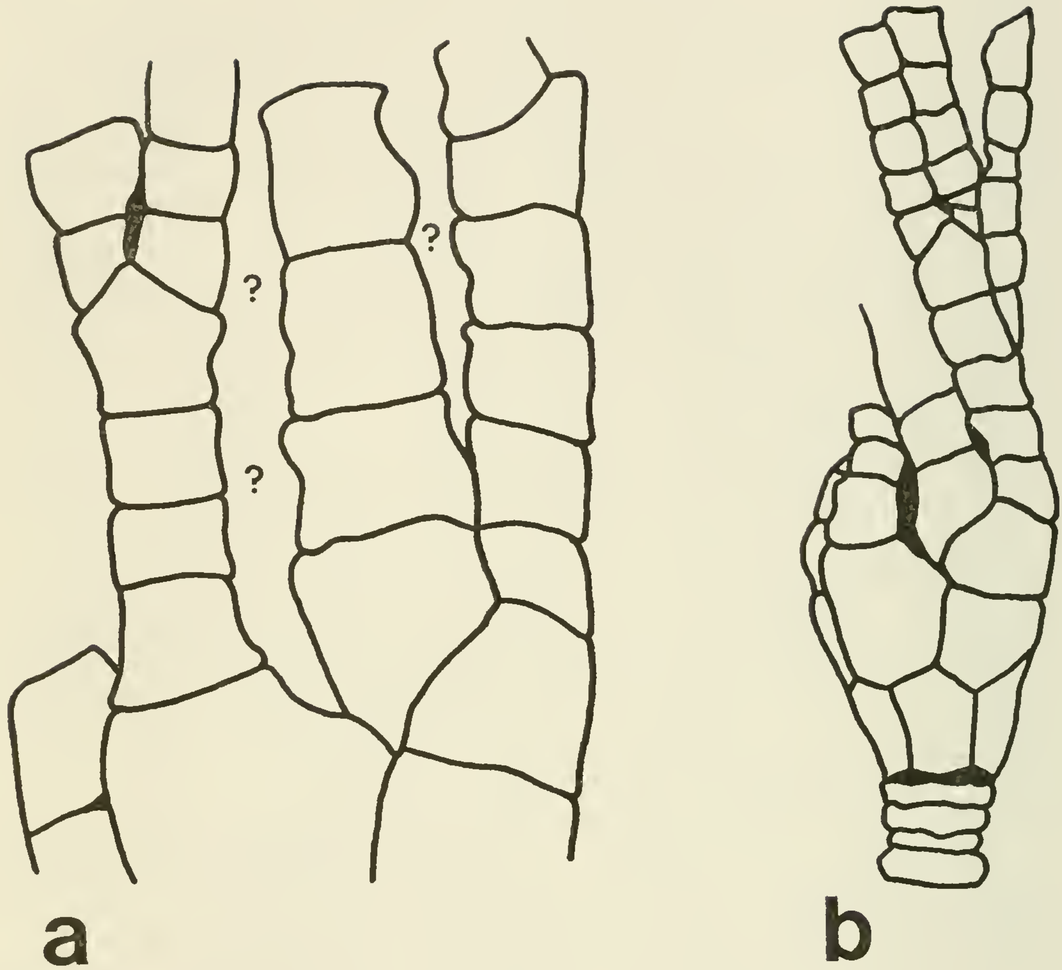
Detour Formations, Illinois. Billings (1857, p. 274; 1859, p. 50) described *Heterocrinus tenuis* from the "Trenton limestone" of Ottawa and Montreal (= Hull, Sherman Fall, and/or Coburg beds). Springer (1911, p. 25) alluded to the same species in the Hull crinoid beds at Kirkfield, Ontario. Wilson (1946, p. 32) listed it from Hull (GSC localities 34 and 37), Sherman Fall (GSC locality 44), and Coburg (GSC localities 4, 9, 13, 38, 39, 52, and 53) beds of Ontario and Quebec. Ulrich (1925, p. 87) alluded to two undescribed species: one from "limestone of Black River age" of central Pennsylvania (? = pre-Rocklandian Hatter or Hunter Limestones), another from "Upper Black River" of Wisconsin (? = unnamed pre-Rocklandian Limestones or the Kirkfieldian Decorah Shale). *Isotomocrinus* is common in the Hull crinoid beds at Kirkfield Quarry, Kirkfield, Ontario. A possible *Isotomocrinus,* briefly discussed by Brower and Veinus (1974, pp. 20-21) under the heading "*Isotomocrinus,* n. sp." was reported from Blackriverian rocks of Tennessee by those authors. Because of the limited nature of available material this occurrence will not be further considered in this paper, and the reference is cited only for completeness.

Discussion. — The nature of the arm branching suggests that *Isotomocrinus* may have been the progenitor of all Cincinnaticrininae, and possibly of anomalocrinids as well. Evolution of *Isotomocrinus* to *Cincinnaticrinus* could occur with alteration of isotomous to alternating heterotomous branching and shortening of the anal tube. *Isotomocrinus* may have arisen from *Atopocrinus* or *Ectenocrinus;* alternatively *Isotomocrinus* and *Atopocrinus* or *Isotomocrinus* and *Ectenocrinus* may share an as yet unknown common ancestor.

Isotomocrinus tenuis (Billings), 1857 Pl. 8; Text-fig. 15

1857. *Heterocrinus tenuis* Billings, p. 273; Billings, 1859, p. 50, pl. 4, figs. 6a-b, pl. 10, figs. 1a-c; Springer, 1911, p. 25; Jaekel, 1918, p. 85, text-fig. 79; Wilson, 1946, p. 32; Warn, 1973, p. 10, pl. 1, fig. 1 (*non* figs. 2-19).
1925. *Isotomocrinus typus* Ulrich, p. 87, text-figs. 5a-b; Moore & Laudon, 1944, pl. 52, fig. 11.
1925. *Heterocrinus juvenis* Hall, Fritz, p. 10, text-fig. 7.
?1971. *Ectenocrinus,* n. sp. Steele & Sinclair, pl. 16, figs. 10-11.
1975. *Isotomocrinus tenuis* (Billings), Kolata, p. 27.

Primary type material. — GSC 1438 (the only remaining of Billing's syntypes) was designated lectotype of *H. tenuis* by Wilson



Text-fig. 15. *Isotomocrinus tenuis.*
USNM S.2077a-b are the primary types of *I. typus* Ulrich, 1925, which is a junior synonym of *Heterocrinus tenuis* Billings, 1857. a—camera lucida drawing of a CD interray view of USNM S.2077a; areas with question marks contain what appear to be disarticulated anal backing plates; b—camera lucida drawing of a CD interray view of USNM S.2077b.

(1946, p. 32; Warn, 1973, pp. 11-12). GSC 1438 was adequately illustrated by Warn (1973, pl. 1, fig. 1) but is illustrated again here (Pl. 8, fig. 5). USNM S.2077a (Pl. 8, figs. 1, 4) is the holotype of *I. typus,* a junior synonym of *Isotomocrinus tenuis*. USNM S.2077b (Pl. 8, figs. 2, 4) and USNM S.2077c (Pl. 8, figs. 3, 4) are paratypes of *I. typus*. GSC 1438 is from the Kirkfieldian Hull beds at Ottawa, Ontario, while USNM S.2077a, b, and c are from the Kirkfieldian crinoid beds at Kirkfield, Ontario.

The specific diagnosis and description of *I. tenuis* are essentially identical to that of the genus, given above. Comparisons with *I. minutus* Kolata, the only other known species, are made in the discussion of the latter. Occurrences of *I. tenuis* are coextensive with those of the genus, excepting the Grand Detour Formation record.

Discussion. — *I. tenuis* is known from the Trenton Limestone of Kirkfield and Ottawa, Ontario, and Montreal, Quebec, and from the Buckhorn Member, Dunleith Formation, Illinois. Numerous good specimens, mainly from Kirkfield, are housed in the collections of: Royal Ontario Museum, Geological Survey of Canada, United States National Museum, and University of Cincinnati Geological Museum (in the Kopf Collection).

The specimen figured by Steele and Sinclair (1971, pl. 16, figs. 10-11) as a new species of *Ectenocrinus* appears to be a cincinnaticrinid. It resembles both *I. tenuis* and *Cincinnaticrinus varibrachialus* but shows no arm branching, critical for differentiation between these two species. Because its occurrence is more reconcilable with *I. tenuis* than with *C. varibrachialus,* the authors have tentatively referred it to *I. tenuis*. The specimen has a more steeply conical cup than in other *Isotomocrinus tenuis* specimens and a smaller anal X than any other cincinnaticrinid.

Heterocrinus tenuis (Billings) was referred to *Isotomocrinus* by Kolata (1975, p. 26), who regarded it and *I. typus* as separate species. For the reasons stated above we prefer to subsume *I. typus* into *I. tenuis*.

A good case can be made for evolution of *Cincinnaticrinus varibrachialus* from *Isotomocrinus tenuis* with reduction of the anal tube and transformation of isotomous to alternating heterotomous branching. In fact, *I. tenuis* probably gave rise, directly or indirectly, to all other Cincinnaticrininae. Choosing a progenitor for *I. tenuis* is a greater problem. No known crinoid (other than a member of the Cincinnaticrininae) exhibits a sufficiently obvious close morphological relationship with *I. tenuis* (including *Atopocrinus,* the only older cincinnaticrinid) to merit consideration as a progenitor of *I. tenuis.*

Isotomocrinus minutus Kolata, 1975

1975. *Isotomocrinus minutus* Kolata, pl. 4, fig. 4, text-figs. 4, p. 27.

Primary type material. — UI X-4886 is the holotype; two paratypes are UI X-4940 and UI X-491. All types are deposited in the collections of the University of Illinois (UI).

Diagnosis. — *Isotomocrinus* with small steep-sided dorsal cup and anal X deeply set within dorsal cup (Kolata, *op. cit.,* p. 27).

Remarks. — This species has been well described by Kolata (*op. cit.*) and will not be redescribed here. Pending further study the species is accepted as valid, but the possibility remains that the three specimens placed in *I. minutus* by Kolata are juvenile *I. tenuis.* The steep-sided dorsal cup and more strongly pentagonal stem as compared to adult *I. tenuis* could be immature features; juvenile *Cincinnaticrinus* as noted above, exhibit similar morphology. The ontogeny of *Isotomocrinus,* however, is not so well known as that of the related *Cincinnaticrinus,* so the possibility remains that *I. minutus* is a valid species. The noted deeper penetration of the anal X into the cup in *I. minutus* could also be a feature that changes during ontogeny. All of the *I. tenuis* from the Dunleith, while occurring in a different formation, are much larger. The finding of undoubted *I. tenuis* of similar size to *I. minutus* would be necessary, in our opinion, to solidly establish the species.

Genus **OHIOCRINUS** Wachsmuth & Springer, 1886

1886. *Ohiocrinus* Wachsmuth & Springer, p. 208; Miller, 1889, p. 263; Wachsmuth, 1900, p. 152; Springer, 1911, p. 27; Springer, 1913, p. 212; Ulrich, 1925, p. 90; Moore, 1962, p. 13, text-fig. 5-4a-d ((4a, b, d are from Ulrich, 1925, p. 90, text-figs. 7a-c).

Type species. — *Heterocrinus laxus* Hall, 1866 by original designation of Wachsmuth and Springer (1886, p. 208).

Diagnosis. — *Cincinnaticrininae* with spirally coiled anal sac and ten arms exhibiting alternating heterotomous branching.

Description. — Like *Cincinnaticrinus, Ohiocrinus* has an anal sac that is an armlike branch of four (or possibly five) facing plates (XX) off the C ray sR, filled out by numerous small backing plates proliferated from the tegmen. In *Cincinnaticrinus* the backing plates close around the back of the XX to form a short, straight tube; but in *Ohiocrinus* the backing plates extend away from, and beyond, the XX as an inflated, polygonally polyplated, high-spired coil with wide whorls (Text-fig. 17). In contrast to Wachsmuth and Springer's (1886, p. 208) description of the anal sac as composed of ". . . numerous hexagonal pieces, arranged alternately, and in longitudinal rows," the backing plates are polygonal (quadragonal, pentagonal, hexagonal, or septagonal) and are apparently not arranged in definite rows or circlets. In other respects (column morphology, B and IBr shape, etc.) *Ohiocrinus* is like *Cincinnaticrinus*.

Occurrence. — Maysvillian. *Ohiocrinus* is known from the Fairview Formation from Cincinnati, Ohio, and Madison, Indiana.

Discussion. — For a time, the authors thought *Cincinnaticrinus* and *Ohiocrinus* to be congeneric, for it seemed that *Ohiocrinus* (specimens with spiral anal sacs) were simply *Cincinnaticrinus* with preservation of the polyplated sac. This view was bolstered by Wachsmuth and Springer's (1886, p. 208) footnote to the description of their new genus *Ohiocrinus*:

> "*Ohiocrinus* resembles *Stenocrinus* [a junior synonym of *Heterocrinus* but used for Meek's, 1873 concept of *Heterocrinus* that is herein called *Cincinnaticrinus*] very closely, and can only be upheld by the form of the ventral tube. We [Wachsmuth and Springer] never saw the appendage of *Stenocrinus* [*Cincinnaticrinus*], but Mr. S. A. Miller claims it to be distinct, and this induced us to make the separation."

However, so many beautifully preserved *Cincinnaticrinus* with the anal sac ending as a short tube are now known that the two seem to be distinct, as Miller postulated.

Ulrich (1925, p. 90) described *Ohiocrinus* as having a dorsal cup structurally similar to those of *Cincinnaticrinus* and *Dystactocrinus* but with great variation due to "breakage and irregular regeneration of parts." Ulrich did not know the repository of Hall's holotype (MCZ 2167) of *Heterocrinus laxus*, tvpe species of *Ohiocrinus*, but had at least six specimens (USNM 42304a-e and an unlocated specimen represented by Ulrich, 1925, text-figs. 9, 9a) which he had in

1882 used as the basis for his new species *H. oehanus* and which he thought were perhaps conspecific with *H. laxus*. For *H. laxus,* Ulrich substituted (at least conceptually) *H. oehanus* as the type species of *Ohiocrinus*. Three of the four best (of the six) syntypes of *H. oehanus* are abnormal specimens (Text-figs. 16a-b-c), which caused Ulrich to characterize *Ohiocrinus* as having great cup variability. The authors, after comparing the types of *H. laxus* and *H. oehanus,* believe the two to be conspecific. *H. oehanus* is, then, a junior synonym of *H. laxus*.

Ohiocrinus evolved from *Cincinnaticrinus* with elongation, inflation, and coiling of the tubelike anal sac and gave rise to no known successors.

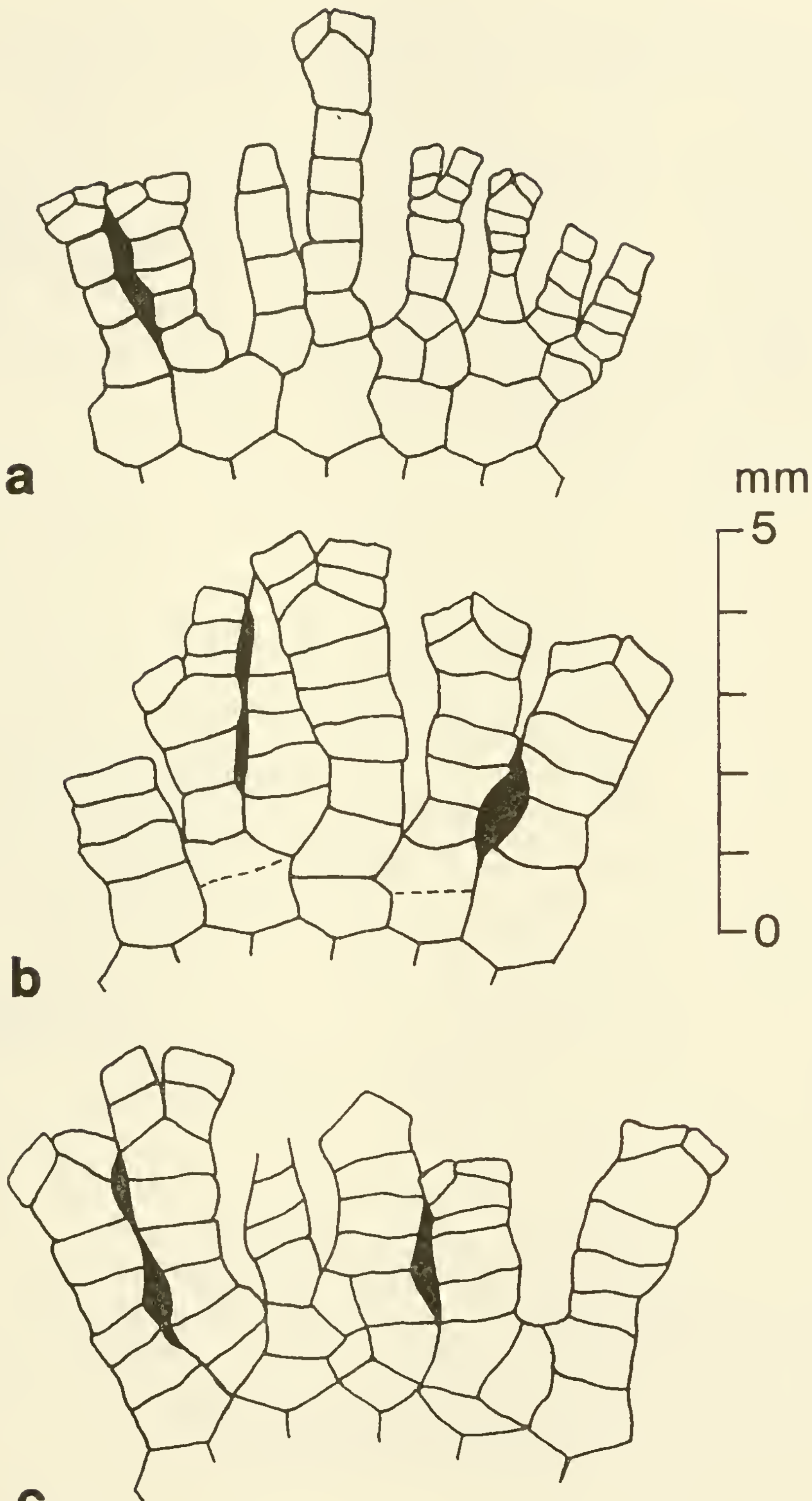
Ohiocrinus laxus (Hall). 1871 Pl. 9; Text-figs. 16a-c

1871. *Heterocrinus laxus* Hall, pl. 1, fig. 15; Hall, 1872, p. 211, pl. 5, fig. 15; Meek, 1873, p. 5, pl. 1, fig. 12.
1882. *Heterocrinus (Iocrinus) oehanus* Ulrich, p. 175, pl. 5, figs. 9, 9a-c.
1925. *Ohiocrinus laxus* (Hall), Ulrich, p. 90, text-fig. 7a; Moore, 1962, pl. 1, fig. 5.
1925. *Ohiocrinus oehanus* (Ulrich), Ulrich, p. 90.

Primary type material. — MCZ 2167 (pl. 7, figs. 5-7) is the holotype of *H. laxus* Hall, 1871.

Diagnosis. — *Ohiocrinus* with markedly heterotomous branching, *i.e.,* with arms strikingly broader than the armlets.

Description. — *O. laxus* has a distally expanding crown that widens uniformly and long arms with numerous branches (six to ten per arm). Each division series has three to seven Brr (four or five is most common). Number of Brr per division series appears to be variable, both among individuals and in different rays of the same individual, but not to the extent as in *Cincinnaticrinus varibrachialus*. Whereas a single specimen of *C. varibrachialus* might have as many as four different numbers of IBrr in the five rays (*e.g.,* UCGM 40500 with the following IBr arrangement: A-2, B-4, C-4, D-3, E-5), a single specimen of *Ohiocrinus laxus* typically has fewer different numbers of IBrr in five rays (*e.g.,* MCZ 2167 with: A-5, B-4, C-4, D-4, E-4). This diminished variability is apparently true also for higher division series. Thus, while total intraspecific variation in number of Brr per division series in *O. laxus* is as great as in *Cincinnaticrinus varibrachialus* (species range of variation > individual



Text-fig. 16. Ulrich's (1882) abnormal specimens of *Heterocrinus oehanus* (junior synonym of *Ohiocrinus laxus*).
a—exploded diagram of USNM 42304a. b—exploded diagram of USNM 42304b. c—exploded diagram of USNM 42304c.

range of variation), variation in single individuals is greater in *C. varibrachialus*. Armlets given off at the axillaries bifurcate two or three times and appear to reach the tips of the arms.

Occurrence. — Maysvillian. *O. laxus* is known from at least seven specimens from the Fairview Formation at Cincinnati. Hall (1872, p. 211) described *Heterocrinus laxus* from the "Hudson-river group" at Cincinnati. Ulrich (1882, p. 176) described *H. oehanus*, a junior synonym of *O. laxus* from "on the hills back of Cincinnati, Ohio, at an elevation of about 325 feet above low-water mark in the Ohio river" (= Fairview Formation).

Discussion. — USNM 42304a (Pl. 9, fig. 9; Text-fig. 16a) is herein designated lectotype and the specimen figured by Ulrich (1882, pl. 5, figs. 9, 9a) and USNM 42304b-e (Text-figs. 16b-c) lectoparatypes of *H. oehanus* Ulrich, 1882, a junior synonym of *H. laxus* Hall, 1871, the type species of *Ohiocrinus*. The specimen represented by figures 9 and 9a has not been located, although a note, apparently in Ulrich's handwriting, accompanying the USNM type specimens reads: "Remainder of Oeh's spms [specimens] are at Yale." However, search at Peabody Museum of Natural History, Yale University (1973), failed to reveal other specimens.

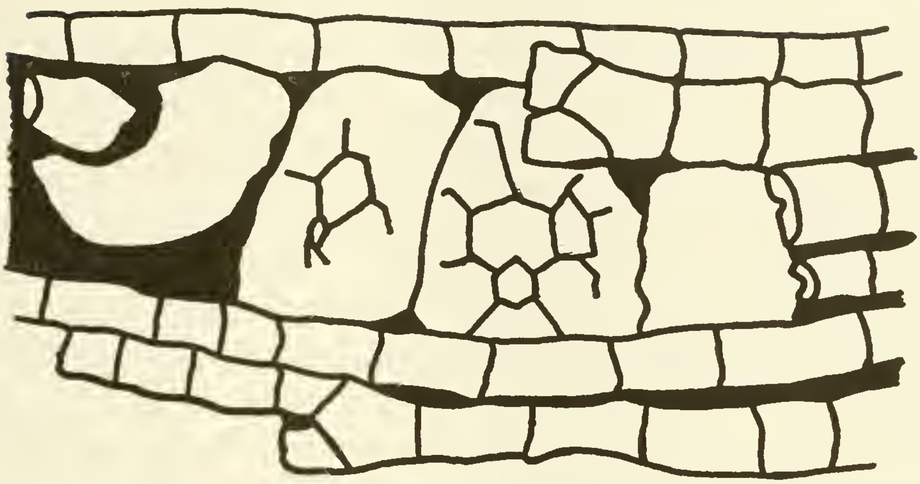
O. laxus probably arose from *Cincinnaticrinus varibrachialus* by elongation, inflation, and coiling of the anal sac and elongation of the arms, either directly or with *O. brauni* as intermediary.

O. laxus and *Dystactocrinus constrictus* (Hall) Ulrich, 1925 may be conspecific. Wachsmuth and Springer (1886, p. 208) placed *Heterocrinus constrictus* Hall, 1872 (type of *Dystactocrinus* Ulrich, 1925) in their new genus *Ohiocrinus* (with *H. laxus* Hall, 1871 as type species). *O. laxus* has broad arms and narrow armlets, as does *D. constrictus*, and the BB are markedly hexagonal (as in *D. constrictus*). One specimen (UCGM 23048; Pl. 9, fig. 1) of *O. laxus* particularly resembles *D. constrictus*. At present, however, the two are considered distinct, for examination of specimens referred here to *D. constrictus* has brought to light no spiral anal sac, although the anal tube-bearing ray is visible on some specimens.

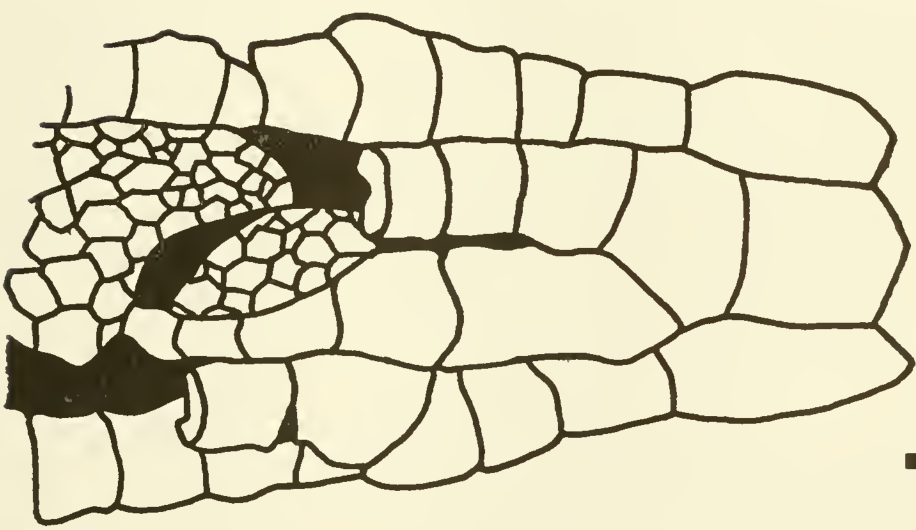
Ohiocrinus brauni Ulrich, 1925 Pl. 10; Text-fig. **17**

1925. *Ohiocrinus brauni* Ulrich, p. 90, text-figs. 7b-c.

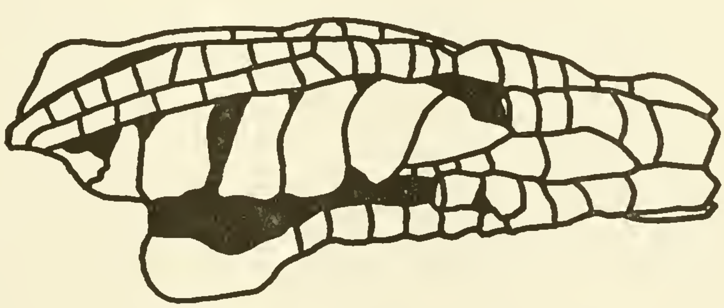
Primary type material. — USNM S.2082a (Ulrich's text-fig. 7b)



c



b



a

Text-fig. 17. *Ohiocrinus brauni.*
a—camera lucida drawing of a CD interray view of USNM S. 2082b. b—the same from a slightly different angle. c—camera lucida drawing of an E ray view of USNM S. 2082a.

and S.2082b (Ulrich's text-fig. 7c) are syntypes of *O. brauni.* USNM S.2082b (Pl. 10, figs. 1-3; Text-fig. 17) is herein designated lectotype and USNM S.2082a (Pl. 10, figs. 4-6; Text-fig. 17) lectoparatype of *O. brauni.* Both are Maysvillian, from Madison, Indiana.

Diagnosis. — *Ohiocrinus* with nearly isotomous branching, *i.e.,* with the arms and armlets of about the same width.

Description. — *O. brauni* has arms with three or four branches per arm and three to four (commonly four?) Brr per division series. Br variability is apparently smaller than in *O. laxus.* Arms and armlets are about the same size, but armlets (given off on alternate sides beginning with the first abradially or away from the ray) continue unbranched to the tips of the arms.

Occurrence. — Maysvillian. *O. brauni* is known from only two specimens from the Fairview Formation at Madison, Indiana.

Discussion. — *O. brauni,* while differing from *O. laxus,* may not really be distinct; it is conceivable that specimens referred to *O. brauni* might be juveniles of *O. laxus.* This will remain uncertain, however, until our knowledge of the ontogeny of *O. laxus* approximates that known for *Cincinnaticrinus varibrachialus, Cincinnaticrinus pentagonus,* and *Ectenocrinus simplex. O. brauni* could have arisen from *C. varibrachialus* by elongation, inflation, and coiling of the anal sac, either directly or with *O. laxus* as intermediary.

Subfamily **ATOPOCRININAE,** new subfamily

Diagnosis. — Cincinnaticrinidae with a conical (less steeply than in the Cincinnaticrininae) dorsal cup; with unequal-sized compound RR in the C and E rays; the C ray R is somewhat shorter and the E ray R somewhat taller than the nearly equal-sized fused RR in the A, B, and D rays; the anal series is an armlike branch off the C ray IBr_1 (termed brachianal by Moore, 1962).

Genus **ATOPOCRINUS** Lane, 1970

*1970. *Atopocrinus* Lane, p. 14.

Type species. — *Atopocrinus priscus* Lane, 1970 by original designation (p. 14), Whiterockian of Utah.

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*The generic name *Atopocrinus* was first used by Clark (1912) for an extant comatulid crinoid. It was later used by Lane (1970) for an Ordovician inadunate from Utah. Lane (pers. comm., Mar. 22, 1977) proposed the substitute name *Othneiocrinus* for the Ordovician form.

Description. — *Atopocrinus* has equidimensional, pentagonal BB that expand distally. The E ray sR extends nearly to the distal margins of the A and B ray $IBrr_2$. The C ray IBr_1 (brachianal) has a truncated left shoulder to support anal X; succeeding IBrr are narrower and rest on the remaining distal edge of the IBr_1. There are two arms in the A and B rays, but branching in the C, D, and E rays is unknown. The A and B ray IBrr are as wide as the underlying RR (the A and B ray IBrr are quite low rectangles), but the C and E (and apparently D) ray IBrr are much narrower than the underlying RR: the C and E ray IBrr are low, nearly square rectangles. The IBrr and one or two proximalmost IIBrr lack armlets; the next ten or so Brr have armlets given off from every Br on alternate sides, with the first given off as an inner branch; succeeding Brr have armlets given off one or both sides of each Br. Where there are two armlets per Br, they are offset, indicating derivation from an alternating heterotomous condition by fusion of two adjacent Brr. Armlet facets on the oral surfaces of the arms are connected to the ambulacral groove by oblique grooves that join the ambulacral groove alternately (Text-fig. 18c). The stem is circular, pentapartite with radial pentameres, and has a proximal portion that tapers rapidly distally (as in members of the Homocrininae).

Occurrence. — Whiterockian. *Atopocrinus* is known from a single specimen from the M zone (of Hintze, 1951) of the Kanosh Shale near Ibex, Utah.

Discussion. — Among inadunates, branching of the anal series off the third radial plate of the C ray, rather than off the first or second, is a rarity. The only other known inadunate with this C ray plate arrangement is *Peniculocrinus* Moore, 1962. However, *Atopocrinus* differs from *Peniculocrinus* in having compound RR in two rays rather than in all five. Possession of an anal series as a branch off the C ray IBr_1 (branchianal) is a primitive feature and supports the view that the anal series originated as a C ray arm branch that came to be modified and incorporated into the calyx.

Atopocrinus's branching in the distal portions of the arms is unique among disparids and appears to have been derived from an alternating heterotomous condition by fusion of adjacent Brr in sets of two. Derivation from an ancestor with alternating heterotomous arms is not only supported by food groove configuration of bipinnulate Brr but also by individual arm ontogeny (unbranched — alternating heterotomous — bipinnulate Brr).

Atopocrinus priscus Lane, 1970 Pl. 2; Text-fig. 18

1970. *Atopocrinus priscus* Lane, p. 15; p. 8, text-fig. 2f-j; p. 11, pl. 1, figs. 4-6.

Primary type material. — The holotype and only known specimen of *A. priscus* is USNM 165240.

Because *A. priscus* is presently the only known species of *Atopocrinus,* the specific diagnosis, description, and occurrence are the same as for the genus.

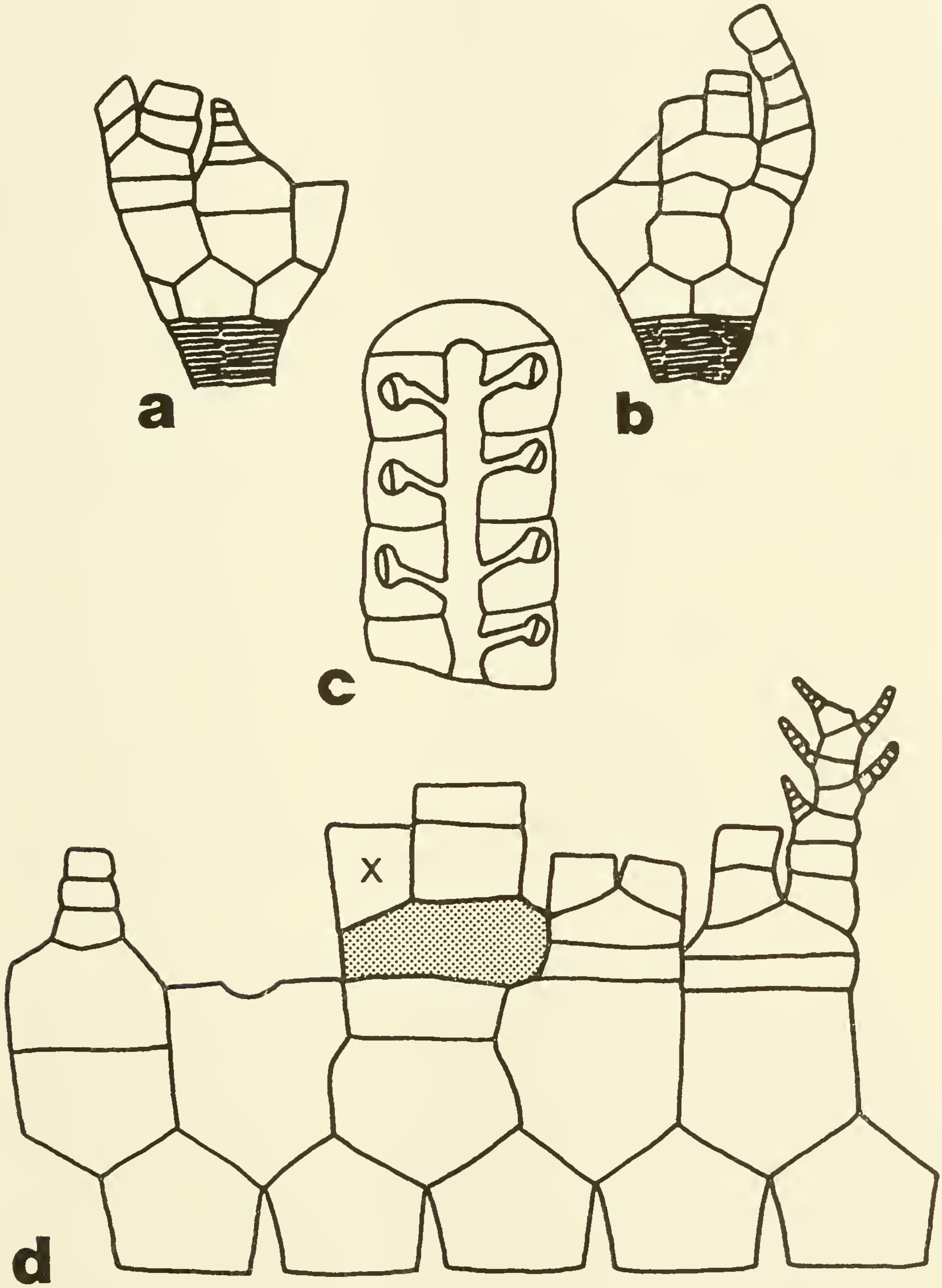
Superfamily **Homocrinacea** Kirk, 1914

(*nom. transl.* Ubaghs, 1953 *ex.* Homocrinidae Kirk, 1914)

Diagnosis. — Disparid inadunate crinoids with a steeply conical dorsal cup having undivided RR in two rays (in the A and D rays) and compound RR in three rays (in the B, C, and E rays).

Description. — The homocrinacean dorsal cup has five symmetrically or four asymmetrically and one symmetrically pentagonal BB, about equal in size. The distal left corner of the C ray sR and the distal right corner of the D ray R are truncated to accommodate anal X, which is a branch off the C ray. Succeeding XX are quadrangular and backed by numerous small polygonal plates to form a tubular (and armlike) anal sac (this is unknown in *Ibexocrinus* but known to varying degree in other homocrinaceans). Each of the five RR supports a series of quadrilateral IBrr. IBr_1 articulates with the underlying R by immoble suture (and is thus fixed) along its entire proximal surface.

Discussion. — Kirk (1914) erected the family Homocrinidae for *Homocrinus.* Kirk was of the opinion that, while *Homocrinus* is related to the Heterocrinidae, especially to *Ectenocrinus* (this was, of course, prior to Ulrich's, 1925, transferral of *Ectenocrinus* to the Homocrinidae), the Heterocrinidae could not house *Homocrinus.* Jaekel (1918, p. 54), believing that *Homocrinus* was dicyclic, added his new genera *Nassoviocrinus, Jahnocrinus,* and *Ascocrinus* (all dicyclic and none closely related to *Homocrinus*). Ulrich (1925) added *Ectenocrinus* Miller, 1889, and his new genera *Drymocrinus, Daedalocrinus,* and *Sygcaulocrinus. Drymocrinus* is considered as a junior synonym of *Ectenocrinus.* Lane (1970, p. 12) added his new genus *Ibexocrinus.* Ubaghs (1953) elevated Kirk's family Homocrinidae to superfamily Homocrinacea. The superfamily Homocrinacea as now envisioned, then, contains *Homocrinus, Daedalocrinus, Ectenocrinus, Apodasmocrinus,* n.g., *Ibexocrinus,* and *Sygcaulocrinus.*



Text-fig. 18. *Atopocrinus priscus.*
All are of USNM 165420, after Lane (1970).
a—E ray view. b—C ray view. c—ventral view of arm. d—exploded diagram.

Homocrinaceans are morphologically similar to cincinnaticrinaceans; both typically have steeply conical cups, similar arm size and shape, and similar placement of X (except for *Atopocrinus*); homocrinaceans have three compound RR (in the B, C, and E rays) and only two fused RR (in the A and D rays); *Ectenocrinus, Apodasmocrinus, Ibexocrinus,* and *Sygcaulocrinus* have alternating heterotomous branching as do the Cincinnaticrinacea (except *Isotomocrinus,* which has isotomous branching).

Homocrinaceans occur in Whiterockian to Niagaran rocks of western, central, mideastern, and eastern United States and mideastern Canada. They have been found in Edenian and Maysvillian strata in the tristate Ohio-Kentucky-Indiana area (around Cincinnati); in Shermanian and Edenian rocks of northwestern New York; in the Edenian of southern Pennsylvania; in Kirkfieldian to Edenian rocks of the Ottawa-St. Lawrence lowland of Canada; in Richmondian strata of Iowa; in Whiterockian strata of Utah; in Maysvillian strata of Wyoming; in Blackriverian rocks of Oklahoma, Tennessee and Virginia; and in Niagaran rocks of New York.

Family **HOMOCRINIDAE** Kirk, 1914

Because this is the only family of the Homocrinacea, familial characters are the same as for the superfamily. Two subfamilies are envisioned here. The subfamily Homocrininae contains *Homocrinus, Ectenocrinus, Apodasmocrinus, Ibexocrinus,* and *Sygcaulocrinus.* The subfamily Daedalocrininae is erected to accommodate *Daedalocrinus,* which is somewhat removed, morphologically and presumably phylogenetically, from other homocrinids.

Subfamily **HOMOCRININAE** Kirk, 1914
(*nom. transl. ex* Homocrinidae Kirk, 1914)

Diagnosis. — Homocrinidae with equal-sized compound RR (in the B, C, and E rays) somewhat taller than the equal-sized fused RR (in the A and D rays) and with a round column that tapers rapidly distally just below the dorsal cup.

Description. — Members of the subfamily Homocrininae have $IBrr_1$ that taper distally and $IBrr_2$ that expand slightly distally. The column is round with a pentagonal lumen and tapers rapidly distally just below the calyx. *Ibexocrinus,* however, is an exception to both statements; it has rectangular $IBrr_1$ and $IBrr_2$, and the column of *Ibexocrinus,* while round, tapers more gradually than in other Homocrininae.

Discussion. — Apparently, members of the Homocrininae have a point of columnal generation at the base of the rapidly tapering proximal portion of the column rather than at the base of the dorsal cup, the common location of columnal addition (aside from distal insertion). It appears that a trend in Homocrininae is to incorporate proximal columnals into the calyx. This feature is undeveloped in *Ibexocrinus,* the oldest of the Homocrininae; well developed in *Ectenocrinus;* and best developed in *Sygcaulocrinus* and *Homocrinus,* the youngest of the Homocrininae.

Members of the Homocrininae occur in Whiterockian to Niagaran rocks of western, central, mideastern, and eastern United States and mideastern Canada. They have been found in Edenian and Maysvillian strata around Cincinnati; in Shermanian and Edenian rocks of northwestern New York; in the Edenian of southern Pennsylvania; in Edenian rocks of the Ottawa-St. Lawrence lowland of Canada; in Richmondian strata of Iowa; in Maysvillian rocks of Wyoming; in Whiterockian strata of Utah; and in Niagaran rocks of New York.

Genus **HOMOCRINUS** Hall, 1852

1852. *Homocrinus* Hall, p. 185 (*partim*); Hall, 1859, p. 102 (*partim*); Miller, 1889, p. 255 (*partim*); Kirk, 1914, p. 476; Ulrich, 1925, p. 94; Moore & Laudon, p. 145; Moore, 1962, p. 7, text-figs. 1-8; pp. 10, 11, text-figs. 3-4.
1880. *Non Homocrinus* Hall, Wachsmuth & Springer, p. 77, text-fig. 6; Wachsmuth & Springer, 1886, p. 144; Bather, 1893, p. 101; Bather, 1900, p. 178; Wachsmuth, 1900, p. 155; Slocom, 1907, p. 289; Springer, 1913, p. 217.
1900. *Non Homocrinus* Hall, Wachsmuth, p. 155.

Type species. — *Homocrinus parvus* Hall, 1852 by subsequent designation of Meek and Worthen (1866, p. 182).

Diagnosis. — Homocrininae with tall (about twice as tall as broad and about as tall as the RR), symmetrical, and similarly shaped BB; with the five rays unbranched; and with proximal columnals short, of about equal height.

Description. — Specimens belonging to the genus *Homocrinus* are minute (height of the dorsal cup is less than two and one-half millimeters — commonly about one and three-fourths millimeters). The BB are tall, about one-half the height of the dorsal cup. The

A and D ray RR are fused; the B, C, and E ray RR are slightly taller and compound, divided into iRR and sRR of about equal size. The anal structure beyond anal X is unknown but is presumably similar to other homocrinids, cincinnaticrinids, and related forms (*i.e.,* the anal series is probably an armlike branch off the C ray).

According to Kirk (1914, p. 477), each of the five arms has a food groove roofed over by an alternating biseries of tiny cover plates. The $IBrr_1$ articulate along their entire proximal surfaces with the underlying RR and are apparently fixed; they are shaped like inverted truncated cones and are shorter than succeeding Brr; the $IBrr_1$ are about as broad as tall. Succeeding IBrr are about twice or more as tall as broad and shorten somewhat distally; they are wider at the articulations than at the middles of the plates.

The column tapers rapidly in a distal direction just below the cup. Kirk (1914, pp. 477-478) related that just distal to the tapering portion is an area in which two sizes of columnals alternate and that this alternating portion grades distally into an area with columnals of uniform size. Specimens examined in connection with this study show a round column that gradually enlarges distally below the rapidly tapering portion with all columnals observable approximately equal in size to their neighbors.

Occurrence. — Niagaran. *Homocrinus* is known from the Rochester Shale around Lockport, New York, (according to Ringueberg, 1888, p. 269 from the top of the lower third of the Rochester Shale).

Discussion. — *Homocrinus* was mistakenly thought to be dicyclic until Kirk's (1914) restudy of *Homocrinus.* Thus, in the synonymy, all pre-1914 references were to *Homocrinus* as being dicyclic; those with *partim* were with *H. parvus* (monocyclic) as type species, while those with *non* were with a dicyclic type species (and with *H. parvus* at most only listed as an included species). From 1914 to the present, references have been to *Homocrinus* as monocyclic with *H. parvus* as type (and only) species.

Hall (1852, Paleontology of New York, vol. 2) included in his new genus *Homocrinus* two new species, *H. parvus* (p. 185, pl. 41, figs. 1a-c) and *H. cylindricus* (p. 186, pl. 41, figs. 2a-c, 3a-c), and two species described by Hall in the first volume of the Paleontology of New York (1847), *Poteriocrinus alternatus* (p. 83) and *P. gra-*

cilis (p. 84). In 1859a Hall added two new species (both dicyclic), *Homocrinus scoparius* (p. 102, pl. 1, figs. 1-9) and *H. proboscidialis* (p. 138, pl. 84, figs. 24-25).

Hall's original description of *Homocrinus* is pertinent and will be quoted in part (Hall, 1852, p. 185):

> Crinoidea having the calyces composed of three series of simple plates, each series consisting of five plates; sometimes one or more irregular plates intercalated between the scapular or third series of plates on one side; arms proceeding from the summit of the third series of plates, simple or bifurcating, composed of a single series of plates, without tentacula.

Hall evidently believed that all species he referred to his new genus had similar plate configurations. The generic description is clearly intended to apply to dicyclic crinoids (*i.e.,* with three principal series of plates; IBB, BB & RR of current usage) with one or more anal plates ("irregular plates" of Hall, *op. cit.*) intruded into the cup. This definition, while loose by modern standards, does clearly apply to two species which were placed by Hall in *Homocrinus (H. cylindricus, H. scoparius)* but could not accommodate *H. parvus,* which, as established by Kirk (*op. cit.*), is a monocyclic crinoid with three compound radials. Hall's description of *H. parvus* was based on incomplete material which Hall assumed represented a dicyclic species. He was only able to deciper a small part of the calyx plate arrangement (Hall, pl. 41A, fig. 1d); nonetheless his description assumes three complete circlets of plates (*op. cit.,* p. 185).

In neither of his two papers on *Homocrinus* did Hall designate a type species. This practice is characteristic of his earlier work. In the second volume of the Paleontology of New York (1852), for example, although numerous new genera (besides *Homocrinus*) are described, none is explicitly given a type species. It seems likely that Hall intended the first species in each to be the type, but this cannot be demonstrated consistently from his own works. The so-called "first species rule" (Stoll, *et al.,* 1961, p. 71) is incorporated in the Code, but only as a recommendation. The first subsequent designation of a type for *Homocrinus* has been overlooked in the later literature but is apparently valid. However, as later workers based their revisions on the incorrect designation the history of the genus will be reviewed briefly below.

A discussion of the Devonian-Mississippian crinoid genus "*Poteriocrinus*" (= *Poteriocrinites, partim*) by Meek & Worthen (1866, p. 182) contains the following sentence:

> Again, if this arrangement of the lowest anal plate excludes it from *Poteriocrinus,* how can it, upon such a basis of classification, be referred to *Homocrinus*?, the type of which (*H. parvus*) presents the marked difference of having the lowest anal piece resting directly down upon the basal pieces, to say nothing of the wide differences, in the structure of the arms.

This sentence would seem to qualify as a valid subsequent designation of a type species under Article 69a, paragraph iii of the Code (Stoll, *et al.*, 1961, p. 69):

> In the absence of a prior valid type-designation for a nominal genus, an author is considered to have designated one of the originally included nominal species as type species, if he states that it is the type (or type-species), for whatever reason, right or wrong, and if it is clear that he himself accepts it as the type-species.

In this paper, this is accepted as legitimate designation of the type of *Homocrinus.*

Wachsmuth and Springer (1880, pp. 77-78) attempted to make *H. scoparius* type species of *Homocrinus*:

> The typical specimens which Hall used for description were most unsatisfactory, that of *H. parvus* being evidently a very young individual, while those of *H. cylindricus* are very imperfectly preserved. In Hall's corrected list of New York fossils he seems to have given up both *Dendrocrinus* and *Homocrinus*, as he groups the species of both under *Poteriocrinus* [no such reference has been located; indeed, Hall, 1859a, p. 82, listed *H. parvus* and *H. cylindricus* in unaltered fashion]. In 1861 [1859b], however, he described two new species under *Homocrinus,* from good specimens. They are not *Poteriocrinus,* for they have no pinnulae, nor *Cyathocrinus,* for they have an extra intercalated plate above the basals; nor *Dendrocrinus* for that plate is not radial; but their affinities are the closest with the latter, with which they agree in all principal characters. We [Wachsmuth and Springer] therefore regard *Homocrinus* as a subgenus under *Dendrocrinus* [dicyclic] . . . with *Homocrinus scoparius* Hall [dicyclic] as type. . . .

Designation of *H. scoparius* Hall, 1859 as type species of *Homocrinus* Hall, 1852 is not allowable under article 69a of the Code (Stoll, *et al.*, 1961, p. 69), for *H. scoparius* is not one of the (four) originally included nominal species.

In 1889 Miller (p. 255) listed *H. parvus* as type species of *Homocrinus,* possibly based on Meek and Worthen's statement. Later, Bather (1893, p. 101),) rejected *H. parvus* as type species:

> There is certainly nothing in the description or figures of *H. parvus* to show that it is congeneric with *H. cylindricus,* and it seems very doubtful to what genus it belongs; it is therefore better to ignore this species, at all events until it has been properly described, and not take it, as Mr. S. A. Miller has done, for the type-species of the genus.

Bather then suggested that *H. cylindricus* be considered type species of *Homocrinus,* and referred other dicyclic species to the genus.

It is apparent that, until Kirk's (1914) revision of *Homocrinus,* the genus was considered to be dicyclic, largely because three different species (*H. parvus,* monocyclic; *H. cylindricus,* dicyclic; and *H. scoparius,* dicyclic) were considered the type by various authors, and because the monocyclic nature of *H. parvus* was not known (in fact, 20 dicyclic species have been referred to *Homocrinus,* and only one monocyclic species, *H. parvus,* has ever been included). Kirk, applying the convention of page priority, chose *H. parvus* as type species (apparently Kirk was not aware of Meek and Worthen's work and did not consider Miller's 1889, listing of *H. parvus* as the type species adequate, perhaps because no one after Miller, 1889, and before Kirk, 1914, *e.g.,* Bather, 1893, had either). He also correctly demonstrated for the first time the monocyclic nature of *H. parvus.* He erected the new dicyclic genus *Lasiocrinus* with *H. scoparius* as type species for some of the dicyclic forms formerly referred to *Homocrinus.* Kirk berated some authors' choice (*e.g.,* Wachsmuth and Springer's, 1880) of a species not included among those in the original description of the genus for the type and farsightedly argued for the need for rules in paleontology to restrict ". . . the powers of subsequent writers in revising the original author's conception of the genus. . . ." (Kirk, 1914, p. 474). As will be seen from the above it is doubtful that *H. parvus* really represents Hall's conception of the genus. Nonetheless Kirk's emendation of the genus is apparently technically justified. Kirk's (1914) work caused *H. parvus* to be accepted universally as the type species and put an end to over fifty years of confusion on the nature of *Homocrinus parvus.*

The diminutiveness of *H. parvus* has led some crinoid specialists (*e.g.,* Wachsmuth and Springer, 1880) to view specimens attributed to *H. parvus* as juveniles of some other species with a radically different adult form. However, many specimens, all tiny, have been found; no gradation in morphology away from the common *Homocrinus parvus* form has been observed, and no morphologically reasonable potential adult is known from the same strata. It appears that adults of *H. parvus* are minute.

Homocrinus differs from other Homocrininae mainly in having five unbranched arms and taller BB. As (Kirk, 1914, p. 479) suggested, *Homocrinus* would make a good ancestor for cincinnaticrinids; it would also be a good ancestor for homocrinids. However, its age (Niagaran) precludes its being anything but a successor to known homocrinids and cincinnaticrinids. Possibly *Homocrinus* was a precursor of haplocrinitids (Devonian), which have similar structure in the radial circlet and unbranched arms, and pisocrinids (Silurian-Devonian), which have modified homocrinid cup structure and unbranched arms.

Homocrinus parvus Hall, 1852 Pl. 11; Text-fig. 19

1852. *Homocrinus parvus* Hall, p. 185, pl. 41, figs. 1a-f; Kirk, 1914, pl. 42, figs. 6-7; Meek & Worthen, 1866, p. 182; Kirk, 1914, p. 476, pl. 42, figs. 1-5, 8; Ulrich, 1925, p. 93, text-figs. 10a-b (mislabelled 10a-a); Moore & Laudon, 1943, pl. 1, figs. 4a-b; Moore & Laudon, 1944, pl. 53, figs. 4a-e; Springer, 1920, pl. 4, fig. 22 (an illustration of *Lecanocrinus nitidus* with *H. parvus* entangled among its arms); Moore & Laudon, 1944, pl. 52, fig. 7.

Primary type material. — AMNH 1705a, b, and c (all from the Rochester Shale, Lockport, New York) are syntypes of *H. parvus.* AMNH 1705a (Pl. 11, figs. 1-2) is herein designated lectotype and 1705b and c (Pl. 11, figs. 3-4) lectoparatypes of *H. parvus* Hall, 1852.

Because *H. parvus* is at present the only known species of *Homocrinus,* the specific diagnosis, description, occurrence, and discussion are the same as for the genus.

Genus **ECTENOCRINUS** Miller, 1889

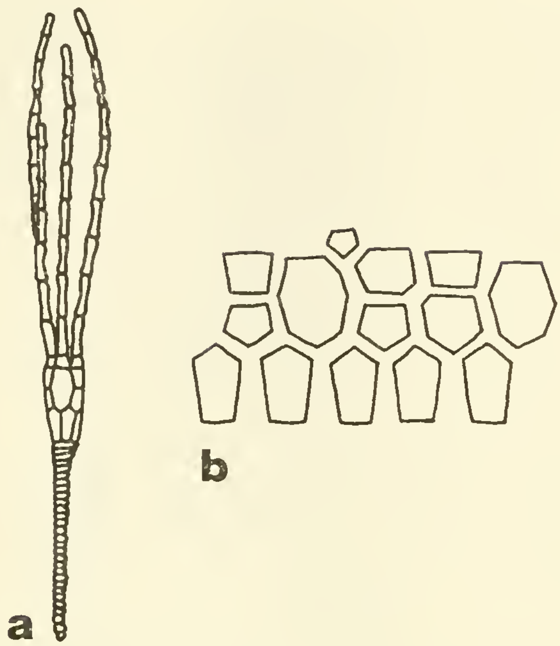
1847. *Heterocrinus* Hall, p. 278 (*partim*); d'Orbigny, 1850, p. 24 (*partim*); Pictet, 1857, p. 329 (*partim*); Billings, 1857, p. 271; Billings, 1859, p. 48; Hall, 1866, p. 4; Hall, 1872, Op. 210 (*partim*); Meek, 1873, p. 1 (*partim*); Zittel, 1879, p. 358 (*partim*); Wachsmuth & Springer, 1880, p. 68 (*partim*); Wachsmuth & Springer, 1886, p. 205; Cumings, 1908, p. 713; Miller, 1889, p. 252 (*partim*); Bather, 1893, p. 25; Wachsmuth, 1900, p. 152; Jaekel, 1902, p. 1100; Grabau & Shimer, 1910, p. 50 (*partim*); Springer, 1913, p. 212; Jaekel, 1918, p. 86; Fritz, 1925, p. 10 (*partim*).

1886. *Stenocrinus* Wachsmuth & Springer, p. 207 (*partim*).

1889. *Ectenocrinus* Miller, p. 242; Bather, 1900, p. 146, fig. 58-3; Wachsmuth, 1900, p. 152; Cumings, 1908, p. 712; Springer, 1911, p. 26; Springer, 1913, p. 212 (*partim*); Slocum, 1924, p. 337; Ulrich, 1925, p. 94; Moore & Laudon, 1943, p. 27, text-fig. 3; Moore & Laudon, 1944, p. 145; Moore, 1962, p. 7, text-figs. 1-6, p. 10.

1925. *Drymocrinus* Ulrich, 1925, p. 96; Moore & Laudon, 1944, p. 145; Moore, 1962, p. 10.

Type species. — *Heterocrinus simplex* Hall, 1847 by original designation (Miller, 1889, p. 242).



Text-fig. 19. *Homocrinus parvus.*
a—A ray view (after Kirk, 1914); b—exploded diagram (after Kirk, 1914).

Diagnosis. — Homocrininae with short (about half as tall as broad) BB; one symmetrically pentagonal B (in the BC interray) and four asymmetrically pentagonal BB; with five rays bifurcating isotomously to form ten arms; and with proximal columnals short, of about equal height.

Description. — *Ectenocrinus* has short, irregularly pentagonal BB; BB that underlie a compound R and a simple R have one sloping upper side (under the compound R) and one horizontal upper side (under the fused R); a single B (in the BC interray) underlies two compound RR (in the B and C rays) and has two sloping upper sides. The compound RR (in the B, C, and E rays) are inverted pentagons, divided into a taller sR and shorter iR; compound RR are slightly taller than fused RR, which are tall rectangles. The distal left corner of the C ray sR and distal right corner of the D ray R are truncated to accommodate the armlike anal series. Anal X is an inverted, nearly parallel-sided, pentagon that supports a series of rapidly tapering distally XX backed by numerous small polygonal plates to form a tube.

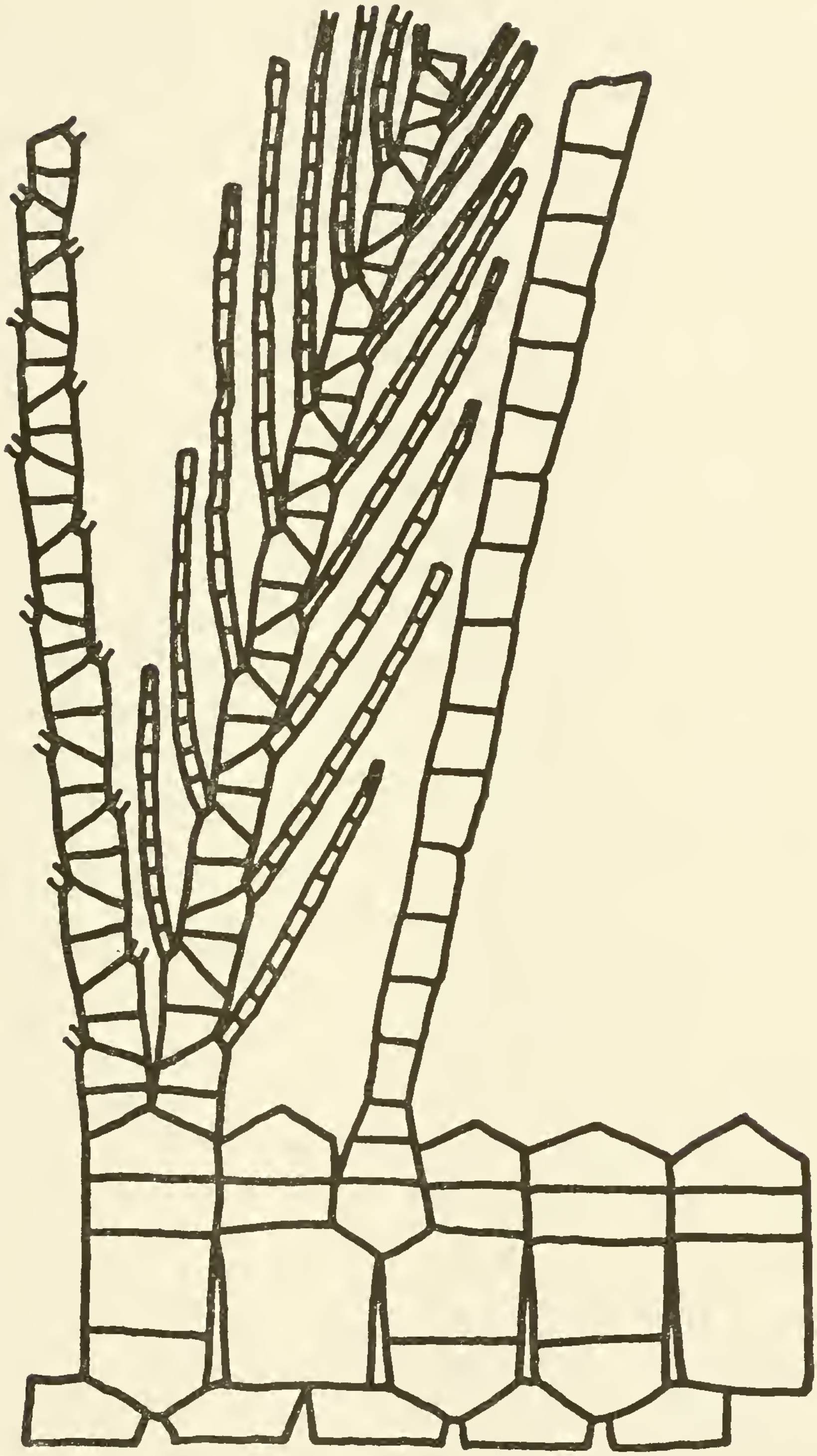
Ectenocrinus has two IBrr in each ray. IBr_1 is a low rectangle nearly twice as broad as high; it articulates along its entire proximal surface with the underlying R and is fixed. IBr_2 is a pentagonal axillary supporting two arms (to form a total of ten arms) with alternating heterotomous branching with the first armlets given off away from the ray.

Occurrence. — Kirkfieldian or Shermanian to Richmondian. *Ectenocrinus* is known from the Kope and Fairview Formations (Edenian and Maysvillian at Cincinnati) in the Ohio-Kentucky-Indiana tristate area; from the "Trenton limestone," Trenton Falls, New York, Ottawa, Ontario, and Montreal, Quebec; the Maysvillian of Wyoming; and from the Maquoketa Formation (Richmondian?) of Iowa. In addition, Ulrich (1925, p. 95) reported a few specimens from the Curdsville formation (Kirkfieldian?) of central Kentucky, but this report requires verification.

Discussion. — *Ectenocrinus* is the genus that for over half a century was confused with *Heterocrinus* (see discussion of *Cincinnaticrinus varibrachialus*). Two species, *E. simplex* and *E. geniculatus*, are recognized. *H. geniculatus* is the type species of *Drymocrinus* Ulrich, 1925, but the differences between *H. geniculatus* and *E. simplex* appear to be specific rather than generic. *Drymocrinus,* then, is a junior synonym of *Ectenocrinus*. *Ectenocrinus* may have been the progenitor, directly or indirectly, of all homocrinids, although *Ibexocrinus* or *Daedalocrinus* could have served this function.

Ectenocrinus simplex (Hall), 1847 Pls. 12-14; Text-fig. 20

1847. *Heterocrinus simplex* Hall, p. 280, pl. 76, figs. 2a-d; Cumings, 1908, p. 720.
1857. *Heterocrinus simplex* Hall, Billings, 1857, p. 271; Hall, 1871, pl. 1, figs. 11-12; Hall, 1872, p. 5, figs. 11-12; Meek, 1873, p. 7, pl. 1, figs. 4a-b, 5a-b; Cumings, 1908, p. 720, pl. 4, figs. 10, 10a; Grabau & Shimer, 1910, p. 502, text-fig. 1814; Moore & Laudon, 1943, pl. 1, figs. 5a-b; Moore & Laudon, 1944, pl. 53, figs. 8a-b; Moore, 1962, pl. 1, fig. 2a.
1859. *Heterocrinus canadensis* Billings, p. 48, pl. 4, figs. 5a-d.
1873. *Heterocrinus simplex* var. *grandis* Meek, p. 9, pl. 1, figs. 6a-b, 7a-c; Grabau & Shimer, 1910, p. 502, text-fig. 1814; Moore, 1962, pl. 1, figs. 2b-c.
1909. *Ectenocrinus canadensis* (Billings), Wood, p. 22.
1914. *Ectenocrinus grandis* (Meek), Foerste, p. 124, pl. 1, figs. 8a-d.
1924. *Ectenocrinus raymondi,* Slocom, p. 337, pl. 29, figs. 5-9; Thomas and Ladd, 1926, p. 14, pl. 2, fig. 2.
1925. *Ectenocrinus simplex* (Hall), Ulrich, p. 95, text-fig. 11; Moore & Laudon, 1944, pl. 52, fig. 7.



Text-fig. 20. Exploded diagram of *Ectenocrinus simplex* (after Ulrich, 1925).

Primary type material. — AMNH 656/2a, b, c, d, e, f, g, and h are syntypes. AMNH 656/2a (Hall, 1847, pl. 76, figs. 2a and d; herein Pl. 12, figs. 1-2) is herein designated lectotype and 656/2 b, c, d, e, f, g and h lectoparatypes of *Heterocrinus simplex* Hall, 1847.

Diagnosis. — *Ectenocrinus* having straight arms made up of numerous syzygial pairs, each pair composed of an armlet-bearing epizygal above articulating syzygally below with a hypozygal. Cup subconical, stem facet covering base.

Description. — *E. simplex,* as well as having the generic (*Ectenocrinus*) features of two Brr in the IBr series, has two Brr in each succeeding series. Diagonal sutures, alternating in direction of slope, separate each division series, with an armlet (pinnule) given off at the highest part of every second Br (hypozygal). The armlets are not visible when the arms are folded tightly together, which is commonly the case (presumably for the same reason that cincinnaticrinacean arms are usually folded, see cincinnaticrinacean discussion). Young (small) *E. simplex* have tall Brr, while older (larger) individuals have shorter Brr. Apparently Brr are first secreted as tall quadrilateral ossicles which then grow faster laterally than vertically and so get proportionally shorter.

Distal to the rapidly tapering proximal part (a homocrininan character), the column of *Ectenocrinus simplex* shows a columnar gradation similar in some respects to that of *Cincinnaticrinus varibrachialus.* Just below the rapidly tapering portion of the column, columnals are short and nearly equal in size to the few adjacent columnals on either side. The column enlarges gradually distally, and the section of equal-sized short columnals grades into a zone with columnals of two different sizes: smaller (shorter and narrower) columnals alternating with larger (taller and broader) columnals (Pl. 13, fig. 3).

The column is tripartite with the trimeres of each columnal disposed in the following manner: one occupies the EA and AB interrays, another lies in the BC interray and the C ray, and the third occupies the D ray and the DE interray (Text-fig. 20). Each trimere is in optical continuity; therefore, the trimeres are apparently not derived from a pentameric condition by fusion of two sets of two plates (such derivation is obvious in the basal circlets of many crinoids having only three BB as well as in nearly all blastoids). Derivation from a pentameric condition by fusion of two sets of two pentameres is also precluded by the unique disposition of the inter-trimeric sutures. One is interradial (in the CD interray) and two are radial (in the B and E rays). In monocyclic crinoids with penta-partite columns, interpetameric sutures are all interradial, whereas in dicyclic and pseudomonocyclic crinoids with pentapartite columns, all interpentameric sutures are radial (Warn, 1975). The axial canal in *Ectenocrinus simplex,* however, is pentalobate with the lobes directed interradially (Warn, 1975, text-fig. 3).

Occurrence. — Kirkfieldian or Shermanian to Richmondian. *E. simplex* is known from the Kope and Fairview Formations around Cincinnati; the Trenton Limestone around Ottawa and Montreal and at Trenton Falls, New York; the Martinsburg Formation of southern Pennsylvania; and the Maquoketa Formation at Clermont, Iowa. Hall (1847, p. 280) described *Heterocrinus simplex* from ". . . the soft shaly portions of the Blue limestone of Ohio at Cin-cinnati, equivalent in position to the Hudson-river group of New York." Billings (1857, pp. 271-273) described specimens he found in the "Trenton limestone, Ottawa and Montreal" as *H. canadensis,* which is now a junior synonym of *E. simplex.* Wood (1909, p. 23) reported *E. canadensis* (Billings) from the ". . . lower part of Tren-ton formation [at] Frankfort, Kentucky." Slocom and Foerste (1924, pp. 337-339) described *E. raymondi,* a junior synonym of *E. simplex,* from the lower part of the Maquoketa Formation at Clermont, Iowa. Additionally, numerous good specimens are known from the Kope Formation around Cincinnati and the Martinsburg Formation of southern Pennsylvania (especially from Swatara Gap).

Discussion. — Small *Ectenocrinus simplex* and lichenocrinid bases are a common association, and juvenile *E. simplex* probably have a lichenocrinid holdfast. Because *Cincinnaticrinus varibrachia-lus* and *E. simplex* usually occur together (in the Kope), nothing definite can be said of the *E. simplex* holdfast. In these occurrences, however, there are holdfasts that differ from those that can probably be referred to *C. varibrachialus* in two respects: they are somewhat larger (with diameters of about four to five mm as opposed to two to two and one-half mm) and the plates of the polyplated upper wall are well demarcated (unlike the *C. varibrachialus* holdfast which is obscurely plated).

It appears that in adult *E. simplex* new columnals are added at the base of the rapidly tapering proximal column and intercalated distally, for the smallest (cup height of 1.4 mm) individual has a rapidly tapering portion, as do all others (the largest has a cup height of 7.0 mm). A growth zone, similar to that at the base of the cup in most disparids, some distance below the cup (at the base of the rapidly tapering portion of the column) is a feature common to homocrinids and apparently unique among disparids. Evidently, a trend in homocrinids is to incorporate a few proximal columnals into the calyx. The interradial lumen extensions suggest that *Ectenocrinus simplex* is a true monocyclic crinoid, but the strange trimeric distribution suggests both monocyclicism and pseudomonocyclism.

The taxonomic splitting of *E. simplex* (as shown in the synonymy) was largely due to lack of awareness of population variation during the classical period of paleontology. Billings (1857, p. 273) reported that his specimens were conspecific with *Heterocrinus simplex*:

> I had drawn up the description of our Canadian specimens as above, under the impression that they were of a species different from that of the Hudson River Group [*H. simplex*]. But having since seen Professor Hall's collection, I now believe that ours are identical. . . Should, however, it hereafter be found that ours is different from the Hudson River species, I beg that it may be called *H. Canadensis*. . . .

Hall (1847, p. 280) had incorrectly described the proximal part of the column of *H. simplex* as pentagonal (it is round), and Billings (1859, pp. 48-49) used the Canada specimens' having round columns as the *differentium* between *Heterocrinus canadensis* and *H. simplex*. Meek (1873, pp. 9-10) described *H. grandis* as a subspecies of *H. simplex;* the subspecies was reported to be larger than *H. simplex* with shorter Brr than in *H. canadensis*. Slocom (1924, pp. 337-339) described *Ectenocrinus raymondi* as like *E. grandis* but with shorter Brr, more slender pinnules, and transverse grooves on the dorsal sides of the arms. Size of the crown and height of Brr are poor taxobases, for individuals grow larger and Brr grow faster laterally than vertically, so that older individuals have proportionally shorter Brr than younger individuals. The transverse grooves in the single specimen (CFM UC24701) of *E. raymondi* may be a unique feature, but *E. raymondi* is considered to be conspecific with *E. simplex*.

E. simplex probably gave rise to *E. geniculatus* with addition of a third Br in each division series and geniculation of the arms: *E. simplex* may have given rise to *Sygcaulocrinus typus* with heightening of the BB, heightening and fusion of the three most proximal columnals, and addition of Brr in each division series; and perhaps *E. simplex* produced *Homocrinus parvus* with heightening of the BB and elimination of branching.

Ectenocrinus geniculatus (Ulrich), 1879 Pl. 14-16

1879. *Heterocrinus geniculatus* Ulrich, p. 16, pl. 7, figs. 13, 13a-c.
1925. *Drymocrinus geniculatus* (Ulrich), Ulrich, p. 96, text-figs. 12a-b; Moore & Laudon, 1944, pl. 52, fig. 7.
1925. *Drymocrinus manitoulinensis* Foerste, p. 101, pl. 7, figs. 7.
1925. *Drymocrinus* sp. Foerste, pl. 7, fig. 2

Primary type material. — The holotype (figured by Ulrich, 1879, pl. 7, fig. 13) is UCGM 36313. A natural mold of the holotype is USNM 42219a. USNM 42219b, c, d, e, f, g, h, i, j, k, and l and CFM UC8829 are paratypes. All are lowest Edenian at Cincinnati.

Diagnosis. — *Ectenocrinus* with geniculate (zigzag) arms and two to four IIBr and higher (more commonly two or three than four).

Description. — *E. geniculatus* has $IBrr_1$ that taper distally and $IBrr_2$ that expand slightly distally. The $IBrr_1$ are shaped like upright, truncated cones. Thus, the junction of the $IBrr_1$ and $IBrr_2$ forms a constriction in the crown that marks the position of the tegmen, above which the arms become free. The IBr and higher axillaries expand noticably distally. Whereas the armlets in *E. simplex* are usually concealed when the arms are folded together (which is usually the case), the armlets in *Ectenocrinus geniculatus* are obvious in folded specimens for the zigzag nature of the arms reveals them.

The column is round and expands gradually distally. Near the cup, the columnals are short, but they become gradually taller distally until they are nearly as tall as wide (Pl. 15, fig. 6). Ulrich (1925, p. 96) reported that the column is quinquepartite, but this has not been verified. The nature of the column is difficult to determine from specimens in the type suite; the column is probably pentapartite, as Ulrich said, but may be tripartite, as in *E. simplex*. The axial canal is pentalobate with the five lobes directed interradially.

Occurrence. — Edenian. At the base of the Kope Formation in the immediate vicinity of Cincinnati; Sheguiandah Formation northeast of Tamarack Point and at St. Hyacinthe in the Manitoulin Island (in Lake Huron) area of Canada.

Discussion. — Ulrich (1925, p. 96) described the column of *E. geniculatus* as being cirrose and illustrated it (p. 96, text-fig. 12b) as being profusely so. One of the paratypes (USNM 422191) has numerous appendages that resemble cirri but are apparently broken armlets lying along its column (none appear to be attached to the column). No specimen examined for this report possesses either cirri or attachment sites for cirri, and the column of *Ectenocrinus geniculatus* is evidently not cirrose.

Ulrich (1925, p. 96) also described the anal sac as like that of *E. simplex* but wider and with ". . . a series of thin quadrate plates on either side of the median series." Available evidence, however, indicates that *E. geniculatus* has an anal sac like that of *E. simplex* (a series of facing XX backed by numerous small polygonal plates).

E. geniculatus was probably a short-lived offshoot from *E. simplex* that gave rise to no successors. Such evolution would have required only geniculation of the arms and slight increase in number of Brr in the IIBr, and higher, division series.

Ectenocrinus sp. indet. Kolata, 1976

1976. *Ectenocrinus* sp. indet. Kolata, p. 447, pl. 1, figs. 6-7, text-fig. 2.

Primary type material. — A single speciemen, UI X-5184.

Diagnosis. — A species of *Ectenocrinus* with rotund, pyriform dorsal cup that is wider than high; anal X arcuate, elongate; compound radials (in B, C, & E rays) with inferradial and superradial components about equal in height; arms unknown; axial canal of column and preserved proximal columnals round; column tapering rapidly distally.

Discussion. — Though the arms are lacking this crinoid was probably correctly placed in *Ectenocrinus* by Kolata (1976). The cup shape is unlike that of *E. simplex* or *E. geniculatus* and reminiscent of that of *Apodasmocrinus punctatus*. Like the latter *E.* sp. indet. has a round column that is apparently not tri- or pentapartite. However the distal taper of the column and relatively wide column facet are more comparable to those of the better-known *Ectenocrinus* species. The near-equal size of the inferradial-superradial pairs is a feature characteristic of *Ectenocrinus* and far removed from the strongly unequal compound RR of *Apodasmocrinus*.

Kolata (1976, p. 448) compared his species with an unnamed species discussed by Ulrich (1925, p. 95) and cited by him as from the Curdsville Limestone of Kentucky and the lower Trenton crinoid beds near Kirkfield, Ontario. The authors have not located Curdsville *Ectenocrinus* but the Trentonian specimens from Canada appear to be *E. simplex*. Ulrich's description does not seem to us applicable to this species, because the dorsal cup of Ulrich's crinoid is "more slender, and tapers more gently and more regularly into the expanding proximal part of the column [in comparison to *E. simplex*]" (Ulrich, *op. cit.*, p. 95). The cup of this species is stouter than *E. simplex* and the rounded sides cause the change from cup to column to appear more abrupt than in *E. simplex* or *E. geniculatus*, but less so than in *Apodasmocrinus punctatus*.

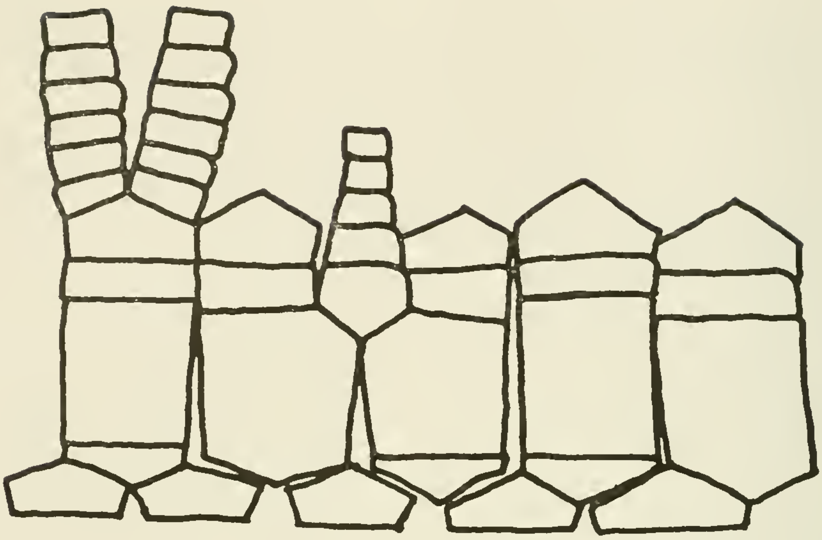
Until better preserved and more complete material is encountered the species is best left unnamed, but the generic assignment seems plausible. *E.* sp. indet. was probably a derivative of *E. simplex* that retained primitive cup characters (*i.e.*, size of infer- and superradials) but had a more evolved column.

Genus **Apodasmocrinus** Warn and Strimple, new genus
Text-fig. 21

Type species. — *Apodasmocrinus daubei* Warn and Strimple, 1977 by original designation herein.

Diagnosis. — Homocrininae with barrel-shaped dorsal cup having a moderate basal concavity; with superradials (in compound rays)only slightly shorter than simple radials; column round except in most proximal segment, heteromorphic, with large barrel-shaped nodals and internodals; proximal columnals much narrower than cup base; arms 10, apparently uniserial, arms constricted at distal end of IBr_1, expanding above; "pinnules" present, exact arrangement unknown.

Description. — Crown long, slender, constricted at the summit of primibrachs *1*. Cup barrel-shaped, widest at mid-section of superradials or above mid-height of simple radials; base of cup broad, planate with narrow columnar attachment area impressed into base, forming a narrow but moderately deep basal concavity; compound



Text-fig. 21. Exploded diagram of *Apodasmocrinus daubei.*

radials in *C, B* and *E* rays (familial characteristic) with short inferradials (Text-figure 21); anal X small, resting mainly on diagonal left shoulder of *C* superradial but notching slightly into right shoulder of *D* radial. Arms 10, uniserial, long and slender; proximal end of primibrachs *1* fills distal faces of radials (or superradials) but they taper sharply to become narrow at distal ends; axillary primibrachs *2* expand rapidly distalward; arms do not taper appreciably until well above mid-height. Column round except in proximal segments which are reported to be composed of five pentameres in *Apodasmocrinus punctatus;* columnals barrel-shaped with non-cirriferous nodals alternating with much smaller nodals.

Name. — Gr. *apodasmos*-divided, with reference to the divided or compound radials.

Occurrence.—Middle Ordovician, Blackriverian; North America (Va., Tenn., Okla.). The type species is from the Bromide Formation of Oklahoma. Brower & Veinus (1974) reported *A. punctatus* from Benbolt Formation localities in southwestern Virginia and northeastern Tennessee.

Discussion. — *Apodasmocrinus* has extremely narrow inferradials, perhaps indicating a trend toward eventual elimination, rather than fusion, of compound RR in one ectenocrinid line. The anal tube is not preserved on available material but may be much like that of *Ectenocrinus.* The arms divide once on the axillary $IBrr_2$

and are pinnulate (bear armlets). Like those of *Ectenocrinus* the armlets of *Apodasmocrinus* are not visible when the arms are tightly folded. As the arms (main rami) appear completely uniserial and only a few pinnules are preserved on the paratype of *A. daubei* it is not known with certainty whether the pinnules are alternate on each brachial or arranged as in *E. simplex.* The narrowness of each arm brachial suggests either that syzygial pairs are not developed in this genus or, less likely, that formerly paired brachials have fused. The strict uniseriality of the brachials indicates that the former is more probable.

The barrel-shaped dorsal cup is unusual among Homocrinacea, being most nearly paralleled in *Sygcaulocrinus.* The rounded base and well-developed, though narrow, basal concavity are present in both species of *Apodasmocrinus.* No other cincinnaticrinacean posses both features. Nevertheless, the other features of the genus individually are found in other Cincinnaticrinacea, and separation even on a subfamilial level does not appear warranted at this time. Constriction of the arms above the $IBrr_1$ in *A. daubei* is reminiscent of a similar trend in *Cincinnaticrinus* and is also well exemplified in *Dystactocrinus constrictus.* Development of pentameres involving only the proximal-most columnals in *A. punctatus* (Brower and Veinus, 1974, pp. 18-19) indicates that the column is morphologically advanced. The genus appears to be specialized in most features (compound RR, column, IBr arm constriction, cup shape) but retains some archaic features, *e.g.* uniserial main arms.

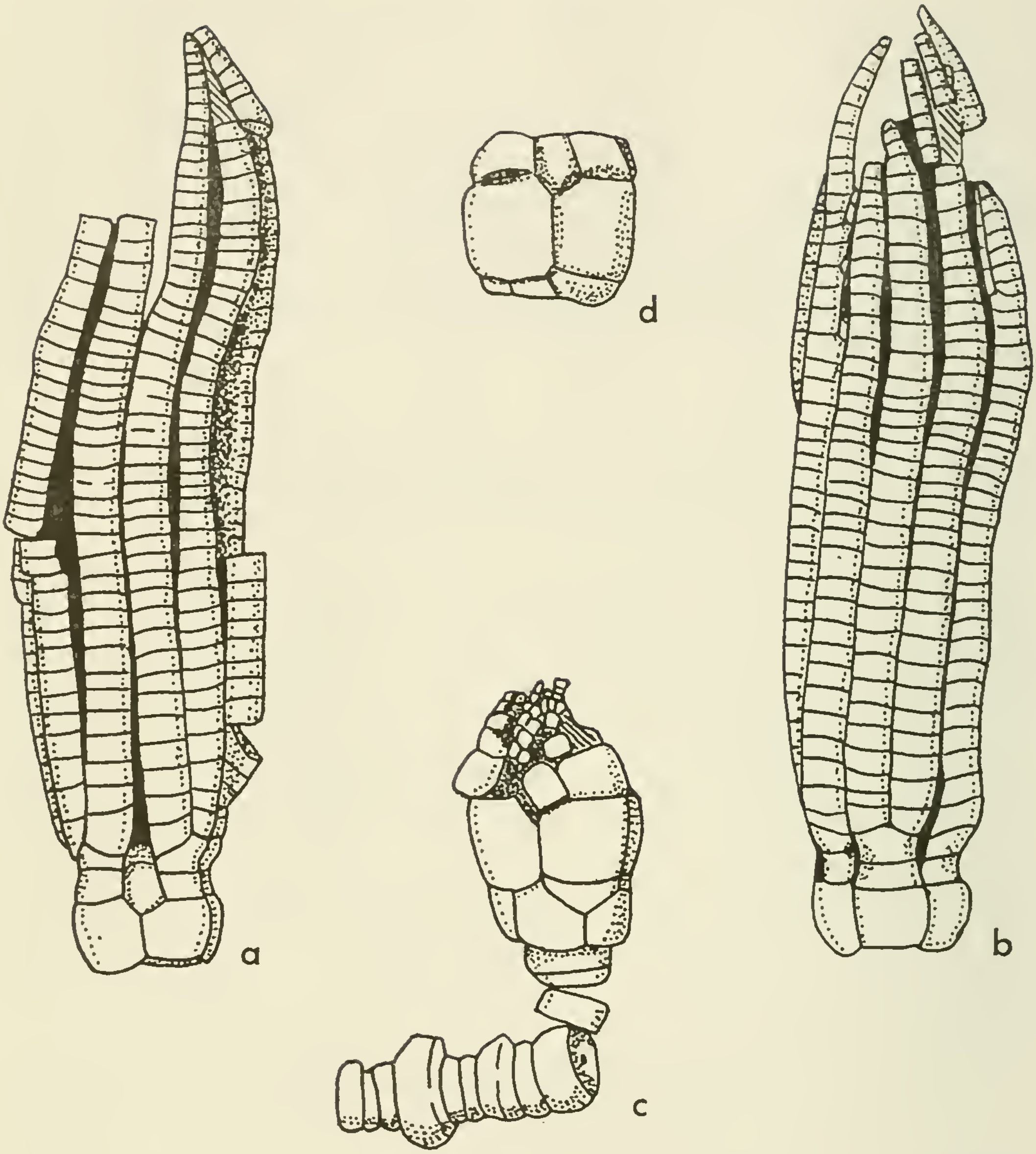
Occurrence. — Blackriverian, Benbolt Formation and Hogskin Member of Lincolnshire Formation or Benbolt Formation, Tennessee, and Virginia; Mountain Lake Member, Bromide Formation, Oklahoma.

Apodasmocrinus daubei Warn & Strimple, new species   Text-fig. 22 a-c

Primary type material. — Holotype SUI 39593 (Repository, University of Iowa); paratype USNM 164106.

Diagnosis. — Base of cup broad with large basals flexed upward to form an appreciable portion of lateral sides of cup. Cup plates tumid and smooth. Occasional pinnule-like ramules in distal portions of arms.

Description. — Same as that of genus, except where noted (see



Text-fig. 22. *Apodasmocrinus*. a — CD interray view of *A. daubei*, paratype USNM 164106. b — A ray view of *A. daubei*, paratype USNM 164106. c — Holotype of *A. daubei* (SUI 39593); drawing centered on CD interray. d — Drawing of holotype of *A. punctatus* (USNM 164097), CD interray view. Adopted from Brower & Veinus (1974), pl. 2, fig. 1.

above and discussion sections under both *Apodasmocrinus* species).

Discussion. — *A. daubei* and *A. punctatus* are similar in overall appearance but the punctate plate ornament of the latter and the proportionately taller basals of *A. daubei* readily distinguish the two species. Additionally *A. daubei* has a broader stem facet (compared to maximum cup width) than does the Benbolt species, and its column appears to lack a differentiated quinquepartite proximal portion even in young specimens (*e.g.*, the holotype). *A. punctatus* has basal plates with only the distal tips flexing out of the basal plane which contributes to formation of a proportionately shorter dorsal cup than that of *A. daubei*. In most other respects the two species are remarkably similar.

Measurements in millimeters:

	Holotype SUI 39595	Paratype USNM 164106
Length of crown (excluding basals)	—	31.4
Width of crown (at secundibrachs *2*)	—	6.7
Height of cup	4.0	—
Width of cup (maximum)	4.2	5.3
Width of cup (antero-posterior)	—	5.2
Height of anal X	1.3	1.5
Width of anal X	1.2	1.4
Height of *D* radial	2.2	2.5
Width of *D* radial	2.3	2.6
Height of *C* superradial	2.1	2.2
Width of *C* superradial	2.2	2.8
Height of *C* inferradial	0.7	—
Length of *C* inferradial lateral sides	0.4	—

Name. — Particular mention is made here of the kindness of Leon Daube who first allowed the junior author permission to collect on his ranch and to the later cooperation of his heirs, Mrs. Olive Daube and son Sam Daube, and to Jim Manton, manager of the Daube Ranch Company. It is with this in mind that the presently described species is named *daubei* in slight token of gratitude to Leon Daube.

Occurrence. — "*Platycystites* zone," Mountain Lake Member, Bromide Formation, Blackriveran, Middle Ordovician; West Branch of Sycamore Creek, Daube Ranch, Johnson County, Oklahoma (SW 1/4 SE 1/4 NW 1/4 sec. 27, T. 3 S., R. 4 E.).

Apodasmocrinus punctatus (Brower & Veinus), 1974 Text-fig. 22 d

1974. *Ectenocrinus punctatus* Brower & Veinus, pp. 17-20, pl. 1, figs. 2-4; pl. 2, figs. 1-6.

Primary type material. — Holotype, USNM 164097; paratypes, USNM 164098-164105; UMMP 57521, 57522; MCZ 621.

Diagnosis. — A species of *Apodasmocrinus* with BB barely visible in side view; cup short, broad, barrel-shaped in young individuals but somewhat quadrate appearing in mature specimens. Column round, possibly proximally quinquepartite; distally strongly heteromorphic; column facet narrow.

Discussion. — The original description by Brower and Venus (*op. cit.*, pp. 17-20) is complete and needs no supplementation. Though no specimen with arms has been found, the cup shape, narrow inferradials, and column features suggests referral to *Apodasmocrinus*. The proportionately narrower stem facet of this species is likely an advanced feature, as is the reduction in size and prominence of the BB; however, the proximal portion of the column of *A. punctatus* still is quinquepartite, indicating a closer relationship for this species to its probable ectenocrinid ancestors. Possibly both species are descended from a common ancestor which itself had earlier diverged from *Ectenocrinus*. The most likely antecedent for both *Apodasmocrinus* species is a form like *Ectenocrinus* sp. indet. Kolata.

Genus **IBEXOCRINUS** Lane, 1970

1970. *Ibexocrinus* Lane, p. 12.

Type species. — *Ibexocrinus lepton* Lane, 1970 by original designation (p. 12).

Diagnosis. — Homocrininae with symmetrically pentagonal BB about as tall as wide and equal in size; with five rays bifurcating isotomously to form ten arms; and with proximal columnals narrow, of about equal height.

Description. — *Ibexocrinus* has compound RR divided about equally into iRR and sRR. The anal tube, aside from the first two XX, is unknown but is probably like that of *Ectenocrinus*. Each ray apparently has two IBrr, with isotomous branching on the $IBrr_2$.

IBr_1 is a low rectangle nearly twice as broad as high, articulating with the underlying R along its entire distal surface. IBr_2 is a pentagonal axillary supporting two equal-sized arms. Succeeding branching is alternating heterotomous with the first armlets on the outside (or abradially). In subsequent arm divisions there are six to nine IIBrr branchials in each division series. The stem is round and expands only slightly proximally just below the dorsal cup; it is pentapartite with radial pentameres.

Occurrence. — Whiterockian. *Ibexocrinus* is known from a single specimen from the M zone (of Hintze, 1951), Kanosh Shale, near Ibex, Utah.

Ibexocrinus lepton Lane, 1970 Pl. 16, figs. 4-6; Text-fig. 23

1970. *Ibexocrinus lepton* Lane, p. 13; p. 8, text-figs. 2b-c; p. 11, pl. 1, fig. 1.

Primary type material. — The holotype and only known specimen of *Ibexocrinus lepton* Lane, 1970 is USNM 165239.

Because *I. lepton* is presently the only known species of *Ibexocrinus,* the specific diagnosis, description, occurrence, and discussion are the same as for the genus.

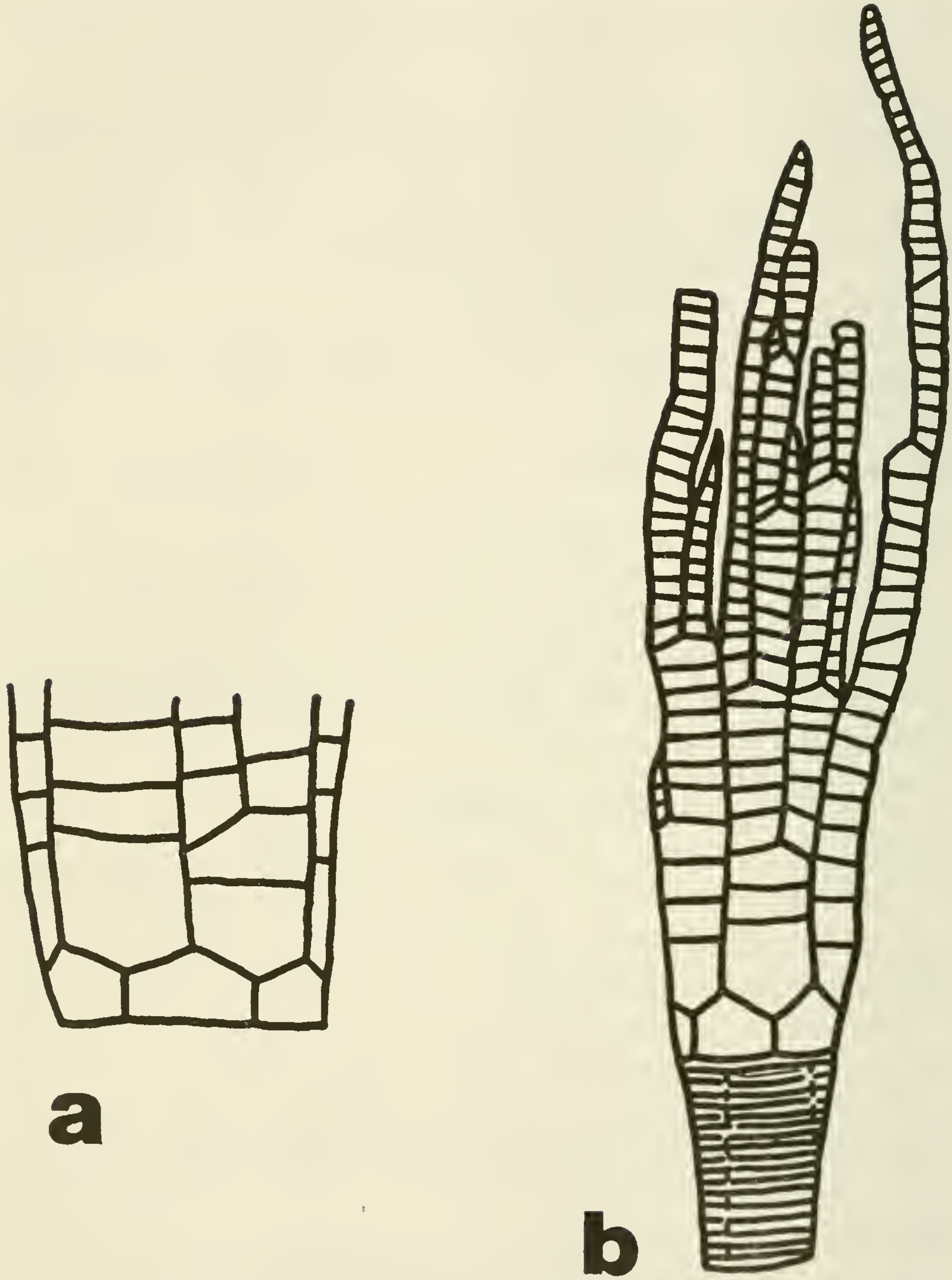
Genus **SYGCAULOCRINUS** Ulrich, 1925

1925. *Sygcaulocrinus* Ulrich, p. 98; Moore & Laudon, 1944, p. 145; Moore, 1962, p. 11, text-figs. 3-7a-b (b is Ulrich, 1925, p. 93, text-fig. 10b).

Type species. — *Sygcaulocrinus typus* Ulrich, 1925, by original designation (Ulrich, 1925, p. 99).

Diagnosis. — Homocrininae with tall BB, about one and one-half times as tall as broad; with one symmetrically pentagonal B (in the BC interray) and four asymmetrically pentagonal BB; with five rays bifurcating isotomously to form ten arms; and with proximal columnals inflated, greatly taller than adjacent (more distal) columnals.

Description. — *Sygcaulocrinus* has irregularly pentagonal BB; those BB that underlie a compound R and a simple R have one steeply sloping upper side (under the compound R) and one nearly horizontal upper side (under the fused R). A single B (in the BC interray) underlies two compound RR and has two sloping upper sides. The compound RR (in the B, C, and E rays) are inverted pentagons, divided into a taller sR and a shorter iR; compound RR



Text-fig. 23. *Ibexocrinus lepton.*
USNM 165249 (both after Lane, 1970). a—CD interray view. b—A ray view.

are taller than fused RR. They are unlike *Homocrinus* and *Ibexocrinus,* which have the proximal points of the RR even (at the same level of the cup) and the distal edges of the compound RR higher. They are also unlike the compound RR of *Ectenocrinus,* which have the distal edges higher and the proximal points lower than those of the fused RR. The distal edges of all RR in *Sygcaulocrinus* are even, and the proximal points of the compound RR are lower than the proximal points of the simple RR. Only anal X of the anal series is known; it is an inverted, distally tapering pentagon inserted into the notch formed by the truncated shoulders of the C and D ray RR.

Sygcaulocrinus has two IBrr in each ray. IBr_1 articulates along its entire proximal surface with the underlying R and tapers somewhat distally. IBr_2 is a pentagonal axillary supporting two arms. Branching and number of Brr per division series beyond this isotomous division is unknown except for USNM 89876 (the holotype of *S. typus*).

The most distinctive feature of *Sygcaulocrinus* is the "exploded" nature of the proximal columnals. The most proximal columnals (usually three) are wider and higher than distally adjacent columnals. As in other Homocrininae, this proximal portion of the column tapers distally. The column is evidently round, although it is unknown beyond (distal to) the first five or six most proximal columnals.

Occurrence. — Richmondian. Maquoketa Formation from Fort Atkinson, Iowa.

Discussion. — Ulrich (1925, pp. 98-99) described and illustrated a number of features for *Sygcaulocrinus* that cannot be verified from known specimens: 1) a tripartite column, 2) alternating heterotomous branching, 3) three to six IIBrr and higher, and 4) a tiny anal X lying in a similar-sized notch at the junction of the C and D ray RR. The authors have been unable to establish the tripartite nature of the column. Only the holotype exhibits branching or number of Brr beyond the IBr axillaries, but number of IIBrr and branching pattern is difficult to determine from this specimen. However, anal X and the proximal column have been observed in a number of specimens. Anal X, and the notch formed by the truncated corners of the C and D ray RR, seem to be larger than Ulrich reported (Strimple, 1974, p. 116). Ulrich probably described anal X as minute because anal X of the holotype has been rotated and only the northeast corner of the plate juts through sediment enclosing it. Strimple (*op. cit.*) regarded this crinoid as a bottom-dweller which autotomizes a portion of the column at some point during growth.

Sygcaulocrinus typus Ulrich, 1925 Pl. 17; Text-fig. 24

1925. *Sygcaulocrinus typus* Ulrich, p. 90, text-figs. 10a-b (? mislabelled 10b-b); Moore & Laudon, 1944, pl. 52, fig. 7.
1926. *Ectenocrinus elongatus* Thomas & Ladd, p. 12, pl. 2, figs. 3-8, pl. 5, figs. 3-4.

Primary type material. — The holotype of *S. typus* Ulrich, 1925 is USNM 89876.

Because *S. typus* is presently the only known species of *Sygcaulocrinus,* the specific diagnosis, description, occurrence, and discussion are the same as for the genus.

Subfamily **DAEDALOCRININAE,** new subfamily

Diagnosis. — Homocrinidae with the dorsal cup made up of strongly interlocking RR; with the compound RR somewhat taller than the fused RR, except for the B ray R, which, although compound, is the same height as the fused RR; with five rays bifurcating isotomously to form ten arms, after which branching is endotomous; and with a pentagonal column without a proximal tapering portion.

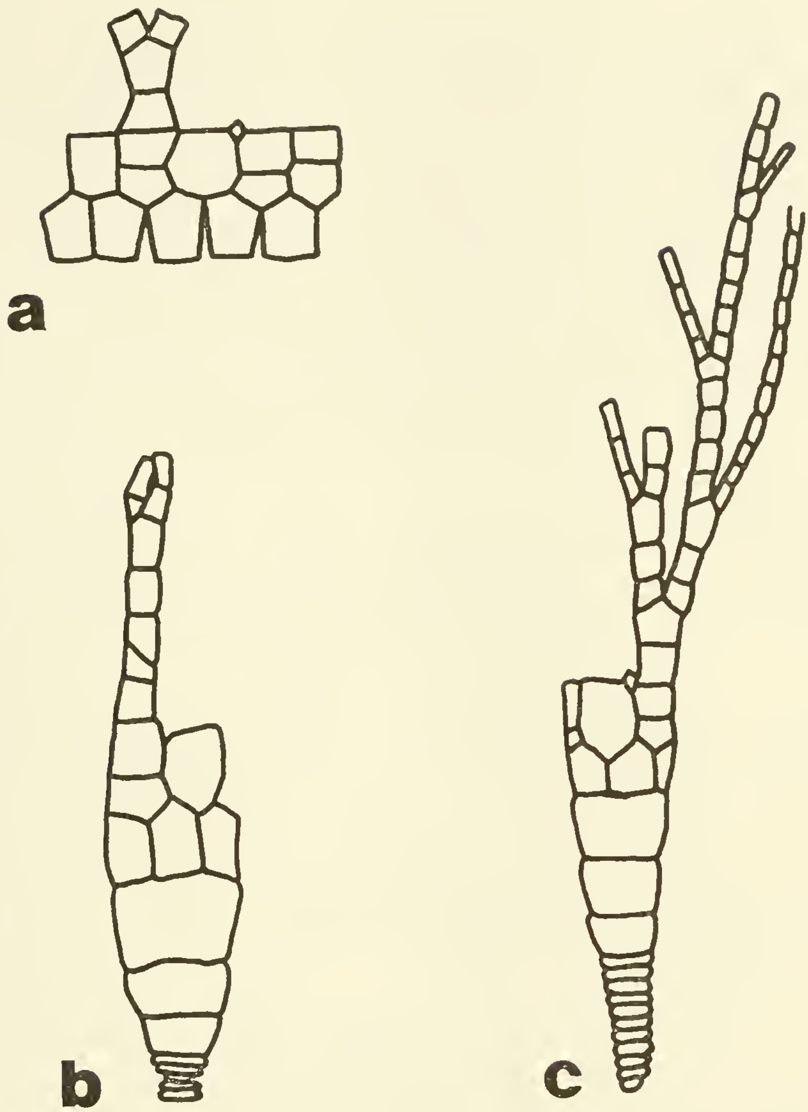
Because this is a monogeneric subfamily, other features are discussed under *Daedalocrinus.*

Genus **DAEDALOCRINUS** Ulrich, 1925
Text-fig. 25

1925. *Daedalocrinus* Ulrich, p. 97; Moore & Laudon, 1944, p. 145; Moore, 1962, p. 10.

Type species. — *Daedalocrinus kirki* Ulrich, 1925 by original designation (p. 97); this species is considered a junior subjective synonym of *Heterocrinus bellevillensis* Billings, 1883 herein.

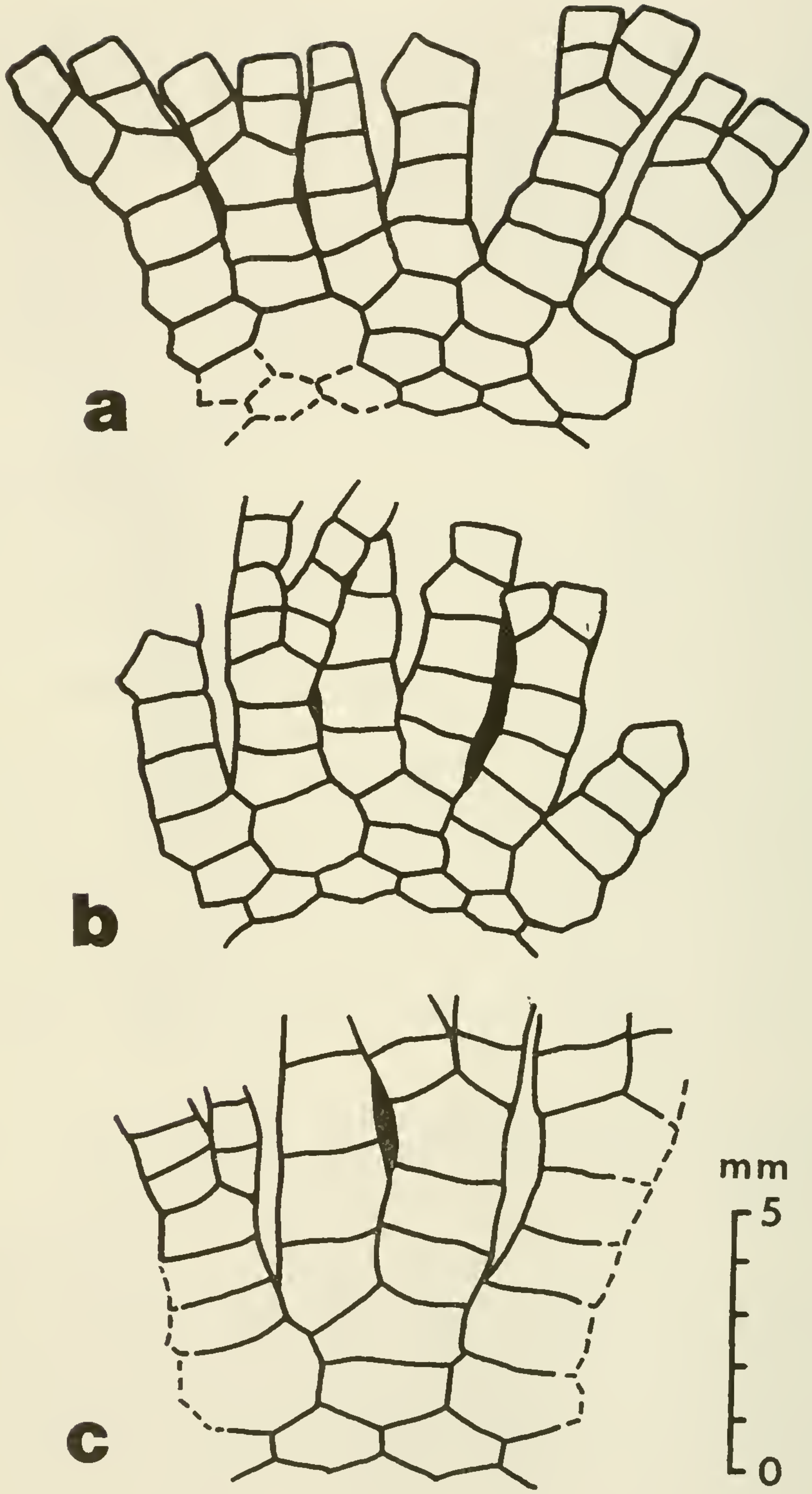
Description. — *Daedalocrinus* has equi-dimensional, symmetrically pentagonal BB of about equal size. The arms are long and have numerous branches; each arm has as many as ten armlets. Armlets are unbranched and extend to the arm tips. The genus has three to five IBrr per ray (apparently four is most common). Like members



Text-fig. 24. *Sygcaulocrinus typus.*
a—exploded diagram (after Ulrich, 1925); b—camera lucida drawing of USNM 89876, D ray view; c—D ray view (after Ulrich, 1925).

of the Cincinnaticrininae, number of Brr in each division series appears to be variable, both among different rays in single individuals and among the same rays in different individuals. Branching beyond the axillary IBrr is variable, with armlets given off anywhere from every third to seventh Br; a single specimen might have an arm with five IIBrr, three IIIBrr, and seven IVBrr.

The column, like that of members of the Cincinnaticrininae, is pentapartite with radially disposed pentameres, has a pentagonal



Text-fig. 25. *Daedalocrinus bellevillensis.*
a—exploded diagram of UCGM K.3669a; b—exploded diagram of UCGM K.3669b; c—exploded diagram of the posterior side of the proximal part of the crown of USNM S.2141 (lectotype of *Daedalocrinus kirki,* a junior synonym of *Heterocrinus bellevillensis.*

lumen with interradial angles, and is pentagonal proximally, with gradation distally from pentagonal to round.

Occurrence. — Kirkfieldian. *Daedalocrinus* is known from the Hull crinoid beds of Belleville and Kirkfield, Ontario. Billings (1883, p. 50) described *Heterocrinus bellevillensis* from the "Trenton limestone" at Belleville, Ontario, (= Hull beds); Ulrich (1925, p. 97) reported its, and another species' (*D. kirki,* considered a junior synonym of *D. bellevillensis*), occurrence in the "Lower Trenton crinoid beds," Kirkfield, Ontario (= Hull crinoid beds at Kirkfield, Ontario, where it is evidently fairly common).

Discussion. — *Daedalocrinus* was erected by Ulrich (1925, p. 97) for inadunates with a conical cup with three compound and two fused RR and with ten arms branching endotomously. The latter feature had previously been noted by Billings (1883, p. 50) for *H. bellevillensis.* Ulrich (1925) placed *Daedalocrinus* in the Homocrinidae.

In some respects, *Daedalocrinus* resembles certain crinoids not referable to the Homocrinidae. It has endotomous branching like *Geraocrinus,* an anomalocrinid, and a column and variable number of Brr per division series like members of the Cincinnaticrininae.

Springer (1911, p. 27) reported that Kirkfield material in the United States National Museum collection makes it evident that *Heterocrinus bellevillensis* has a convoluted anal sac, which would confirm its referral (by Springer) to *Ohiocrinus.* Ulrich (1925, pp. 97-98), using the same material as Springer had, described the anal sac as large and balloon-shaped. The authors have examined a number of well-preserved specimens in the Kopf collection (at the University of Cincinnati) and have perused the USNM cincinnaticrinids and homocrinids but have not found evidence to corroborate Springer's or Ulrich's observations. However, only one of the at least 12 syntypes of *Daedalocrinus kirki* has been located. A note (possibly in Springer's or Ulrich's handwriting) accompanying USNM S.2141 lists 12 specimens collected from Kirkfield, Ontario, in 1905 by Edwin Kirk. However, M. W. Moodey added the comment (dated March 16, 1934) that she "located only what is in this tray [USNM S.2141]." Unless the missing syntypes or better topotype material are discovered it seems best to maintain *Daedalocrinus* Ulrich with the cited type species. Certainly the morphology of the existing material confirms Ulrich's descriptions of the cup, arms, and column, and renders Springer's referral unacceptable.

LOCALITIES

Localities of *Cincinnaticrinus varibrachialus* collected in connection with this study. Numbers refer to Text-figure 10. All were in the Kope Formation. Crinoid remains in all but locality 2 were deposited as large ripples.

1—N39 06′, W84 24′ at the base of an old road cut on the east side of Elstun Avenue, 75 yards (nearly 70 meters) south of Beechmont Avenue. Neither the Kope-Fairview nor the Kope-Point Pleasant contact is visible. Fossil content and elevation of the outcrop suggest occurrence in the Southgate member (Text-fig. 4). Crinoids were found in a north-south trending deposit about 12 feet by 3 feet (nearly 4 meters by 1 meter) in areal extent and about 1/2 inch to 4 inches (about 1 1/4 to 10 centimeters) thick. The deposit was in mudstone and consisted mostly of column fragments, at least 88 tiny *Cincinnaticrinus varibrachialus* crowns and calyces, 7 tiny *Ectenocrinus simplex* crowns, 72 juvenile holdfasts, trilobites, brachiopods, gastropods, trepostome Bryozoa, and small *Mesopaleaster*. The trilobites and starfish were apparently scavenging the dead crinoids before burial. Many (all but the 95 cited above) of the crinoids are presently in the hands of amateur collectors.

2—N39 10′, W84 34′ in the west bank of West Fork Creek 50 yards (about 46 meters) northwest of the intersection of Diehl Road and West Fork Road, 198 feet (about 60 meters) below the Kope-Fairview contact which is visible along Shepherd Road just west of West Fork Road. Crinoids were found in mudstone and occupied about one square yard (nearly one square meter). Long (up to two feet, about 0.6 meters), unbroken columns lay without consistent orientation. Eighteen *Cincinnaticrinus varibrachialus*, 17 *Ectenocrinus simplex*, and 38 juvenile holdfasts were found.

3—N38 39′, W85 07′ near the top of a large outcrop at the southeast corner of the Carrollton, Kentucky I-71 interchange, 30 to 50 feet (about 9 to 15 meters) below the Kope-Fairview contact. The contact is covered here, but it is visible in outcrops along I-71 on the other side of the Kentucky River. The west-northwest—east-southeast trending deposit was about 3 feet by 6 inches in area and 2 inches thick (about 92 × 15 ×5 centimeters) and consisted of 17 *C. varibrachialus*, 2 *E. simplex*, and numerous columns.

4—N38 56′30″, W84 50′ in the creek bed of an unnamed tributary (of the Ohio River) which flows through Rabbit Hash, Kentucky, 70 feet (about 21 meters) below the Kope-Fairview contact which occurs in the westernmost fork of the tributary about 250 yards (about 80 meters) upstream from the pocket. The pocket consisted of "knotted columns" striking approximately east-west, 82 *Cincinnaticrinus varibrachialus* crowns and calyces, 54 *Ectenocrinus simplex*, and 21 juvenile holdfasts in mudstone, becoming more limy northward, and finally grading into a biogenic limestone made up in large part of discrete columnals.

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PLATES

EXPLANATION OF PLATE 1

Unrecognizable species.

Figure		Page
1-2.	**Heterocrinus heterodactylus** Hall Lectotype (designated herein) and latex cast of same, AMNH 1116/3, from Snake Hill, Saratoga County, N.Y., ×1.7.	40, 47
3-6.	**Heterocrinus heterodactylus** Hall Lectoparatype, AMNH 1116/2, from Boonville, N.Y., three lectotypes, AMNH 1116/1, from Pulaski, N.Y., ×0.6.	40, 47
7-8.	**Heterocrinus exilis** Hall Holotype, AMNH 1176/1, from Cincinnati, Ohio, view from CD interray, ×0.8 and ×2.5.	53

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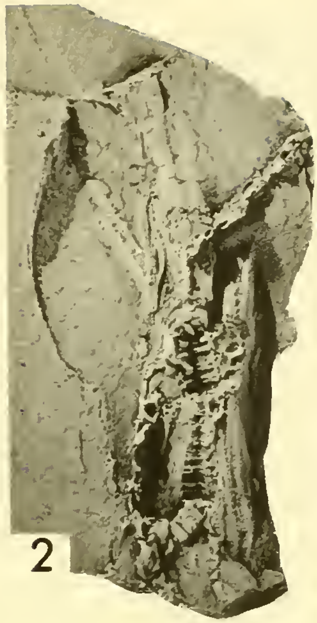

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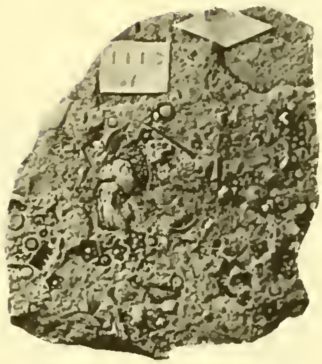

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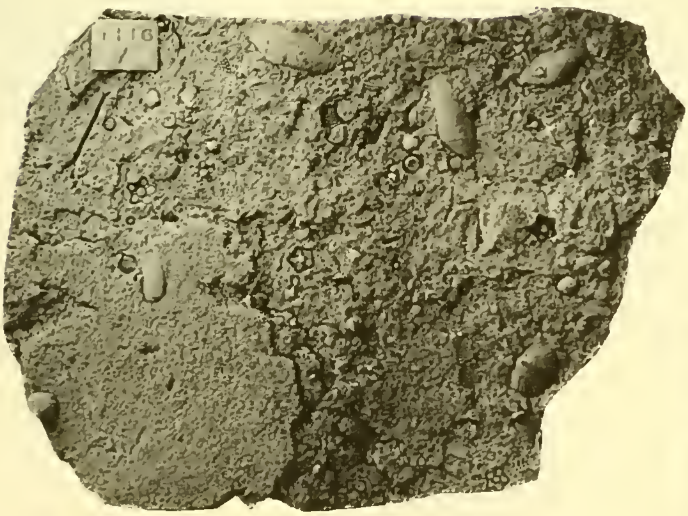

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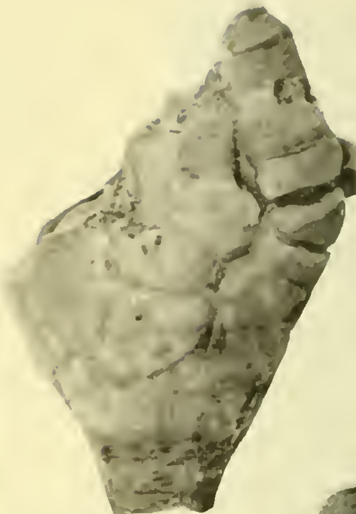

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Explanation of Plate 2

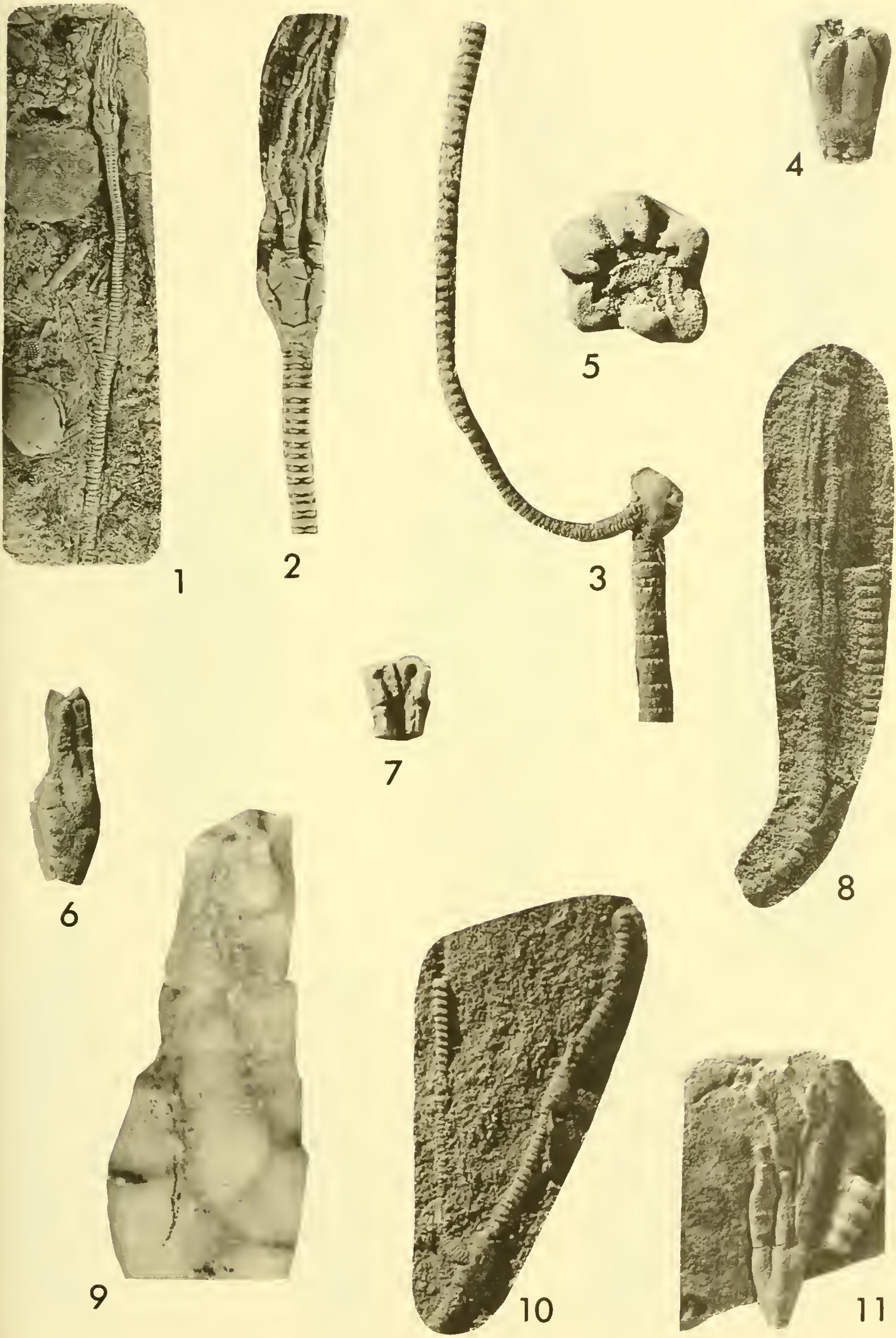
Unrecognizable species (figs. 4-8).

Figure		Page
1-3.	**Atopocrinus priscus** Lane Holotype, USNM 165240, from Ibex, Utah, E ray view; C ray view photographed under ethanol, C ray view, ×2.1.	74
4.	**Heterocrinus? gracilis** Hall Latex cast of holotype, AMNH 1117, from Snake Hill, Saratoga County, N.Y., ×1.7.	38
5.	**Heterocrinus juvenis** Hall Supposed holotype, AMNH 1173/1, purportedly from Lebanon, Ohio, D ray view, ×3.8.	39, 56
6-7.	**Columbicrinus crassus** Ulrich Holotype, USNM 89826, A ray view and CD interray view, from Columbia, Tenn., ×2.1.	31
8.	**Ohiocrinus exilis** Foerste Holotype, USNM 78718, from Rogers Gap, Ky., ×2.1.	60

EXPLANATION OF PLATE 3

Cincinnaticrinus varibrachialus, n. sp.

Figure		Page
1-2.	**Cincinnaticrinus varibrachialus,** n. sp. .... Holotype, UCGM 3871, specimen figured by Meek (1873, pl. 1, figs. 1a-b) as *Heterocrinus heterodactylus,* from Kope Formation, Cincinnati, Ohio, C ray view, ×0.8 and ×2.5.	41
3.	**C. varibrachialus** .... Figured specimen, MU 959a, from Kope Formation, Cincinnati, Ohio, ×2.5.	41
4-5.	**C. varibrachialus** .... Paratype, UCGM 405751, from locality 4, AB interray view with tegmen visible just over $IBrr_1$ as well as anal back plates on anal X (see Text-fig. 8), ×3.0 and oral view, ×6.0.	41
6.	**C. varibrachialus** .... Illustrated specimen, UCGM 40580, from locality 1, CD interray view, ×3.8.	41
7.	**C. varibrachialus** .... Illustrated specimen, UCGM 42674, from Kope Formation, Newport, Ky., ×3.4	41
8.	**C. varibrachialus** .... Illustrated specimen, UCGM 36287, from Trenton Falls, N.Y., ×2.5.	41
9.	**C. varibrachialus** .... Illustrated specimen, UCGM 40580, CD interray view, ×11.5.	41
10.	**C. varibrachialus** .... Illustrated specimen. UCGM 6562, Kope Formation, Rapid Run Creek, Cincinnati, Ohio, ×1.7.	41
11.	**C. varibrachialus** .... Illustrated specimen, UCGM 2021a, Kope Formation, Cincinnati, Ohio, A ray view, ×2.5.	41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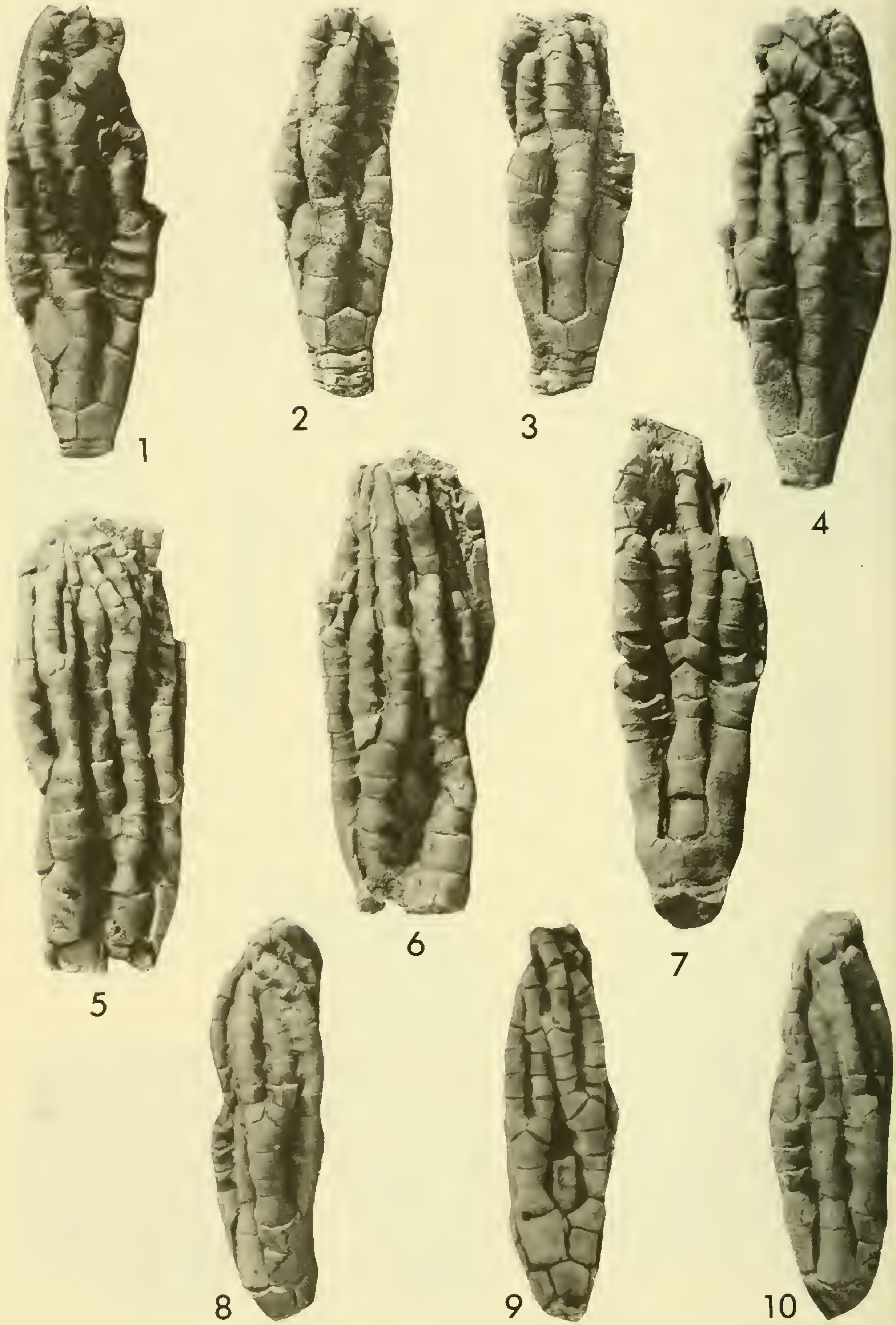
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Explanation of Plate 4

Paratypes of *Cincinnaticrinus varibrachialus*, n. sp.

from locality 5, all ×2.5

Figure | Page

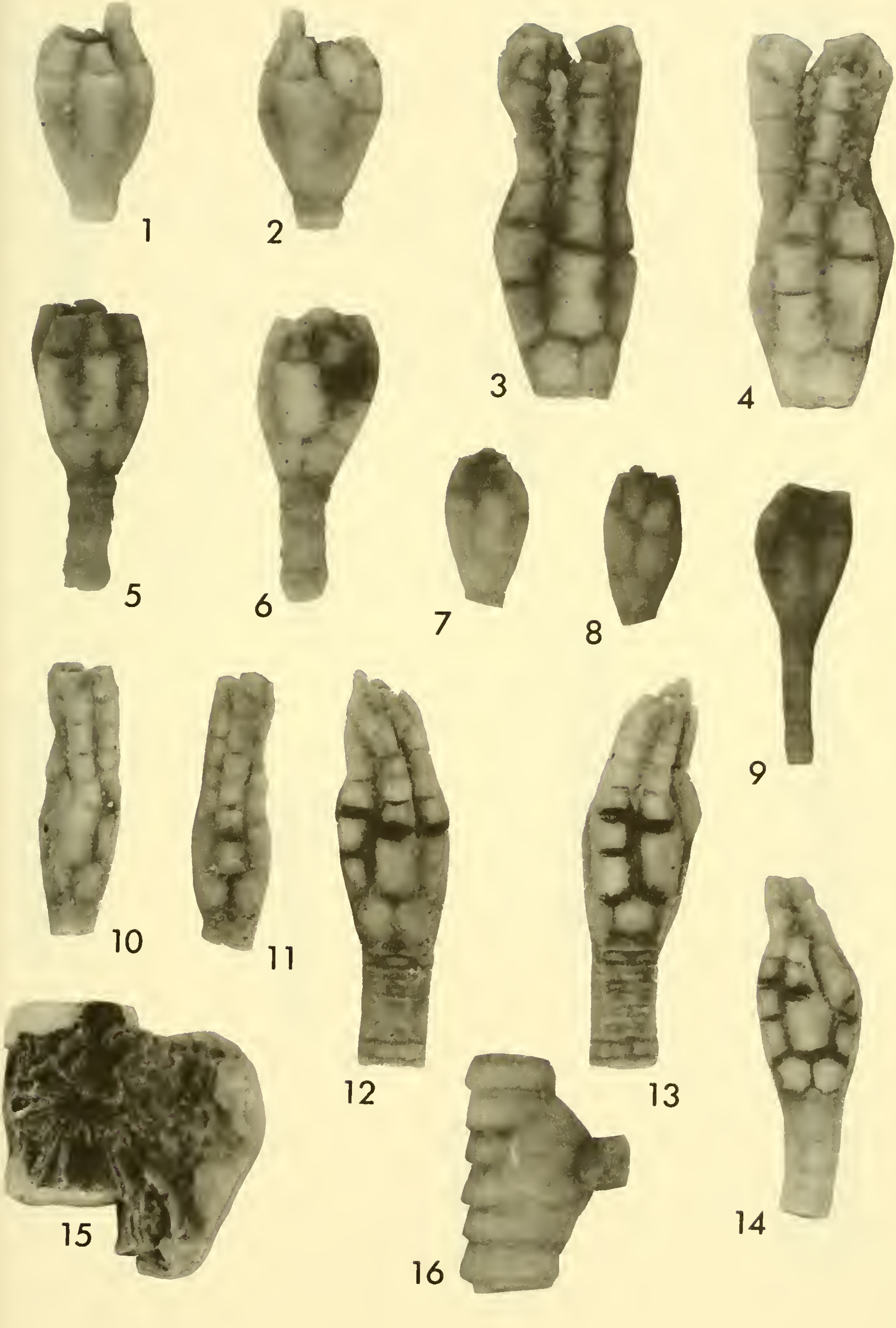
1-10. **Cincinnaticrinus varibrachialus,** n. sp. 41

Paratypes (1) UCGM 40555, C ray view; UCGM 40497, (2) C ray view and (3) E ray view; (4) UCGM 40555, E ray view; UCGM 40500, (5) H ray view and (6) CD interray view; (7) UCGM 50502, E ray view; UCGM 40531, (8) A ray view, (9) CD interray view photographed under ethanol, (10) and E ray view.

EXPLANATION OF PLATE 5

Cincinnaticrinus varibrachialus, n. sp. photographed under ethanol.

Figure		Page
1-9.	**Cincinnaticrinus varibrachialus,** n. sp.	41
	Illustrated specimens, (1-2), UCGM 40579, from locality 1 (see Text-fig. 8), A ray view and D ray view; (3-4) UCGM 40580, from locality 1, B ray view and DE interray view; (5-6), UCGM, from locality 1, A ray view and D ray view; (7-8), UCGM, from locality 1, A ray view and CD interray view; (9), UCGM 40583 BU, from locality 1, B ray view, all ×7.6.	
10-13.	**C. varibrachialus,** n. sp.	41
	Illustrated specimens, (10-11), UCGM 40568, from locality 4, C ray view and E ray view; (12-13), UCGM 40569, from locality 4, B ray view and DE interray view, all ×4.7.	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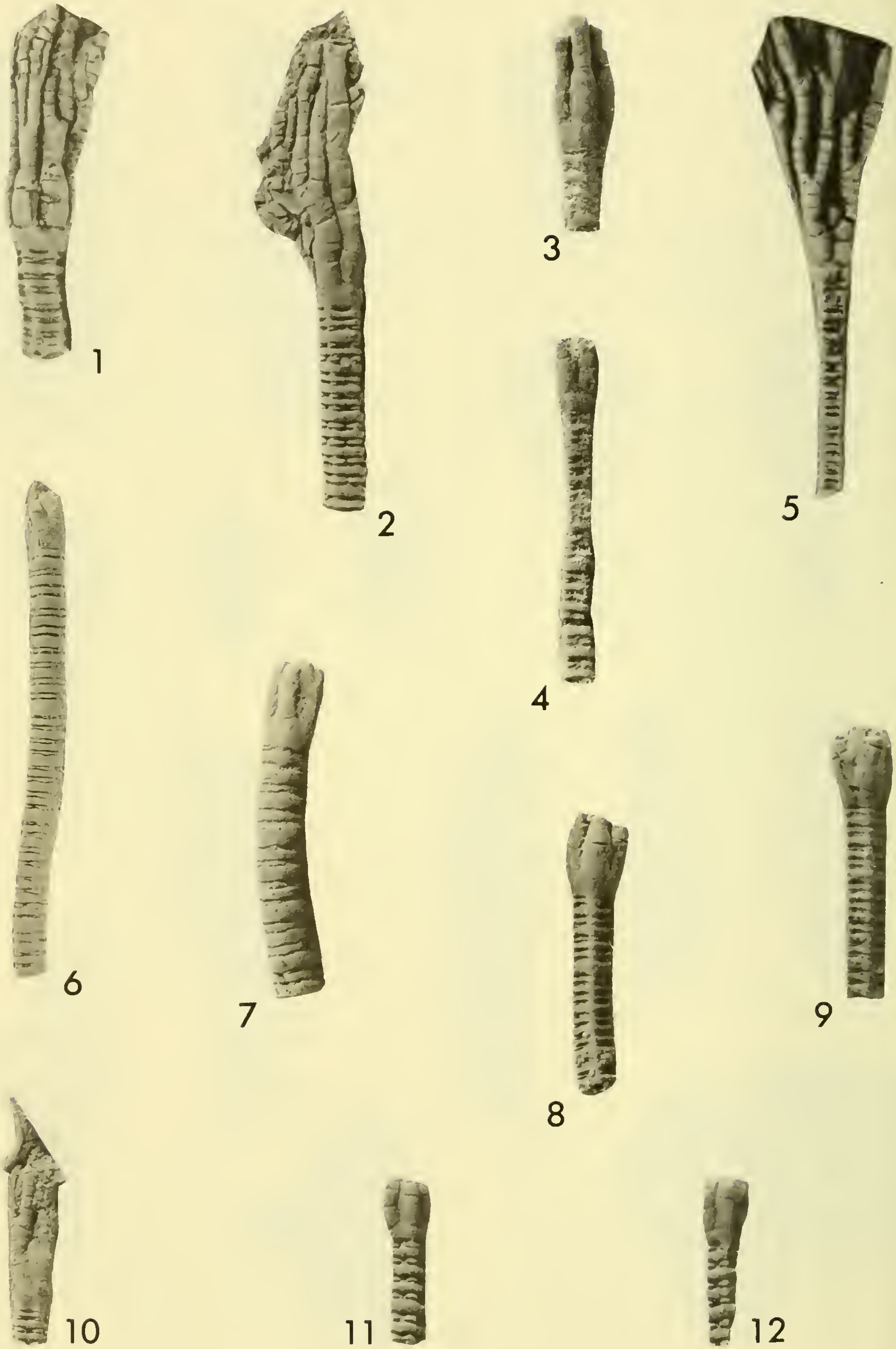
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EXPLANATION OF PLATE 6

Cincinnaticrinus pentagonus (Ulrich)

Figure | Page

1. **Cincinnaticrinus pentagonus** (Ulrich) 55
   Lectotype of *Heterocrinus pentagonus* Ulrich, YPM 24801, from Fairview Formation, Cincinnati, Ohio, EA interray view, ×1.7.

2-4. **C. pentagonus** 55
   Illustrated specimens, (1), UCGM 17626, from Grant Lake Formation?, Lebanon, Ohio, BC interray view; (3), UCGM 6559a, from Bull Fork Formation, Westwood, Cincinnati, Ohio, A ray view; (4) UCGM 11609, from Fairview Formation, Fairview Heights, Cincinnati, Ohio, CD interray view, all ×1.7.

5. **C. pentagonus** 55
   Lectoparatype, YPM 24802, from Fairview Formation, Cincinnati, Ohio, CD interray view, ×1.7.

6-7. **C. pentagonus** 55
   Illustrated specimens, (6) UCGM 41501, from Bull Park Formation, Hueston Woods State Park, Ohio, ×0.8; (7) UCGM 6450c, from Bull Park Formation, Clarksville, Ohio, ×1.7.

EXPLANATION OF PLATE 7

Figure		Page
1-4.	**Dystactocrinus constrictus** (Hall)	60
	Illustrated specimens, (1-2), UCGM 42675, from Cincinnati, Ohio, B ray view and A ray view; (3) UCGM 6542, from Cincinnati, Ohio, A ray view; (4), UCGM 6424, Cincinnati, Ohio, all ×1.3.	
5-7.	**D. constrictus**	60
	Holotype, HMCZ 2165, Grant Lake Formation, Cincinnati, Ohio, B ray view, C ray view and DE interray view, ×1.7.	
8.	**D. constrictus**	60
	Illustrated specimen, UCGM 42676, Grant Lake Formation, Ft. Mitchell, Ky., A ray view, ×0.8.	
9.	**D. constrictus**	60
	Holotype of *Atyphocrinus corryvillensis* (a junior synonym of *D. constrictus*), Grant Lake Formation, Cincinnati, Ohio, ×1.3; USNM 89827.	


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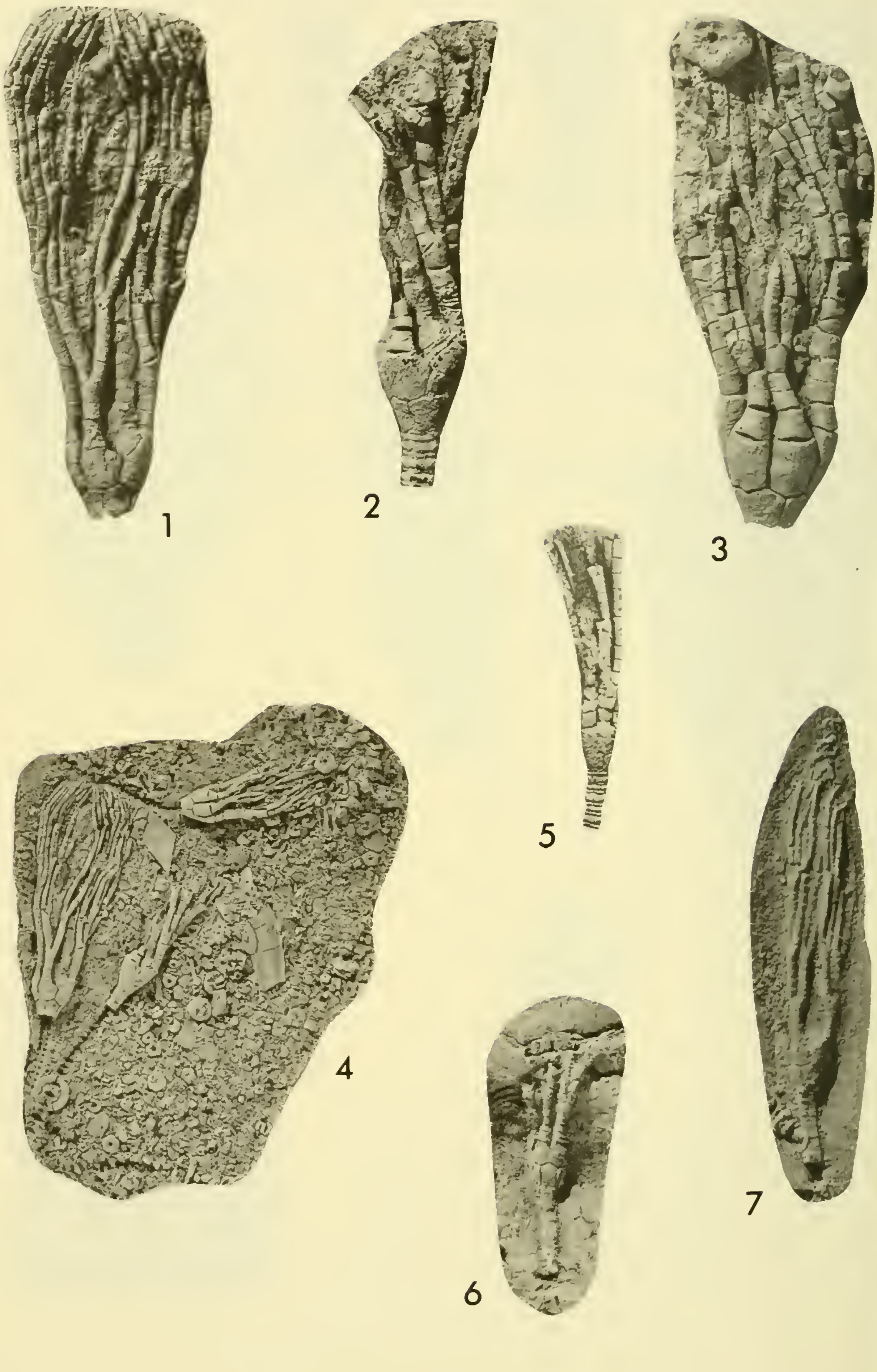
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EXPLANATION OF PLATE 8

Figure | Page

1. **Isotomocrinus tenuis** (Billings) 63

   Holotype, USNM S.2077a, *Isotomocrinus typus* Ulrich, a junior synonym of *I. tenuis,* from Kirkfield, Ontario, D ray view, ×4.7.

2-4. **I. tenuis** 63

   Paratypes, (2) USNM S.2077b, CD interray view, (3) S.2077c, AB interray view, ×4.7, (4) USNM S.2077a-c, ×1.3, all *I. typus* from Kirkfield, Ontario.

5. **I. tenuis** 63

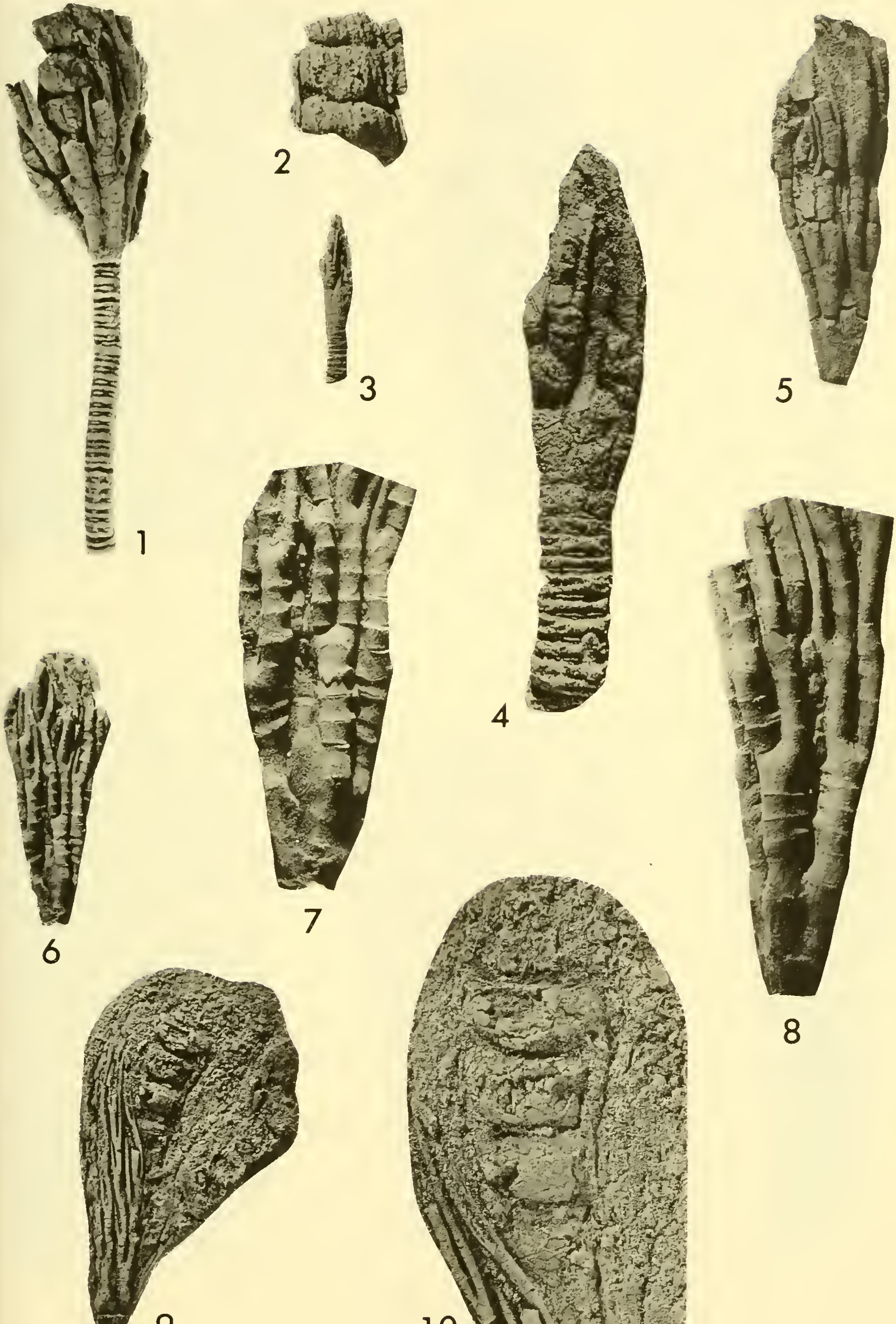
   Lectotype, GSC 1438, from Ottawa, Ontario, EA interray view, ×2.5.

6-7. **I. tenuis** 63

   Illustrated specimens, UCGM K.42677, AB interray view, UCGM K.42678, CD interray view, from Kirkfield, Ontario, ×1.3.

EXPLANATION OF PLATE 9

Figure		Page
1.	**Ohiocrinus laxus** (Hall)	68
	Illustrated specimen, UCGM 23048, B ray view, ×1.3.	
2.	**Ohiocrinus** sp.	67
	Illustrated specimen, UCGM 6600, Fairview Formation, Madison, Ind., ×1.3.	
3-4.	**O. laxus** (Hall)	68
	Illustrated specimen, USGM 6545a, Grant Lake Formation, Orland Ave., Cincinnati, Ohio, CD interray view, ×1.3, and same ×3.8.	
5.	**O. laxus** (Hall)	68
	Holotype, HMCZ 2167, CD interray view, Cincinnati, Ohio, ×1.7.	
6-8.	**O. laxus** (Hall)	68
	Illustrated specimen, UCGM 6524a, Cincinnati, Ohio, (6) CD interray view, ×1.7, (7) same ×3.8, showing spiral anal sac between arms of C and D rays, (8) same, ×3.8, showing spiral anal sac between arms of 5 and A rays.	
9-10.	**O. laxus** (Hall)	68
	Lectotype of *Heterocrinus oehanus* a junior synonym of *O. laxus*, USNM 42304a, Fairview Formation, Cincinnati, Ohio, ×1.3 and ×2.5.	

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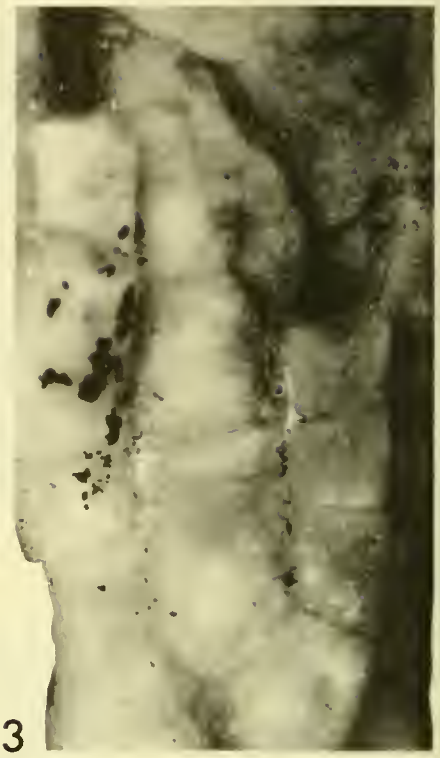
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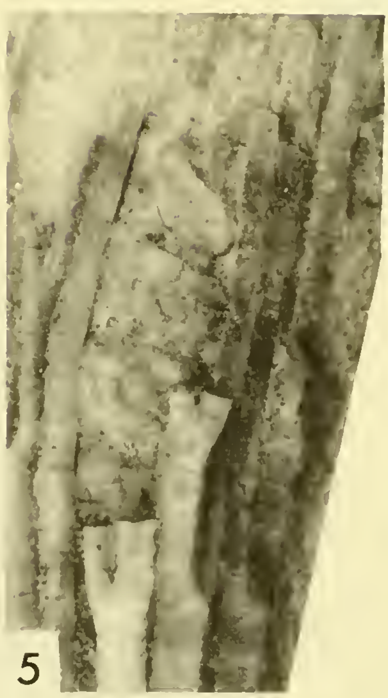
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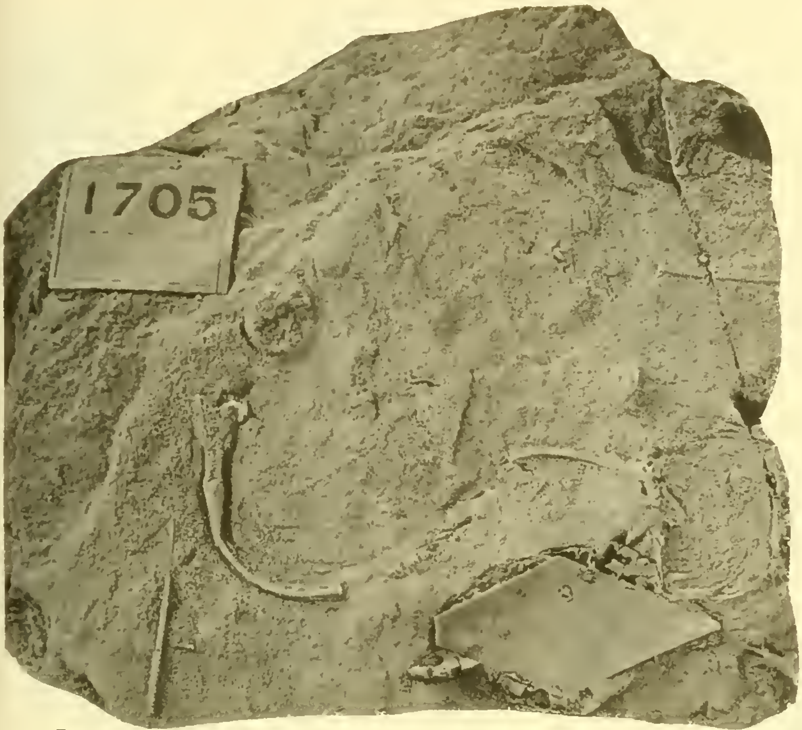
6

EXPLANATION OF PLATE 10

Figure		Page
1-3.	**Ohiocrinus brauni** Ulrich	70
	Lectotype, USNM S.2082b, Fairview Formation, Madison, Ind., CD interray view, ×3.8, photographed under ethanol, ×6.8 and ×13.6.	
4-6.	**O. brauni** Ulrich	70
	Lectoparatype, USNM S.2082a, Fairview Formation, Madison, Ind., E ray view, ×3.8, photographed under ethanol, ×6.8 and ×11.5.	

EXPLANATION OF PLATE 11



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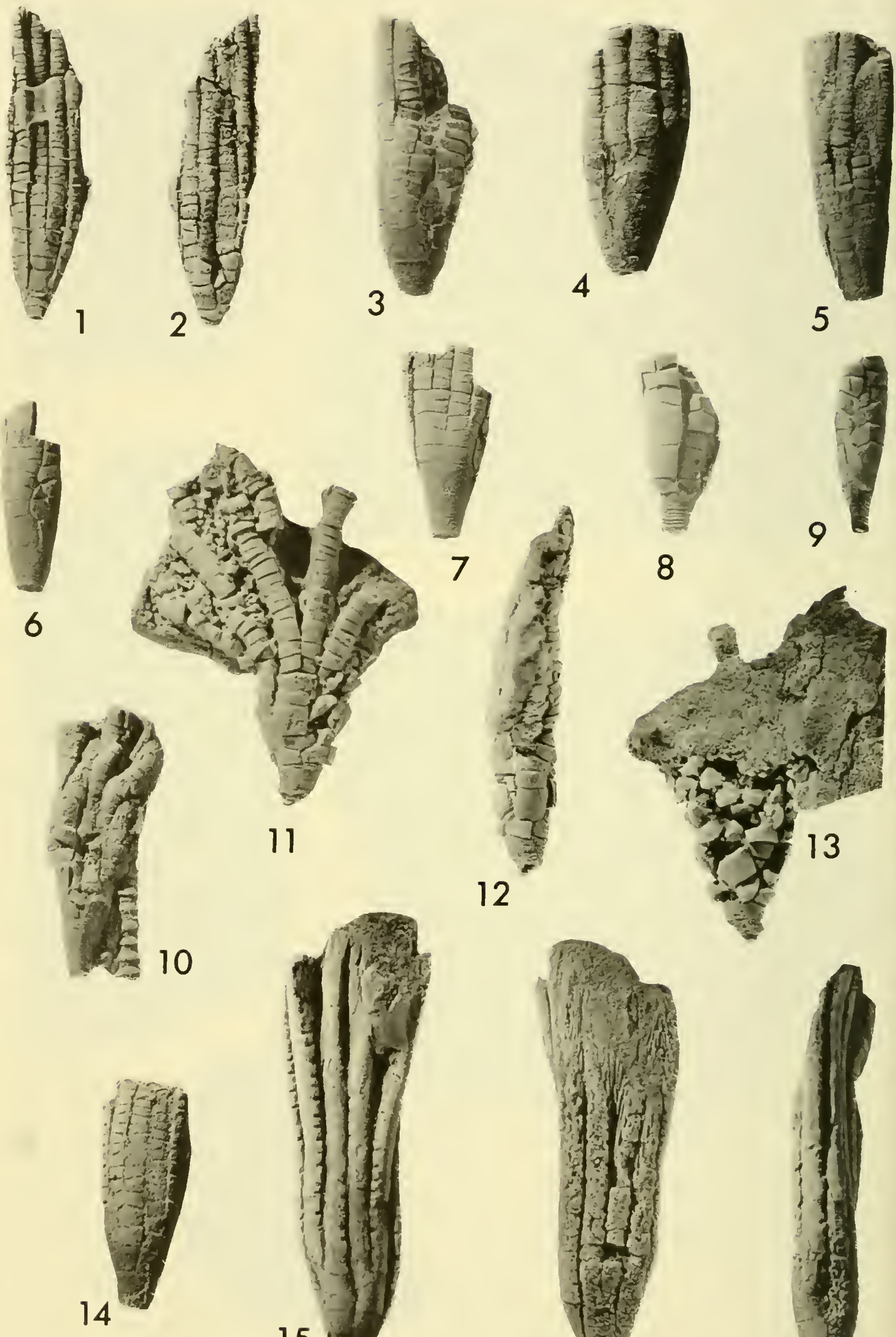
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EXPLANATION OF PLATE 12

All figures magnified ×1.3

Figure		Page
1-2.	**Ectenocrinus simplex** (Hall)	84
	Holotype, AMNH 656/2a, Cincinnati, Ohio, A ray view and CD interray view.	
3-10.	**E. simplex** (Hall)	84
	Paratypes from Cincinnati, Ohio, (3), AMNH 656/2b, CO interray view; (4) AMNH 656/2c, C ray view; (5) AMNH 656/2d, DE interray view; (6) AMNH 656/2e, B ray view; (7-8) AMNH 656/2f, CD interray view and DE interray view; (9-10), AMNH 656/2g, BC interray view, CD interray view.	
11-13.	**E. simplex** (Hall)	84
	Figured specimen, SUI 3770, Maquoketa Formation, Clermont, Iowa, E ray view, A ray view, BC interray view.	
14.	**E. simplex** (Hall)	84
	Paratype, AMNH 656/21, Cincinnati, Ohio, AB interray view.	
15-17.	**E. simplex** (Hall)	84
	Holotype of *Ectenocrinus raymondi* Slocum, junior synonym of *E. simplex,* Maquoketa Formation, Clermont, Iowa, BC interray view, E ray view and CD interray view.	

EXPLANATION OF PLATE 13

Figure | Page

1-3. Ectenocrinus simplex (Hall) 84

Illustrated specimens, (1) UCGM 36281a, Trenton Falls, N.Y., CD interray view, ×1.3; (2) UCGM 36281b, Trenton Falls, N.Y., C ray view, ×1.3; (3) UCGM 42679, ×0.4.

4-5. E. simplex (Hall) 86

Illustrated specimen, latex cast, UCGM 42680, Martinsburg Formation, Swatara Gap, Pennsylvania, A ray view and CD interray view, ×1.3.

6. E. simplex (Hall) 84

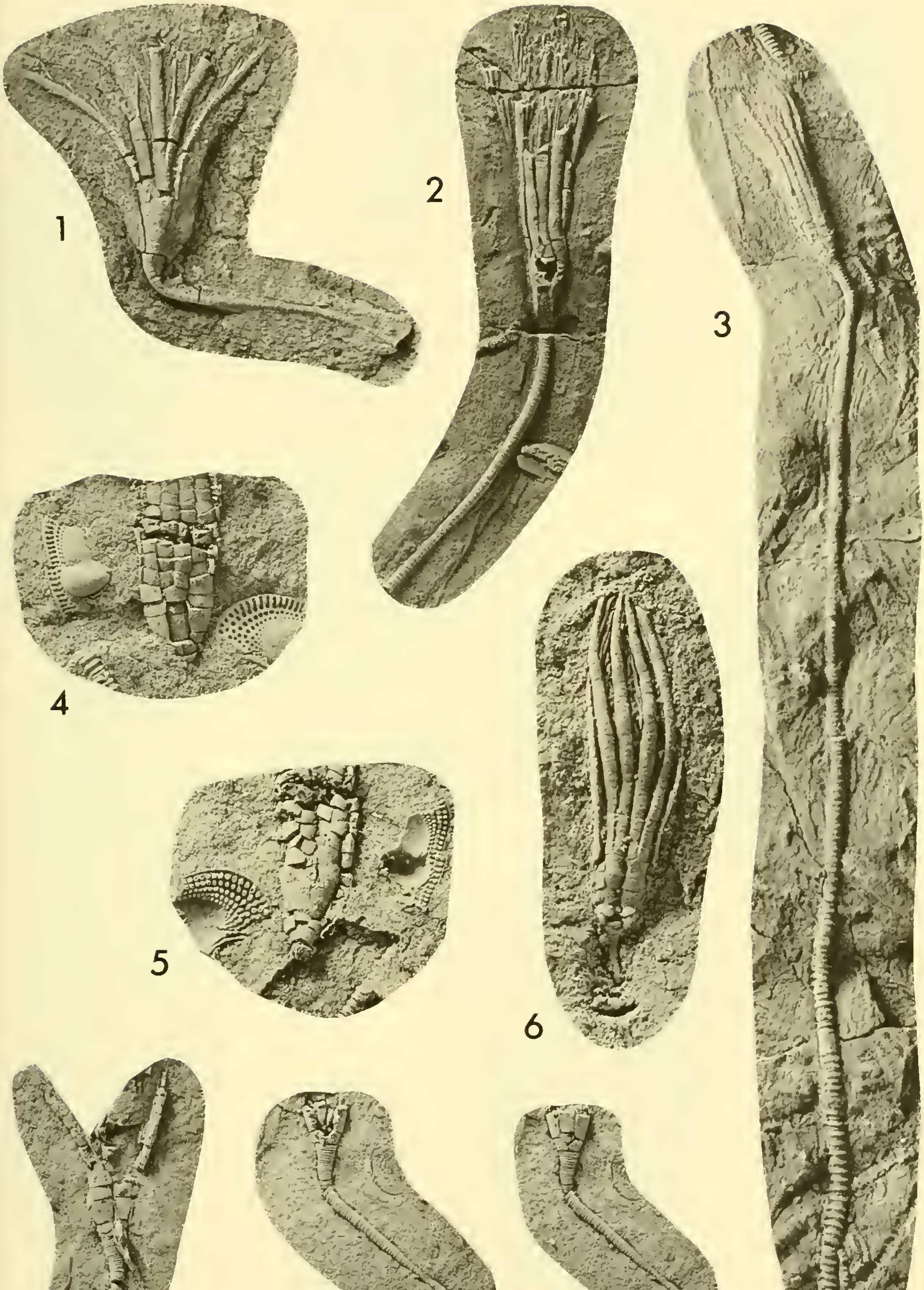
Illustrated specimen, UCGM 42681a, locality 2, BC interray view, ×1.7.

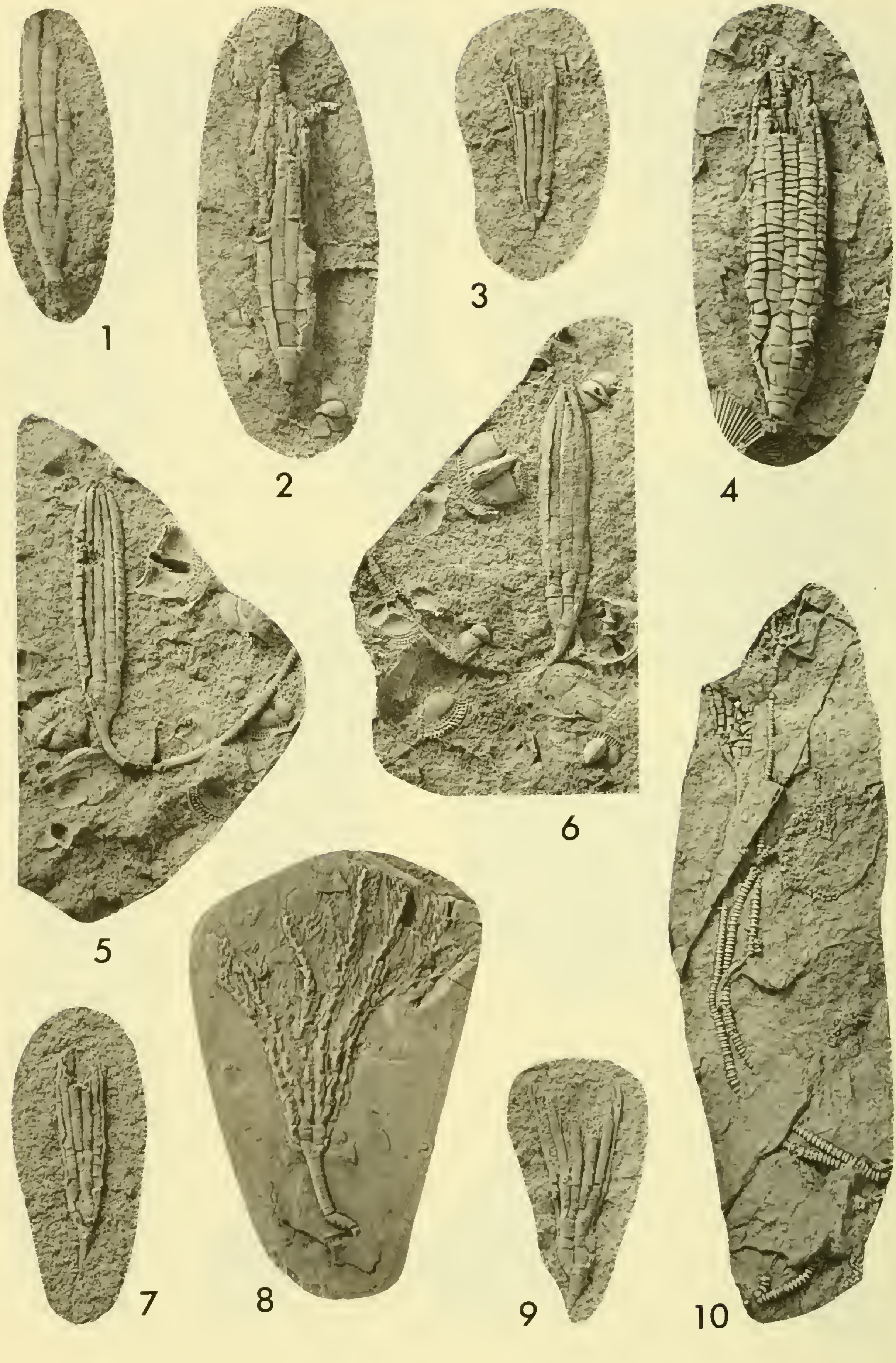
7. E. simplex (Hall) 87

Illustrated specimen, latex cast, Derstler no. 1a, Martinsburg Formation, Swatara Gap, Pennsylvania, BC interray view, ×1.3.

8-9. E. simplex (Hall) 87

Illustrated specimen, latex cast, Derstler no. 1b, Martinsburg Formation, Swatara Gap, Pennsylvania, E ray view showing interior surfaces of B and C radials and E ray view, ×1.3.

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EXPLANATION OF PLATE 14

All latex casts of *Ectenocrinus simplex* (Hall) from the Martinsburg Formation Swatara Gap, Pennsylvania, except figure 8.

Figure | Page

1-7,
9-10. **Ectenocrinus simplex** (Hall) 89

(1) Derstler No. 5, B ray view, ×1.7; (2) Derstler No. 11, D ray view, ×1.3; (3) Derstler No. 12, D ray view, ×1.3; (4) Derstler No. 16, interray view, ×1.3; (5) Derstler No. 3b, cray view, ×1.3; (6) Derstler No. 3a, E ray view, ×1.3; (7) Derstler No. 5b, C ray view, ×1.7; (9) Derstler No. 7a, D ray view, ×1.7; (10) Derstler No. 17, ×1.3.

8. **Ectenocrinus geniculatus** (Ulrich) 89

Holotype, UCGM 36313, lowermost Kope Formation, Cincinnati, Ohio, AB interray, ×1.3.

EXPLANATION OF PLATE 15

All from lowermost Kope Formation, Cincinnati, Ohio.

Figure		Page
1-2.	**Ectenocrinus geniculatus** (Ulrich) .... Paratype, USNM 42219b, BC interray view ×1.7 and ×3.0.	89
3.	**E. geniculatus** (Ulrich) .... Latex cast of USNM 42219a which is a natural mold of the holotype (UCGM 36313), A ray view, ×1.3.	89
4-6.	**E. geniculatus** (Ulrich) .... Paratypes, USNM 42219d, A ray view, ×3, USNM 42219k, B ray view, ×1.7, and USNM 42219d, A ray view, ×1.7.	89

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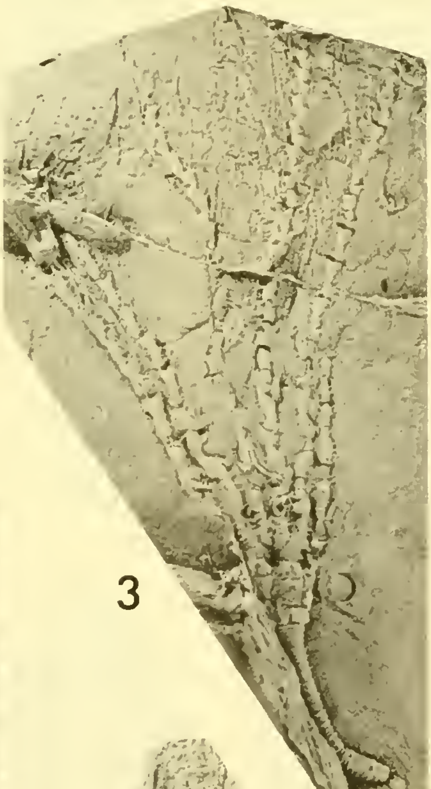

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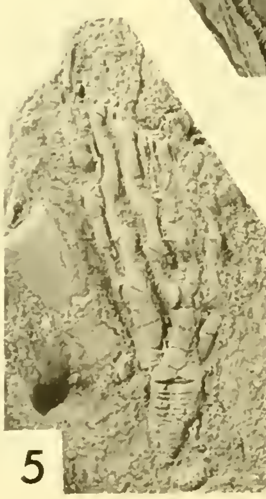

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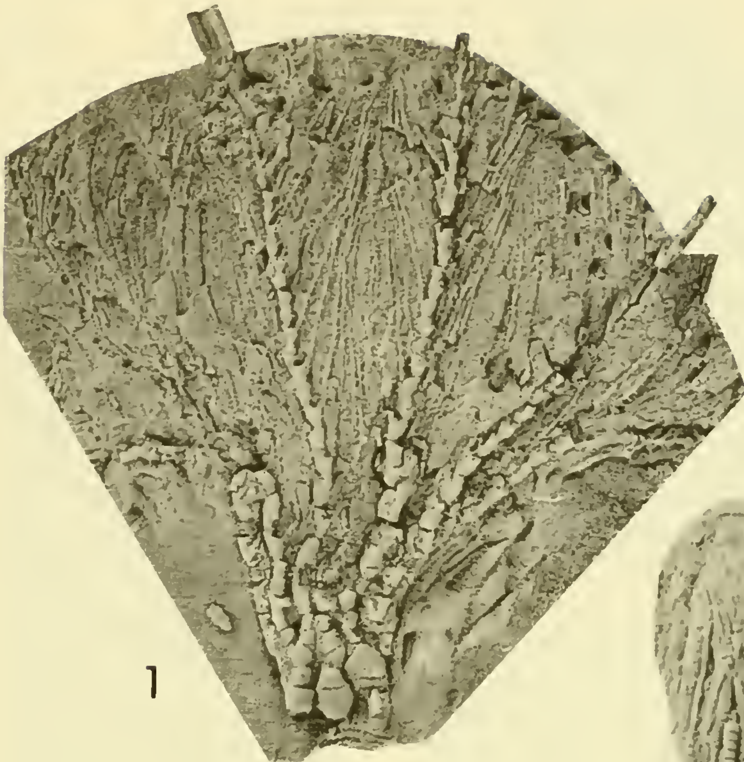
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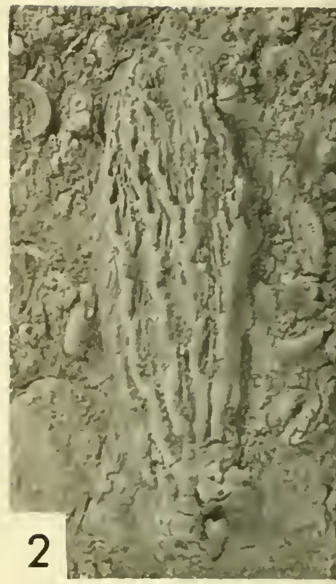
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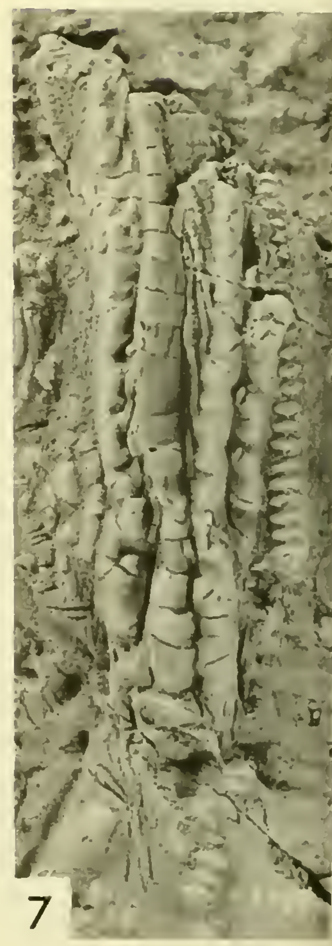
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Explanation of Plate 16

Figure		Page
1-3, 7.	**Ectenocrinus geniculatus** (Ulrich)	89
	Paratypes from the lowermost Kope Formation, Cincinnati, Ohio, USNM 42219c, ?A ray view, ×1.7, USNM 42219f, C ray view, ×1.7, USNM 42219e, ×3.0, and CFM UC8829, ×1.7.	
4-6.	**Ibexocrinus lepton** Lane	97
	Holotype, USNM 165239, from Ibex, Utah, CD interray view, A ray view and CD interray view photographed under ethanol, ×2.1.	

EXPLANATION OF PLATE 17

All specimens from the Maquoketa Formation, Ft. Atkinson, Iowa.

Figure		Page
1-2.	**Sygcaulocrinus typus** Ulrich Holotype, USNM 89876, D ray view, ×2.1 and ×3.0.	100
3-4.	**S. typus** Ulrich Lectotype, SUI 3771, of *Ectenocrinus elongatus* Thomas & Ladd, a junior synonym of *S. typus*, A ray view and CD interray view, ×2.1.	100
5-8.	**S. typus** Ulrich Lectoparatypes of *Ectenocrinus elongatus* (see above), SUI 3772, A ray view and E ray view, SUI 3774, A ray view and CD interray view, ×2.1.	100
9-11.	**S. typus** Ulrich Illustrated specimens, SUI 37921, B ray view, SUI 37923, CD interray view, and SUI 37922, DE interray view, ×2.1.	100


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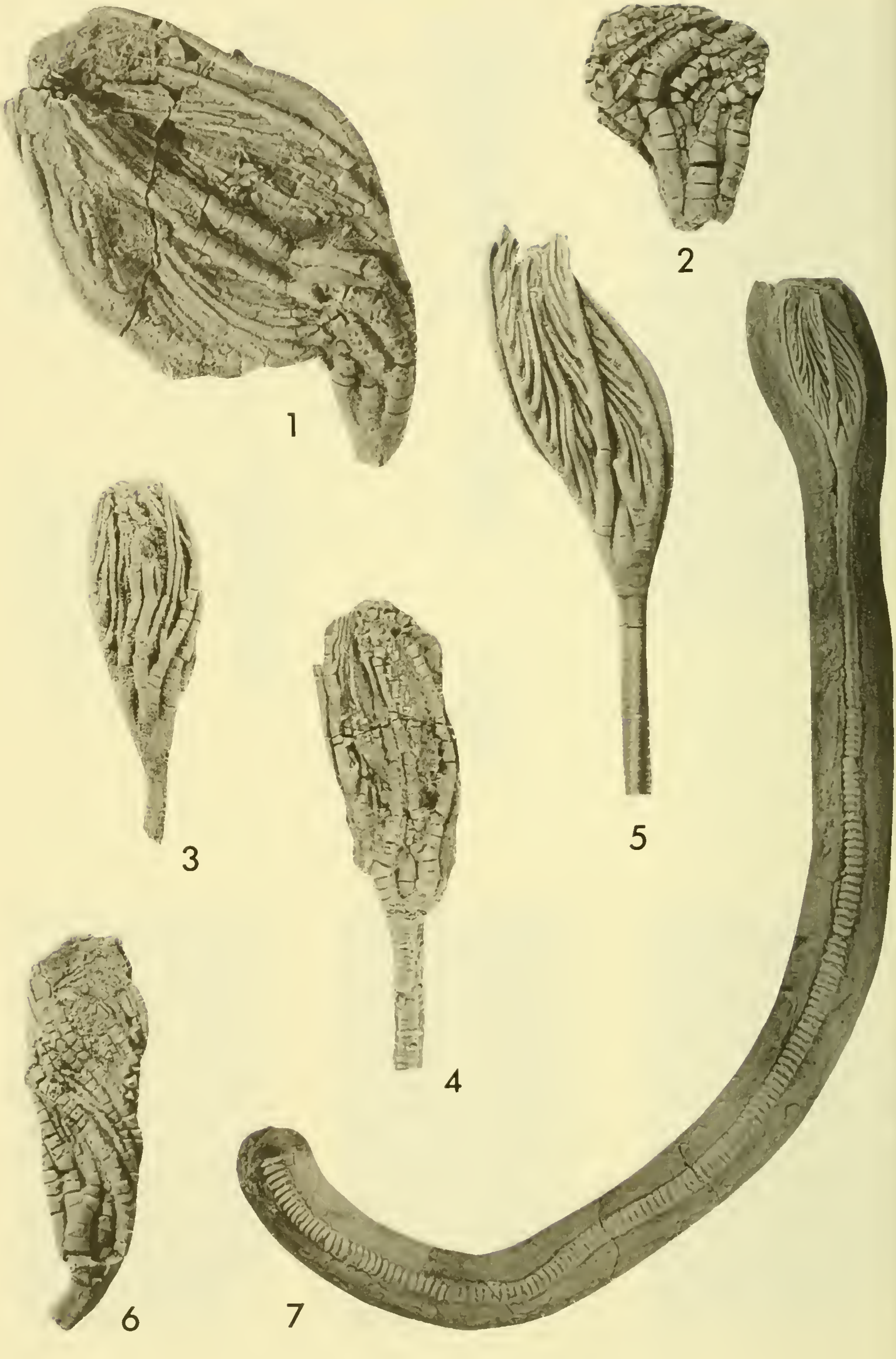
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EXPLANATION OF PLATE 18

All specimens from Kirkfield, Ontario.

Figure		Page
1-4, 6.	**Daedalocrinus bellevillensis** (Billings)	100
	Illustrated specimens, UCGM K.42682, CD interray view, UCGM K.42683, A ray view, ROM 619T, E ray view, UCGM K.42684, CD interray view, and UCGM K.36696b, CD interray view, ×1.7.	
5, 7.	**D. bellevillensis** (Billings)	100
	Lectotype of *Daedalocrinus kirki* Ulrich, a junior synonym of *D. bellevillensis,* USNM S.2141, CD interray view ×1.3 and ×0.5.	

INDEX

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SOME PALEOCENE AND EOCENE BARNACLES (CIRRIPEDIA) OF ALABAMA

By

Norman E. Weisbord

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CONTENTS

SOME PALEOCENE AND EOCENE BARNACLES (CIRRIPEDIA) OF ALABAMA

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ABSTRACT

Four species are described and illustrated. Three of the taxa — *Arcoscalpellum choctawensis,* n. sp., *Euscalpellum isneyensis,* n. sp., and *Balanus antiquus* (Meyer) are late Eocene in age, and one — *Arcoscalpellum toulmini,* n. sp., is from middle Paleocene.

INTRODUCTION

The fossils described in this work, and the locality data pertaining to them, were generously provided by Dr. Lyman D. Toulmin of Florida State University, a colleague of mine in the Department of Geology for nearly 20 years. Among many hundreds of other taxa in the Toulmin collections (which were obtained during many years of field mapping in the Southeastern Coastal Plain), are four species of little-known barnacles from two localities in Alabama: ACH-19, in the upper Eocene Yazoo Group, and ABu-5 in the Porters Creek Formation of Paleocene age. The three Yazoo species are *Arcoscalpellum choctawensis* Weisbord, n. sp., *Euscalpellum isneyensis* Weisbord, n. sp., and *Balanus antiquus* (Meyer), probably. The one Porters Creek species is *Arcoscalpellum toulmini* Weisbord, n. sp., a form reminiscent of, but seemingly distinct from *Arcoscalpellum conradi* (Gabb) found in the Paleocene Vincentown Sand of New Jersey. The four species enumerated above from Alabama have been deposited with the Paleontological Research Institution in Ithaca, N.Y.

LOCALITIES AND STRATIGRAPHY

ACH-19. The three Eocene species with the prefix ACH-19 were collected between Silas and Isney, in Choctaw County, Alabama, on U.S. Highway 84, about 4.0 and 4.2 miles west of Silas. The locality lies in the NW 1/4 of Sec. 4, T 9 N, R 4 W, at approximately 31°46.5′N, 88°24′W, in a small outlier of the Yazoo "Clay". Collected 15 August 1966.

In Alabama (and parts of Mississippi) the Yazoo Group consists of the following stratigraphic units, from bottom to top: the North Creek Member, the Cocoa Sand, the Pachuta Marl, and at the top, the Shubuta Member. The Yazoo sequence occupies the upper three-fourths of the Jackson Group. The lower fourth of the Jackson Group consists of the Moodys Branch Formation resting on the

Scutella bed, which in Alabama represents the base of the Jacksonian. The Jackson Group correlates with the Bartonian and Ludian Stages of England, the Bartonian the earlier of the two.

Thus the North Creek Member of the Yazoo, represented by the ACH-19 barnacles is positioned in about the middle of the Jackson Group which is upper Eocene in age.

ABu-5. The single Paleocene barnacle species, ABu-5, was collected in Butler County, Alabama, Sec. 9, T 11 N, R 12 E, at approximately 31°56.5′N, 86°51′W. According to Toulmin's notes the specimens were obtained from a road cut on a paved road 1.4 miles north of Wolf Creek and 3.0 miles north of Monterey, Butler County, in the Porters Creek Formation. "The fossils are from the thin-bedded zone of gray to brown calcareous sand and sandstones above the lower clay." Collected 11 February 1968.

The Porters Creek Formation is part of the Midway Group which is Paleocene in age. In Alabama the Midway Group is made up at the base of the Pine Barren Limestone followed above by the McBryde Limestone, both limestones within the Clayton Formation. The Clayton Formation is succeeded upward by the Porters Creek Formation, the Matthews Landing Marl, the Oak Hill and Coal Bluff Members of the Naheola Formation, and at the top of the Midway, the Salt Mountain Limestone. The Midway group is correlated with three European stages, the Danian below, the Thanetian in the middle, and the Sparnacian above.

Thus the Porters Creek Formation which is believed to extend from the upper Danian to upper Thanetian in Alabama may be considered as spanning the middle Paleocene in time.

ACKNOWLEDGMENTS

I wish to thank Frank H. Wind of Florida State University for having taken and processed the photographs contained in this work. I am also indebted to Charles W. Copeland of the Geological Survey of Alabama and Druid Wilson of the U.S. Geological Survey for their help in trying to locate the type of *Crucibulum antiquum* Meyer. The generic name of that species was later changed to *Balanus* after the true classification was revealed by careful cleaning of the type specimen. It seems the Aldrich collection, which included many of Meyer's specimens, was originally deposited with

Johns Hopkins University from which it was transferred a number of years ago to the present stewardship of the U.S. Geological Survey at the National Museum of Natural History (U.S. National Museum), Washington, D.C. Three or four of Meyer's types are in the Alabama Survey but *Balanus antiquus* (Meyer) is not among them; neither is it in the Aldrich collection in Washington, D.C., and is thus presumed to be lost.

Katherine V. W. Palmer and her staff have been most helpful in the editorial review of the work, and in the cataloguing of the four species in the Paleontological Research Institution, Nos. 8205-8219.

DESCRIPTION OF SPECIES

Class CIRRIPEDIA Burmeister, 1834

Order THORACICA Darwin, 1854

Suborder Lepadomorpha Pilsbry, 1916

Family SCALPELLIDAE Pilsbry, 1916

Arcoscalpellum (?) choctawensis Weisbord, n. sp. Pl. 19, figs. 9-12

The holotype is a right scutum (ACH-19c) broken off at the apex and the basi-tergal angle, measuring 13.8 mm along the occludent margin and 7 mm in width across the basal margin. The valve is thin and divided into unequl halves, the exterior of the tergal side the narrower, flattish, and sloping, the larger and medial half subregularly convex. Below the apical area there is a transverse depression across both halves of the exterior. The umbonal area is skewed, and extending down from it to near the basi-tergal angle there is a vague fold or bend demarcating the two sides of the exterior; at the fold the numerous growth lineations form nearly a right angle, those of the tergal side vertical, the ones of the middle part of the valve horizontal, and those near the occludent margin turned down rather sharply. In certain light and on the medial area of the exterior there are seen very faint and thin longitudinal ridges extending from the umbone toward the base. The upper and lower tergal margins are straight and form an angle of approximately 143 degrees; the occludent margin is slightly wavy but nearly straight, and projects a little below the base. In the interior of the scutum the apical area is thickened and 6 mm in length, and nearer the occludent side of it there is a prominent furrow 4.5 mm in length and increasing in width from .5 mm to 1.5 mm from top to bottom; adjacent to the furrow on the lower occludent side is a slightly sunken, elongate triangular area marked with fine longitudinal ridges which extend upward into the elongated excavation under the apical area of the exterior. The apical furrow leads below into a faint, rounded muscle scar which is depressed below and nestled into the lower corner of the apical area; bounding the occludent side of the apical furrow and raised slightly above it is a thickened lamina curving around the muscle scar and continuing down the thickened occludent margin to near the base where it merges with the shell material. The interior of the valve below the apical area is shallowly concave except at the margins which are upturned, thus producing the appearance of tumidity of the exterior.

The paratype is a right tergum (ACH-19c1) measuring 18 mm in length and 11.75 mm in greatest width. The valve is thin, flat, and rhomboidal-lanceolate in outline. The exterior of the carinal margin is straight above, slightly concave below where it forms an angle of about 122 degrees with the lower carinal margin; the upper and lower occludent margins are nearly straight and form a rounded angle of about 126 degrees with each other. The growth lineations of the exterior are fine and numerous, and form an acute V at the apico-basal demarcation line. In the interior of the valve the sides of the apical area are widened to about 0.75 mm and diverge down from the apex for about 5 mm, each side shallowly furrowed along the middle. Just below the apex is a laminar ridge following the contour of the apical area, one branch forming the outer rim of the apico-carinal margin, the other running down the middle of the apico-occludent furrow; splaying off from the apex of this laminar ridge are three short welded ridges, each of the outer ones forming the inner margin of the apical furrows, and a medial one some 2.5 mm in length terminating in a pointed spur at its lower end. The paratype tergum is chalky and stained within.

Type locality. — ACH-19, about 4.0 and 4.2 miles west of Silas, Alabama, on U.S. Highway 84, in NE 1/4 NW 1/4 Sec. 4, T 9N, R 4 W, at approximately 31°46.5′N, 88°24′ W, Choctaw County.

Formation. — Yazoo Group (North Creek Member). The north

Creek Member lies above the Moodys Branch Formation and below the Cocoa Sand in the Jackson Group of the upper Eocene.

Diagnosis. — The diagnostic features of the scutum are the prominent elongated furrow of the apical area in the interior and the slightly skewed umbone of the exterior. The tergum is characterized by its rhomboid-lanceolate and flattened form and the unequal areas of the exterior defined by the apico-basal ridge.

Comments. — This species is based on two complete valves, one of them a scutum, the other a tergum. Both valves are thin-shelled, occur within the same formation at the same locality, and are the only two valves that are distinct from scores of others which represent another scalpellid species. Nevertheless I am not certain that the two valves belong to the proposed new species, *Arcoscalpellum choctawensis*. Therefore, the scutum is designated as the holotype and the tergum as the questionable paratype of the new species.

Arcoscalpellum toulmini Weisbord, n. sp. Pl. 20, figs. 1-8

This species is based on four specimens — two scuta and two terga — all presumed to belong to the same taxon.

The holotype is the left scutum (ABu-5a1) which is 12 mm in height from the apex to the basal margin, and 7.1 mm in width across the base. The valve is trapezoidal, with a moderately pronounced apico-basal fold which divides the exterior into unequal halves — a smaller, flatly depressed tergal flank, and a broader, convex occludent side. The occludent margin is evenly and slightly convex, and projects a little at the basal angle; the basal margin is nearly straight except at the basi-occludent angle where it swerves downward; the carinal margin is straight, the tergal somewhat concave. The apex is acute and turned a little toward the tergum. The outer surface is scored faintly with concentric growth furrows between which are minute growth ridges, all of these contoured to form a V at the apico-basal fold. Also there are faint longitudinal radii on the larger half of the valve. In the interior of the left scutum is a large roundish muscle-pit leading to a shallow medial depression which broadens to the basal margin. The apical area, 5 mm in length, is much thickened, its base rising vertically from the muscle-pit. The occludent margin of the interior is also thickened, and there is a fine incision or furrow running along the middle of it from near the base to near the apex. Extending downward from the apex there are four crowded longitudinal ridges, the innermost one the highest and extending along the occludent side, then swerving at the muscle-pit, and continuing therefrom farther down to merge with the shell substance of the margin; the other apical ridges are shorter and bound an elongated triangular pit on the occludent side just below the apex, and marked with six or seven oblique rugae. The tergal side of the apical area is callused and smooth.

The paratype right scutum (ABu-5a2) is 11 mm in height and about 5 mm in width across the base, and is thus proportionally slightly narrower than the left scutum. It is similarly sculptured on the outer surface except that in certain light longitudinal radii on the more chalky surface are somewhat more distinct. The inner surface is chalky and weathered and the triangular pit with the oblique rugae of the left valve are not visible.

The paratype right tergum (ABu-5a3) is blue-gray in color streaked with light gray, in contrast with the cream-colored or whitish scuta; however, a fragment of another tergum (ABu-5a4), similar to the paratype tergum, is also cream-colored, so that although I do not know that the terga belong to *A. toulmini*, the color difference of ABu-5a3 is no hindrance for considering it the same.

The paratype tergum is thin, flat, elongate-subrhomboidal, and broken or worn off at the apex and base. On the exterior there is a faint apico-basal ridge or line of demarcation dividing the valve into unequal halves, the carinal side the narrower, the valve shallowly depressed on either side of the ridge. The numerous growth lineations are fine and closely spaced, and form an acute V at the apico-basal ridge. As seen in the interior, the carinal border is slightly upturned, but the rest of the inner surface is shallowly concave. The shorter apico-carinal margin slants at an angle of about 20° and the longer apico-occludent margin at about 30° with reference to a vertical axis; whether these margins meet to form a pointed apex, or whether the apical area is truncate or blunt as on the two terga at hand is not known. The likelihood is that the apex on a complete tergum is moderately acute. Below the apex are two short longitudinal ridges with a narrow depression between them. Both apical margins are beveled, a little widened, inclined inward, and built up of exceedingly fine elongated ridges, the innermost of which appears to be undercut by the depression of the inner surface of the valve. The paratype tergum (ABu-5a3) is 10.75 mm in length and 6 mm in greatest width but is broken off at the base and apex. Tergum ABu-5a4 is a fragment about 7.5 mm in height, 4 mm in greatest width.

Type locality. — ABu-5, Butler County, Alabama, Sec. 9, T 11 N, R 12 E, the approximate coordinates 31°56.5′N, 86°51′W. According to Toulmin's notes the specimens were collected from a road cut on a paved road 1.4 miles north of Wolf Creek and 3.0 miles north of Monterey, Butler County. "The fossils are from the thin-bedded zone of gray to brown calcareous sand and sandstone above the lower clay."

Formation. — Porters Creek (lower Member); Paleocene.

Comparisons. — The left scutum of *A. toulmini* resembles the left scutum of *A. conradi* (Gabb) from the Vincentown Limesand (Paleocene) of New Jersey, but among other differences the apico-basal ridge of the exterior is less definite, and the apical area of the interior far less elaborately sculptured and ridged on the occludent side of *A. conradi.* These differences might be explained by the greater weathering of the *A. conradi* scutum, but because the tergum of *A. conradi* is not known, and the carina of *A. toulmini* is not known, the two species are considered distinct on the observable differences between the type left scuta of each.

Externally the tergum of *Arcoscalpellum toulmini* is remarkably similar to that of *Arcoscalpellum bakeri* Collins (1973) from the Maestrichtian, Ripley Formation of Oktibbeha County, Mississippi. Not observed on *A. toulmini* and present on the tergum of *A. bakeri* is a faint groove "extending from the apex to near the base of the scutal margin and between this and the apico-basal ridge extend several fine ridges." Because the carina of *A. toulmini* is not known and the scutum of *A. bakeri* not known the slight apparent differences in the two terga plus the discrepant stratigraphic positions of the two taxa lead me to consider each a valid species. Carrying this a step farther, the carina of the Upper Cretaceous *A. bakeri* is dissimilar from the carina of the Paleocene *A. conradi.* I suspect that when the carina of *A. toulmini* is found that it too will be unique to the species.

Euscalpellum isneyensis Weisbord, n. sp. Pl. 19, figs. 1-8

This species is based on 106 valves, 59 of them scuta, 47 terga. The holotype is a left scutum (ACH-19a1), measuring 15.5 mm in length and 6.25 mm in greatest width; a paratype right scutum (ACH-19a2) is 19.5 mm in length and 7.75 mm in greatest width.

The scutum is elongated, crescentic, and moderately tumid, the length about 2-1/2 times the greatest width. The apex is acute and beaklike, and is turned slightly toward the tergal margin. The apico-basal ridge is narrow, curved, and well defined; diverging from it on the paratype a short distance below the apex is a faint minor fold continuing to the base where it is close to the apico-basal ridge; between the two, the surface of the valve is flattish. The tergal margin is gently concave at the upper fourth, convex below, with a rounded angulation at about the lower third. Near the occludent margin, which is convex, there is a fine ridge extending from the apex toward the base where it plays out into a vague narrow rise; the occludent side of the valve adjacent to this rise is narrow and somewhat depressed as is the narrow tergal side from the apex to the lower third of that side. The base is slightly concave on the occludent side of the apico-basal ridge which itself terminates acutely. The exterior of the scutum is strongly sculptured by growth markings which form V's at the apico-basal ridge and are sharply upturned along the margins. The markings consist of elevated ridges with flattish spaces between them, the interspaces themselves bearing microscopic striae. The inner surface of the scutum, except for the upturned margins, is shallowly concave. The adductor muscle-pit is large, subrounded, and nestled more or less centrally into the base of the apical area. The apical area is thickened, about 6.5 mm in length, and is marked by closely spaced fine ridges or striae diverging from the apex down the widened margins, the ridges of the occludent margin playing out at the basi-occludent angle, those of the tergal margin terminating opposite the top of the muscle pit; the rest of the interior, including a central triangular area well below the apex proper, is smooth. The interior of the right scutum (ACH-19a2) is similar to that of the left scutum except that the apical ridges on the occludent side are stronger than those on the tergal side.

The tergal valves vary considerably in outline, some being elongate subtriangular (ACH-19a3), others subrhomboidal (ACH-

19a4), and some obtusely subpentagonal (ACH-19a5). A left tergal valve (paratype ACH-19a3) measures 17.2 mm in length and 7.5 mm in greatest width; a right tergal valve (paratype ACH-19a5) is 19 mm in length and 10.75 mm in greatest width; paratype ACH-19a4 is 16 mm in length and 8 mm in greatest width.

Both terga are flat, the left one, as exemplified by ACH-19a4, subrhomboidal in outline, with an arcuate apico-basal ridge and a subacute apex turned toward the carina. Externally the middle area of the valves is slightly depressed. The occludent margin is convex, moderately so above, less so below; the carinal margin is vertical above, nearly straight to slightly concave from the lateral angle to the base; the basal margin is nearly straight but becomes convex at the basi-occludent angle. The exterior of the terga is sculptured by prominent growth ridges and furrows, the principal ones thickening at the intercepts of the apico-basal ridge, the furrows lined with fine striae. There is a slight narrow depression along the upper half of the occludent margin, bounded by a faint line of sculpture-demarcation from the apex to the basi-occludent angle. The growth markings form a V at the apico-basal ridge and swerve upward at the sides. The inner surface of the terga is smooth and flat, and showing through the calcification in lesser or greater degree are the reflections of the principal growth ridges of the exterior. The apical area is marked by fine striae diverging from the apex halfway down the carinal margin and nearly the full length of the occludent margin. In the interior of the right tergum (ACH-19a5) there is an oval depression or hollow in the upper middle of the widened occludent margin. Unfigured paratype 8209 PRI.

Type locality.—ACH-19, Choctaw County, Alabama, about 4.0 and 4.2 miles west of Silas, on U.S. Highway 84, in NW 1/4 of Sec. 4, T 9 N, R 4 W, at approximately 31°46.5′N, 88°24′W, in an outlier of the Yazoo Group.

Formation.—Yazoo Group (North Creek Member); lower upper Eocene.

Diagnosis.—The scutum of this species is characterized by its elongated crescentic form, the relatively long apical area, the sharp apico-basal ridge, and the strong external markings. The tergum is characterized by its subrhomboidal outline, the strong apico-basal ridge, the slight medial depression adjoining the ridge, and the prominent external markings.

The tergum of this species somewhat resembles that of *Euscalpellum eocenense* (Meyer) (1895) from the middle Eocene Claiborne Group of Alabama, Mississippi, and Texas, but is differentiated from *E. eocenense* by its rhomboidal shape and strong apico-basal ridge. The scuta of both these species, however, are distinct.

Suborder BALANOMORPHA Pilsbry, 1916

Family **BALANIDAE** Leach, 1817

Balanus antiquus (Meyer) Pl. 20, figs. 9-11; Pl. 21, figs. 1-9, 11

Crucibulum antiquum Meyer, 1886b, p. 68, pl. 1, fig. 11; 1887a, p. 55; Pilsbry, 1930, p. 433; Palmer, 1937, p. 149; Zullo. 1963, p. 133; Palmer and Brann, 1966, p. 616.

Balanus antiquus (Meyer), Meyer, 1887a, p. 55; Pilsbry, 1930, p. 433; Palmer, 1937, p. 149; Zullo, 1963, p. 133; Ross, 1965, p. 60; Palmer and Brann, 1966, p. 616.

Balanus aff. *B. unguiformis* J. de C. Sowerby, 1846, pl. 648, fig. 1; Withers, 1953, pp. 72, 91-92; Zullo, 1960, p. 21; Ross and Newman, 1967, pp. 4-7.

?*Hesperibalanus antiquus* (Meyer), Zullo, 1963, pp. 133, 207-208, text-fig. 10A.

Meyer's original description of this species in 1886, under the name of *Crucibulum antiquum* was the following:

> CRUCIBULUM ANTIQUUM, n. sp. Pl. 1, fig. 11.
> Subconical; margin oval, striate within; diaphragm entire; rhomboidal, close to the shell.
> Locality. — Claiborne, Ala.
> The surface of the single specimen is badly preserved. If I am not mistaken it is the first Crucibulum found in the Old Tertiary Formation.

In 1887, under Notes, p. 55, Meyer emended the generic designation of *Crucibulum* to *Balanus* with these statements.

> The following mistake is to be corrected. I described a specimen from Claiborne as *'Crucibulum antiquum'* (Bull. 1, Geol. Surv. Ala., 1886, p. 68, pl. 1, fig. 11). Having recently carefully cleaned the outside of this specimen it proved to be a *Balanus* with preserved operculum.

Measurements of the type were not given, but if I judge the scale next to Meyer's figure 11 correctly, the carino-rostral length at the base is about 12.5 mm, and the width across the base at its widest about 10.5 mm, and this is somewhat smaller than the shell of our ACH-19b.

The four individual specimens referred to *B. antiquus* (Meyer) consist of a nearly whole shell (ACH-19b) with an entire but half-covered basis; a carinolateral compartment (ACH-19b1) with the rim of the basis also preserved; another carinolateral (?) compartment (ACH-19b2); and a nearly entire rostrum (ACH-19b3). No opercula have been found, and there is little likelihood they are present within the sandstone-filled orifice of ACH-19b which has been dug into as far as possible.

ACH-19b has six compartments, is low conic, and is elongate-oval around the basal margin. The specimen is slightly mashed, and the rhomboid orifice is filled with sandstone, obscuring the peritreme. The compartments are intact, and the exposed half of the basis is well enough preserved to show that it is thick and calcareous, and seems to consist of small, closely spaced tubules radiating from an off-centered nucleus; the bottom surface of the basis is crossed by growth lineations following somewhat eccentrically the contour of the basal margin of the shell. In plan view the rim of the base is seen to consist of small quadrangular openings, each one bounded by a short lamina or septum, the openings representing the termini of the tubules of the basis. The aspect around the basal rim is so similar to that of Meyer's drawing of *Balanus antiquus* that the specimens in the Toulmin collection described herein are believed to represent the same species.

As viewed externally, the carina of ACH-19b is somewhat concave in profile, the rostrum somewhat convex, the lateral compartments much the widest, and the carinolaterals much the narrowest. The radii are comparatively wide at their widest, varying from about 1 mm on the carinolaterals to 2 mm on the laterals. The summits of the radii are very oblique and obscurely crenate, and within, their sutural edges are strongly crenulate. The alae are relatively broad and undulatory, varying in height from 2 mm to about 3 mm.

ACH-19b has a carino-rostal length at the base of 14.3 mm, a maximum width of 9 mm across the base, a height of about 9 mm at the carinal end (broken at the apex), and a height of about 10.5 mm at the rostral end (broken at the apex). The sandstone-filled orifice is approximately 9.5 mm in length and 7.8 mm in width. Individual measurements of the compartments are tabulated below in millimeters.

Measurements of ACH-19b

Compartment	Width at base	Height
Carina	4.3	8.7
Carinolaterals	2.5	9.7
	2.6	7.0
Laterals	8.5	11.6
	9.0	8.5
Rostrum	6.5	10.5

The individual compartments from shells other than the ACH-19b but believed to be representatives of *Balanus antiquus* (Meyer) are described below.

ACH-19b1: Carinolateral compartment, height 10.6 mm, width at base 6.6 mm. Radius broken away above. Sheath height about 3 mm. Number of longitudinal ribs in the interior about 26. Thickness of basis at rim of compartment 0.6 mm.

The internal ribs are narrow and pronounced in about the lower 3 mm of the compartment; above that they are abruptly weaker and continue so upward to near the base of the sheath. Below, each rib merges into the basis where it becomes a septum in the narrow space between the basis and inner surface of the paries. Thus looking down on the base of the paries its periphery is seen to consist of small quadrangular openings, each one bounded by a septum. The compartment is moderately convex and marked on the surface by numerous fine growth lineations through which appear some faint longitudinal radii which are reflections of the inner ribs.

The sheath occupies a little less than the upper third of the compartment. On the radius side there is a pronounced transverse furrow below which the sheath is hollowed out a little more than on the opposite half which is undercut but slightly.

The ala is divided into unequal halves, the outer the smaller, by a line of demarcation, at which the lines of growth form a pronounced V.

ACH-19b2: This is externally smooth and is inferred to be another carinolateral compartment, 8 mm in height and 5.2 in width across the base (Pl. 21, figs. 8, 9). There are about 28 internal ribs, a number of them alternating in size, but all of them pronounced and confined to the lower 1.5 mm of the interior. The remainder of the interior is smooth because of the thickened shell which covers the weaker ribs underneath. The sheath is 4 mm in height and is undercut slightly the full width. The furrow on the radius side is even more deeply excavated than in ACH-b1 but the ala of ACH-b2 does not show the line of demarcation of ACH-b1.

ACH-19b3: This is a convex rostrum 10 mm in length and 8.2 mm in breadth across the base. The two radii are intact, each with oblique and erose summits which are obscurely crenate, and each with regularly, strong, and simply crenulate margins. The outer surface is smooth with faint concentric and in places crinkly growth lines on the paries, and nearly vertical growth lines on the radii. In the interior there are about 47 narrow ribs, these most pronounced near the base but continuing weakly to about the middle of the paries where some play out and others persist to near the base of the sheath. The sheath is about 3.4 mm in height and is slightly undercut the full width. Diverging from the apex are two sharp laminar ridges projecting slightly below the base of the sheath to form an inverted V bounding the apical area, with the strong concentric striae of the apical area and of the radii abutting each of the ridges. The interior of the rostrum is white except for the tan apical area and radii, whereas the exterior is tan and the radii alternating tan and white.

Diagnosis. — The distinguishing characters of the shell are its rhomboid aperture, the externally smooth parietes, the numerous longitudinal ribs in the interior, the broad lateral compartments, and the row of small quadrangular openings (of which there may be as many as 180 on an adult specimen) around the basal rim of the shell.

Type locality. — Claiborne (approximately 31°33′N, 87°31′W), Monroe County, Alabama. The precise locality and stratigraphic position of the fossils collected by Meyer at Claiborne are not known, but the locality may well have been Claiborne Bluff or Claiborne Landing on the Alabama River. The Bluff, from water level to top is made up below of the Lisbon Formation overlain by the Gosport Sand, both of the Claiborne Group of middle Eocene age; the Gosport is succeeded by the Moodys Branch and Yazoo Clay of the Jackson Group (upper Eocene). The Yazoo Clay of the Bluff is equivalent to the North Creek Member of the Yazoo between Silas and Isney in Choctaw County, the latter the collecting locality of the *Balanus antiquus* (Meyer) of this paper.

Other localities. — "Middle Eocene, Gosport Sand, Claiborne Landing, Alabama River", as *Hesperibalanus gosportensis* Zullo (Pl. 21, fig. 10). Zullo (1963, p. 133) stated that his *H. gosportensis* "is probably the same as *Balanus antiquus* but the latter species is not recognizably described." Zullo (1963, pp. 207-208, text-fig. 10A) figured a tergum of *H. gosportensis,* but not having seen Meyer's operculum or the shell to which it was attached, I cannot affirm that *H. gosportensis* is the same as *Balanus antiquus* (Meyer), though it may be.

Collections in the American Museum of Natural History from the Claiborne area of Alabama are reported by Ross and Newman (1967) as "Eocene Claiborne Beds, Claiborne, Alabama, Hall collection" and "Gosport Sand, Middle Eocene, Claiborne Group, Claiborne Landing. Collectors Donald F. Squires and William Heaslip, August 1955". In these collections it is likely that the *Balanus* sp. aff. B. *unguiformis* of Ross and Newman is equivalent to *B. antiquus* (Meyer) from the type locality. As indicated by Ross and Newman, the type of *Balanus unguiformis* J. de C. Sowerby (1846, pl. 648, fig. 1), a taxon occurring in the upper middle Eocene and upper Eocene of England, is not clearly established either by Sowerby's illustration or later description by Darwin (1854, pp. 296-298, pl. 8, figs. 8a, 8b). According to Darwin (1854, p. 297), there is indeed a smooth-plated variety of *B. unguiformis,* and its stratigraphic position is equivalent to that of *B. antiquus* (Meyer). Nevertheless, despite the unlikely but possible precedence of the name *unguiformis,* I prefer to relate the Choctaw County taxon to *B. antiquus* (Meyer), because even as to size, the base of the shell looks like Meyer's drawing of *B. antiquus* and is close geographically and stratigraphically to the Claiborne *B. antiquus.*

Mississippi: As "*Balanus* (*B.*) aff. *unguiformis*" reported from the Jackson Group of Mississippi by Withers (1953, p. 72). A locality in Mississippi was not cited by Withers, but I suspect it might be west of Isney, Alabama, in the Yazoo terrain which extends into easternmost Mississippi from western Alabama.

Florida: As *Balanus* sp. aff. *B. unguiformis* Sowerby *in* Ross and Newman (1967). Limerock quarry about 200 yards south of the Withlacoochee River, NE 1/4 Sec. 12, T 12 S, R 16 E, Citrus County. Inglis Limestone, Ocala Group, upper Eocene. Collectors Jackson E. Lewis and Arnold Ross, May, 1965. The Inglis Limestone is considered to be in the lower part of the upper Eocene, or by some geologists, in the middle Eocene. Thus the stratigraphic position is about the same as for *Balanus antiquus*. Although the Florida specimens are not well enough preserved, better material may indicate that the taxon is conspecific with *B. antiquus*.

Geologic range.—Upper middle Eocene to lower upper Eocene in Mississippi, Alabama, and probably Florida.

Classification.—As stated by Ross and Newman, definite conclusions pertaining to the generic or subgeneric classification of the taxon in question cannot yet be reached. And, as stated by Zullo, his *Hesperibalanus gosportensis* cannot be assigned to *Balanus antiquus* (Meyer) until the opercular valves of both are known. Unfortunately I have been unable to track down the whereabouts of the cleaned type specimen of Meyer to which the operculum is adherent and which also might reveal the character of the shell itself.

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PLATES

EXPLANATION OF PLATE 19

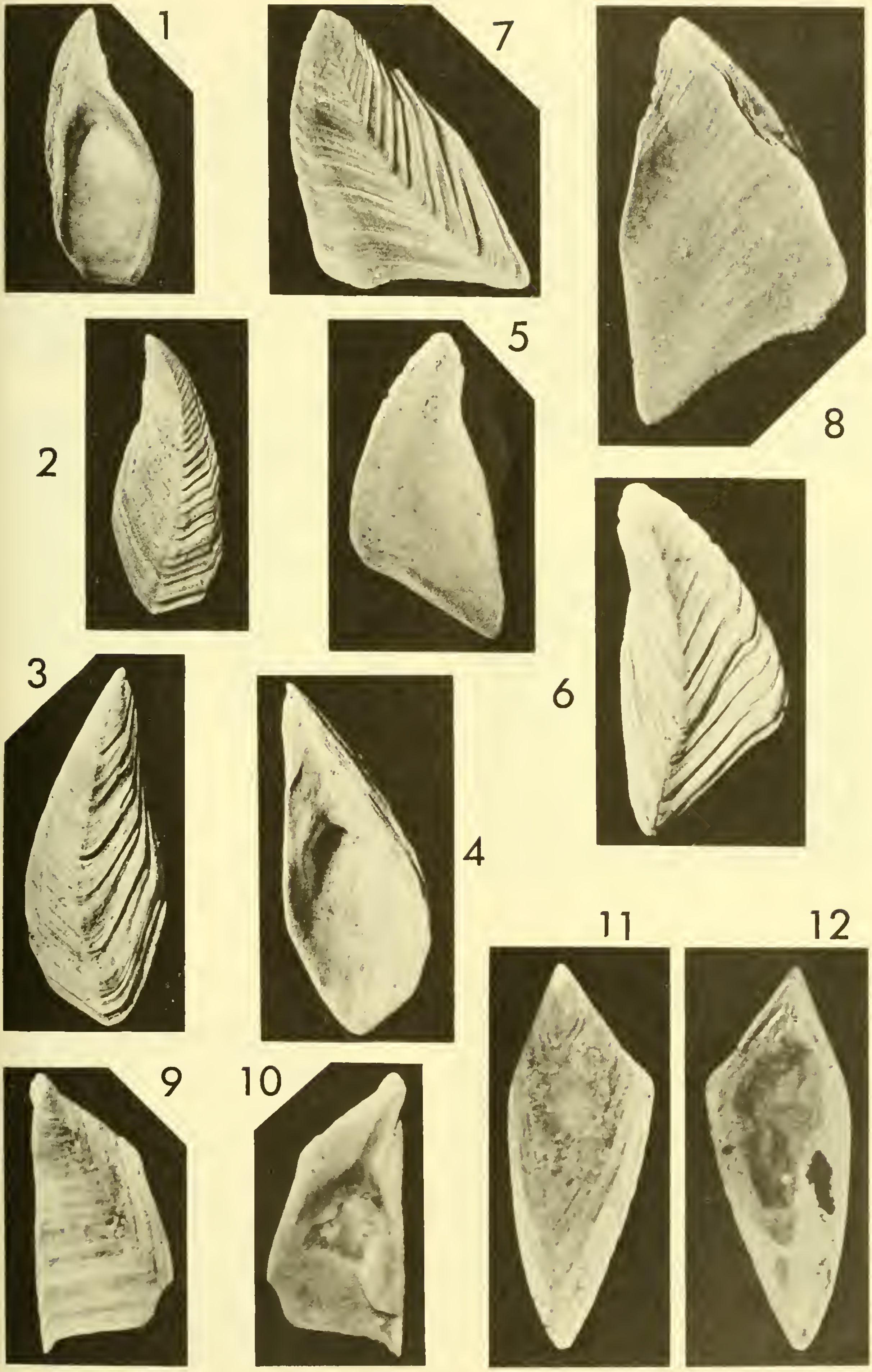
Figure Page

1-8. **Euscalpellum** (?) **isneyensis** Weisbord, n. sp. 150

Figs. 1, 2. Interior and exterior of holotype scutum, No. 8205 PRI, ACH-19a1. Natural size 15.5 mm × 6.25 mm.; figs. 3, 4. Exterior and interior of paratype scutum, No. 8206 PRI, ACH-19a2. Natural size 19.5 mm × 7.75 mm.; figs. 5, 6. Interior and exterior of paratype tergum, No. 8207 PRI, ACH-19a4. Natural size 16 mm × 8 mm; figs. 7, 8. Exterior and interior of paratype tergum, No. 8208 PRI, ACH-19a5. Natural size 19 mm × 10.75 mm.

9-12. **Arcoscalpellum** (?) **choctawensis** Weisbord, n. sp. 145

Figs. 9, 10. Exterior and interior of holotype scutum, No. 8210 PRI, ACH-19c; Natural size 13.8 mm × 7 mm; figs. 11, 12. Exterior and interior of paratype tergum, No. 8211 PRI, ACH-19c1. Natural size 18 mm × 11.75 mm.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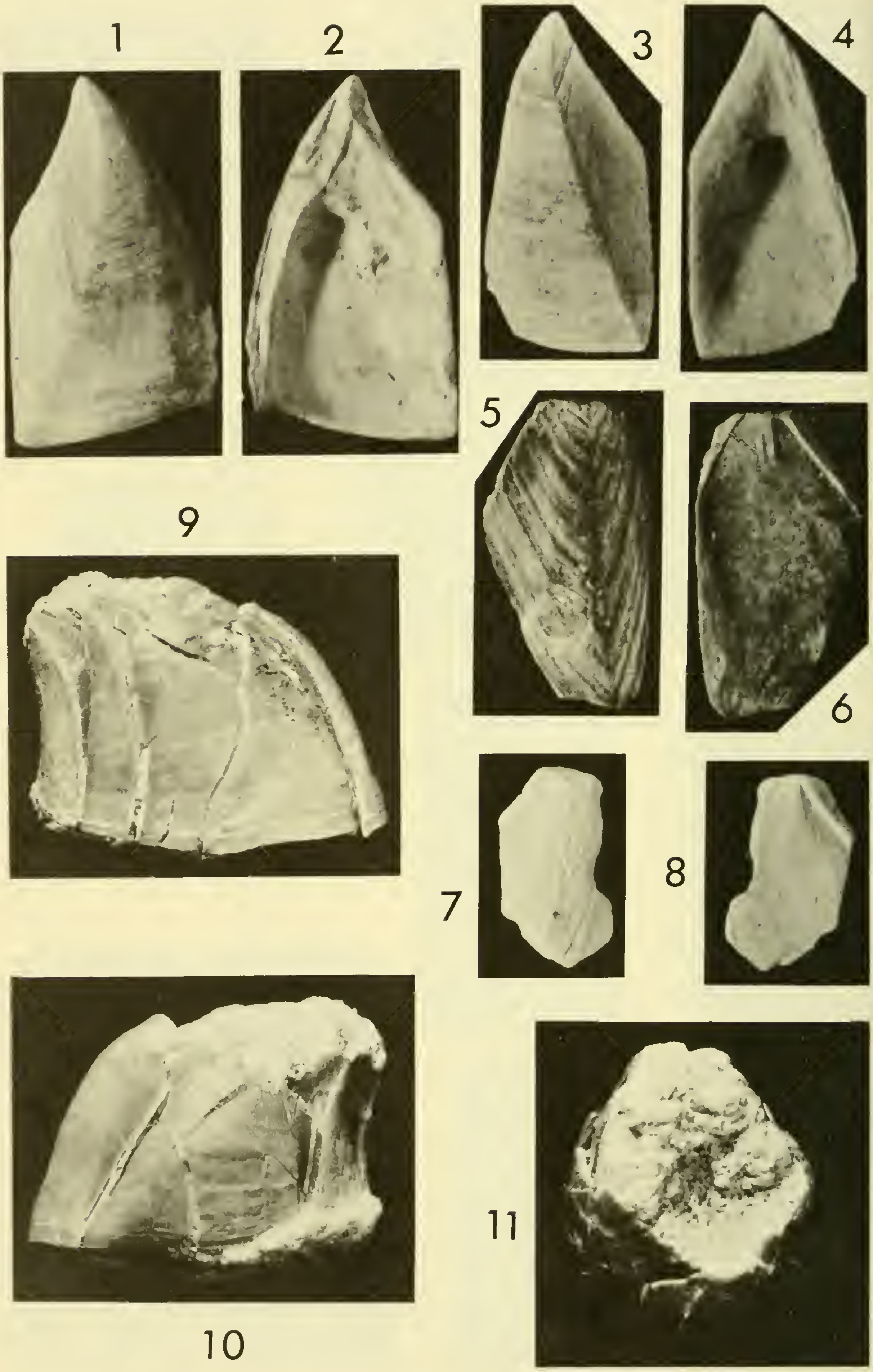


EXPLANATION OF PLATE 20

Figure		Page
1-8.	**Arcoscalpellum toulmini** Weisbord, n. sp.	147

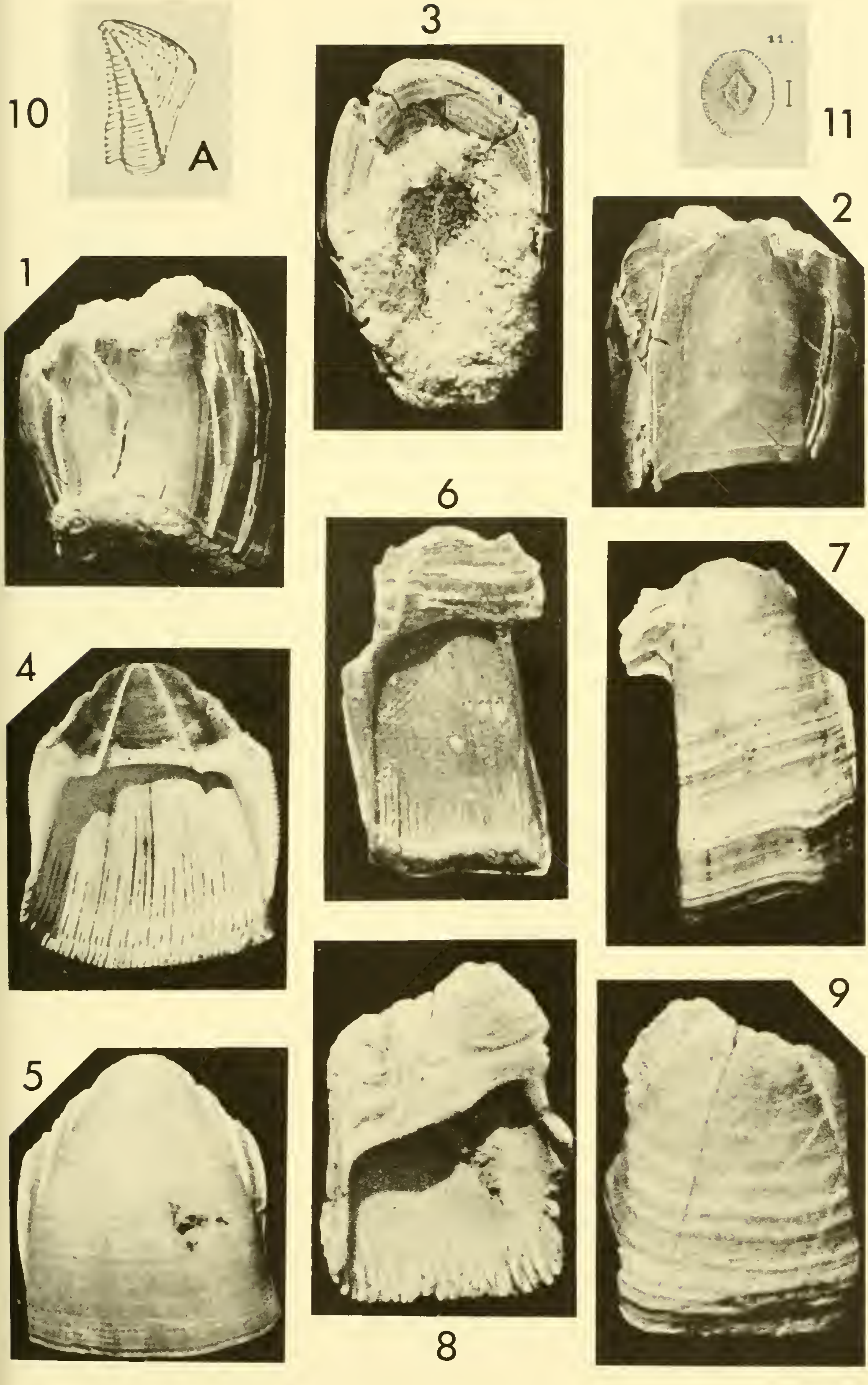
Figs. 1, 2. Exterior and interior of holotype scutum, No. 8212 PRI, ABu-5a1. Natural size 12 mm × 7.1 mm; figs. 3, 4. Exterior and interior of paratype scutum, No. 8213 PRI, ABu-5a2. Natural size 11 mm × 5 mm; figs. 5, 6. Exterior and interior of paratype tergum, No. 8214 PRI, ABu-5a3. Natural size 10.75 mm × 6 mm; figs. 7, 8. Exterior and interior of partial tergum, No. 8215 PRI, ABu-5a4. Natural size 7.5 mm × 4 mm.

9-11.	**Balanus antiquus** (Meyer)	152

Hypotype, No. 8216 PRI, ACH-19b. 9, 10. Lateral views of exterior. Natural measurements; 14.3 mm in length at base; 9 mm in width across base; 9 mm in height at carinal end; 10.5 mm in height at rostral end. Fig. 11, view looking down on sandstone-filled orifice showing rhomboidal outline of peritreme. Length about 9.5 mm; greatest width 7.8 mm.

EXPLANATION OF PLATE 21

Figure		Page
1-7.	**Balanus antiquus** (Meyer)	152
	Figs. 1-3, hypotype, No. 8216 PRI, ACH-19b. Fig. 1. Frontal view of carinal end. Height about 9 mm; fig. 2. View of rostral end. Height about 10.5 mm; fig. 3. View of base showing part of basis and the termini of the inner tubules around the rim. Length 14.3 mm; width 9 mm; figs. 4, 5. No. 8217 PRI, ACH-19b3. Interior and exterior of rostrum. Height 10.5 mm; width across base 6.5 mm; figs. 6, 7. No. 8218 PRI, ACH-19b1. Interior and exterior of carino lateral compartment. Height 8 mm; width across base 5.2 mm.	
8, 9.	? **Balanus antiquus** (Meyer)	152
	ACH-19b2, No. 8219 PRI. Interior and exterior of another carino-lateral compartment. Height 8 mm; width across base 5.2 mm.	
10.	? **Hesperibalanus gosportensis** Zullo	156
	Holotype (?) tergum, ×5. Natural size length about 4.3 mm; maximum width about 2.5 mm. After Zullo, 1965, p. 133, who stated that the tergum "is possibly the same as *Balanus antiquus*."	
11.	**Crucibulum antiquum** Meyer	152
	Holotype = *Balanus antiquus* (Meyer). View of underside (basis absent) showing "numerous striae" within, the termini of the tubules around the basal rim, the opercular ? apparatus, and the rhomboidal shape of the orifice from below. Natural size about 12.5 mm length; 3.6 mm width. After Meyer. Compare with figure 3 adjacent.	



INDEX

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Note: Light face figures refer to the page numbers. Bold face figures refer to the plate numbers.

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By

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THE ARCHAEDISCIDAE OF THE FRAILEYS FACIES (MISSISSIPPIAN) OF CENTRAL KENTUCKY

By

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CONTENTS

ILLUSTRATIONS

THE ARCHAEDISCIDAE OF THE FRAILEYS FACIES (MISSISSIPPIAN) OF CENTRAL KENTUCKY

R. G. Browne,* J. W. Baxter,† and T. G. Roberts‡

ABSTRACT

Samples of washed shale collected from the Fraileys facies of the Big Clifty Formation (Chesterian) in Central Kentucky revealed the presence of a unique free-form foraminiferal fauna. A study made from thin sections of the calcareous forms of this fauna was reported at the generic level by Browne and Pohl (1973). The present report covers a study, from the same fauna, of forms belonging to the family Archaediscidae. They are discussed at the specific level.

Representatives of two subfamilies are recognized as Archaediscinae and Ammarchaediscinae. The Archaediscinae are assigned to two genera — *Archaediscus* and *Nodosarchaediscus* and the Ammarchaediscinae to one, *Ammarchaediscus.*

The authors have availed themselves of the term subgenus to describe those forms which they consider to be monogeneric because they represent morphological changes showing an evolutionary development in chronological sequence and transitional forms exist.

Three subgenera are placed in the genus *Archaediscus* — *Archaediscus, ?Hemiarchaediscus,* and a new subgenus, described but unnamed. Three subgenera are placed in the genus *Nodosarchaediscus* — *Nodasperodiscus, Neoarchaediscus,* and *Asteroarchaediscus.* Three subgenera are placed in the genus *Ammarchaediscus* — *Ammarchaediscus Tubispirodiscus,* and A.

A total of 27 species are described, four of which are new. The original descriptions are given. The geographic distribution and the stratigraphic range are also recorded.

INTRODUCTION

The discovery of a prolific, free-form microfauna from the Fraileys Shale facies of the Big Clifty Formation in central Kentucky was revealed in a preliminary note in 1968 (Pohl, Browne, and Chaplin). This excellently preserved faunule contains representatives of 16 families and approximately 37 genera which include an unusual assortment of calcareous foraminifers. The stratigraphy of the Fraileys Shale and the generic affiliations of the calcareous forms were subsequently discussed in some detail (Browne and Pohl, 1973). The present authors are proceeding to systemize taxonomically related calcareous forms beginning, in this report, with the Archaediscidae.

This paper is the outgrowth of a larger effort directed toward the recognition of time-related taxa within the type Mississippian area and adjacent portions of the Illinois Basin and the establishment of criteria for their use in the biostratigraphic zonation of the type Mississippian. This ongoing research is based on study of col-

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lections that now comprise approximately 7,000 thin sections of type and reference rock material and 9 free-form collections of varying productivity.

The Fraileys fauna was discovered by Dr. E. R. Pohl of Horse Cave, Kentucky, who recognized the biostratigraphic importance of the calcareous Foraminifera and especially that of the Archaediscidae. The senior author joined Dr. Pohl in the early phases of the project. Baxter became involved later, first through consultation on calcispheres (which are a conspicuous component of the Fraileys fauna), and later when he joined the study of the wider aspects of Mississippian biostratigraphy. Since Dr. Pohl's death in 1973, and the addition of Roberts, Pohl's work has been continued in appreciation of his early efforts and has been sustained by the enthusiasm he engendered.

This report is based upon the examination of approximately 700 oriented thin sections cut from free-form archaediscids, washed from shale samples. In most cases the orientation is axial and specimens are sectioned to reveal the proloculus. External views of the specimens, photographed prior to sectioning, were used for comparative purposes. No external views are reproduced for this report.

Any study of calcareous Foraminifera and the Archaediscidae in particular naturally reflects the enormous efforts of specialists working in Western Europe and the USSR. In the section on Systematic Paleontology the reader is referred to existing translations of original descriptions where such are available (as in Ellis and Messina, 1940-1964). Other translations, obtained during the course of our studies, are given.

Credit for translation of Russian literature used in this report is gratefully accorded to Dr. Leonard Latkovski, Professor Emeritus, Department of Foreign Languages, Bellarmine College, Louisville, Kentucky.

ACKNOWLEDGMENTS

We wish to especially acknowledge Professor Raphael Conil of the Institute of Geology and Geography, University of Louvain, Louvain- la Neuve, Belgium. His continued interest in our efforts and his invaluable advice concerning some taxonomic assignments reported here are appreciated. We are also indebted to Dr. M. V. Vdovenko of the Institute of Geological Sciences, Academy of Sciences, Ukrainian SSR, for her enlightening correspondence concerning the comparison of our material with faunas of similar age in the USSR. Finally, we acknowledge Dr. Paul Brenckle of Amoco Production Company, Tulsa, Oklahoma. His review of our material and critical review of this paper were most helpful.

STRATIGRAPHY

The archaediscids described herein were recovered from 11 feet (3m) of grey-blue shale exposed for 200 feet in the road ditch and bank on the west side of the Broadford Church Road, 200 feet south of the junction with KY 1214 at Broadford, Grayson County, Kentucky. The location is in the northwest quarter of section #11, K 42, NJ 16-8, Evansville sheet of the Carter Coordinate System, Millerstown Quadrangle, GQ-417, Kentucky (Browne and Pohl, 1973, p. 176). The stratigraphic details of the Broadford exposure are discussed by Pohl (*in* Browne and Pohl, 1973, pp. 175-190). We can add little to this previous discussion beyond placing the present stratigraphic classification in its historical perspective and showing relationship with adjacent regions.

STRATIGRAPHIC CLASSIFICATION

The microfauna occurs in shale at the base of the Big Clifty Sandstone of Hombergian (Middle Mississippian) age (Text-fig. 1). The Big Clifty of central Kentucky is considered a formation by many authors (Browne & Pohl, 1973; Schwalb, 1975) but as a member of the Golconda Formation on the recent geologic map of the Millerstown Quadrangle (Moore, 1965). The Big Clifty occupies a position below the Haney Limestone and above the Beech Creek Limestone and has a facies relationship with the Fraileys Shale to the west (McFarlan, *et al.*, 1955; Swann, 1963). The productive strata at Broadford contains sparse stringers of crinoidal debris and occasional limestone lenticles and thus resembles typical Fraileys Shale. Pohl (*in* Browne and Pohl, 1973) referred this fauna to the Fraileys "facies" of the Big Clifty Sandstone Formation. This sandstone at one time was correlated with the Cypress Sandstone to the west and was once called "Cypress" (Butts, 1917; McFarlan, 1943) but this miscorrelation was corrected (Dana and Scobey, 1941; Swann and Atherton, 1948) and the name "Big Clifty" (Norwood, 1876) revived for the sandstone equivalent of the Fraileys.

<table>
<tr><th rowspan="3">System</th><th rowspan="3">Series</th><th rowspan="3">Stage</th><th colspan="2">ILLINOIS</th><th colspan="8">KENTUCKY</th><th colspan="3">INDIANA</th></tr>
<tr><th colspan="2" rowspan="2">Swann (1963)</th><th colspan="2">Butts (1917)</th><th colspan="4">McFarlan (1955)
Border of W. Coal Field</th><th colspan="2" rowspan="2">Moore (1965)
Millerstown
Quadrangle</th><th colspan="3" rowspan="2">Shaver et al
(1970)</th></tr>
<tr><th>West</th><th>Central</th><th colspan="2">West</th><th>East</th><th>SE</th></tr>
<tr><td rowspan="6">MISSISSIPPIAN</td><td rowspan="6">CHESTERIAN</td><td rowspan="4">HOMBERGIAN</td><td colspan="2">Glen Dean Limestone</td><td colspan="2">Glen Dean</td><td colspan="4">Glen Dean</td><td colspan="2">Glen Dean</td><td rowspan="5">Stephensport Group</td><td colspan="2">Glen Dean</td></tr>
<tr><td colspan="2">Hardinsburg Sandstone</td><td colspan="2">Hardinsburg</td><td colspan="4">Hardinsburg</td><td colspan="2">Hardinsburg</td><td colspan="2">Hardinsburg</td></tr>
<tr><td rowspan="3">Golconda Group</td><td>Haney Limestone</td><td rowspan="3">Golconda</td><td>Golconda</td><td rowspan="3">Golconda</td><td>Haney</td><td colspan="2">Haney</td><td rowspan="3">Golconda</td><td>Haney Mbr.</td><td colspan="2">Golconda</td></tr>
<tr><td>Fraileys Shale</td><td>Cypress</td><td>Fraileys</td><td colspan="2">Big Clifty</td><td>Big Clifty Mbr.</td><td colspan="2">Big Clifty</td></tr>
<tr><td rowspan="2">GASPERIAN</td><td>Beech Creek Limestone</td><td rowspan="2"></td><td>Beech Creek</td><td>Beech Creek</td><td rowspan="2">Girkin</td><td>Beech Creek Mbr.</td><td colspan="2">Beech Creek</td></tr>
<tr><td colspan="2">Cypress Sandstone</td><td>Cypress</td><td colspan="2">Cypress</td><td>Elwren</td><td colspan="2">"Equivalent of Elwren"</td><td colspan="2">Cypress</td><td>Elwren</td></tr>
</table>

Text-figure 1.—Stratigraphic classification of rocks of the Hombergian and subjacent portion of the Gasperian Stages in Kentucky.

In his classification of Chesterian rocks, Swann (1963) assigned the Fraileys, Haney, Hardinsburg, and Glen Dean to the Hombergian Stage, derived from and roughly equivalent to the Homberg Group of Weller and Sutton (1940). The stage differs from the group in the exclusion of the Cypress Sandstone and Beech Creek Limestone. As pointed out by Vincent (1975), the assignment to a time stratigraphic unit is not entirely justified because the time equivalencies of the boundaries involved have not been established. The similarity of the microfauna of the Fraileys with that of the underlying Beech Creek caused Browne and Pohl (1973) to question the exclusion of the latter from the Hombergian Stage.

CRITERIA FOR CLASSIFICATION OF THE ARCHAEDISCIDAE

The classification of the Archaediscidae followed here is essentially that of Pirlet and Conil (1974) but in the application of the system to our material we find that certain departures are either required by laws of priority or seem advantageous. The family Archaediscidae evolved from ancestral forms by the addition of a clear, more or less radial wall on an ancestral, dark, microcrystalline wall. The recognition of the subfamilies Archaediscinae, Ammarchaediscinae, and Tournarchaediscinae (Table 1) is based upon characteristics that appear to have been inherited from ancestral stock. Thus Ammarchaediscinae probably inherit planispiral coiling from *Pseudoammodiscus* and Archaediscinae and Tournarchaediscinae, a variable plane of coiling from *Brunsia* and *Brunsiina* respectively. The Tournarchaediscinae, not represented in our material, are further characterized by the presence of pseudochambers.

The simple acquisition of a radial layer may in some Foraminifera (*e.g. Tetrataxis*) be of no more than specific importance. However, in the Archaediscidae it marks the beginning of profound chronologically related evolutionary changes that logically lead to the revised generic divisions of Pirlet and Conil (1974) and at various stages of development to the establishment of subgenera. More subtle evolutionary changes permit the recognition of stages within individual species.

GENERIC CRITERIA

Archaediscidae of the Fraileys belong to the subfamilies Archaediscinae and Ammarchaediscinae. For each subfamily the recognition of genera is based upon the presence or absence of occulusions in the form of nodes and stellate central flarings or stellate central flaring. Thus in axial thin sections *Archaediscus* and *Ammarchaediscus* are characterized by free lumina throughout the test and *Nodosarchaediscus* by occluded lumina. Similar occlusions are known among the Ammarchaediscinae, (?*Permodiscus* Conil and Pirlet, *in* Pirlet and Conil, 1974) but such forms are not present in the Fraileys material.

SUBGENERIC CRITERIA

Classification at the subgeneric level is based on the recognition of stages in the evolution of the wall structure and, for subgeneric *Nodosarchaediscus,* of nature of the occlusions of the lumina. Throughout the range of the Archaediscidae there is in each subfamily a progressive diminution in the development of the ancestral dark inner wall layer. Archaediscidae characterized by thick, dark, microgranular inner layers are primitive forms (V1b in Belgium) not present in the Fraileys. Representatives of *Archaediscus* and *Ammarchaediscus* have reached a stage of evolution at which the inner layer either ranges from both poorly developed to almost imperceptible, as in advanced stages of both *A.* (*Archaediscus*) and *Amm.* (subgenus A), or is totally absent as in *Amm.* (*Tubispirodiscus*). We differ from Pirlet and Conil (1974) in our recognition of *A.* (?*Hemiarchaediscus*) as a valid subgenus occupying a position parallel to *Amm.* (*Tubispirodiscus*). *A.* (?*Hemiarchaediscus*) differs from the original description of *Hemiarchaediscus* Miklukho-Maklay (1957) in that the wall is a single radial layer lacking a dark interior layer.

Nodosarchaediscus first appears in the Visean (V2bδ) of Belgium (Pirlet and Conil, 1974) and is known in the Harrodsburg Limestone of Valmeyeran (Middle Mississippian) age in Kentucky, (Baxter, Browne and Roberts, in press). Earliest forms, (*Nodosarchaediscus*), with simple elevated nodes on the lumen floor, have a dark inner layer that is no more than moderate in development, and the importance of the inner layer is progressively diminished in younger forms. Fraileys representatives include (*Neoarchaediscus*) with central stellate flarings, (*Nodasperodiscus*) with nodes and central flaring, and (*Asteroarchaediscus*) with closed lumina throughout most of the test. We differ from Pirlet and Conil (1974) in recognizing a priority for (*Neoarchaediscus*) over (*Asperodiscus*).

Some uncertainty persists in the literature concerning the differentiation between the subgenera *Neoarchaediscus* (*Asperodiscus* of Conil), *Nodasperodiscus* and in some instances *Asteroarchaediscus*. Our concept of (*Neoarchaediscus*) requires central, confused, stellate coiling followed by at least 1½ coils open and free of nodes. In (*Nodasperodiscus*) stellate coiling is followed by final coils in which the lumina are partially open (reduced by nodes) although the ultimate coil may be completely free as in *Nodasperodiscus (Nod.) minimus*. In (*Asteroarchaediscus*) the lumina throughout the test are generally completely closed along irregular crenulations but the final coil may be free or partially free as in *Nod.* (*Asteroarchaediscus*) *postrugosus*.

SPECIATION AND COILING GROUPS

Where the recognition of the various coiling groups defined by Pirlet and Conil (1974) is applicable our speciation is based upon a combination of that feature and traditional biometric measurements. Thus for *Archaediscus* we recognize groups of species with aligned, *stilus;* oscillating, *chernoussovensis;* sigmoidal, *karreri;* imperfect sigmoidal, *gigas;* and initial sigmoidal, *krestovnikovi* coiling.

In the description of the various species of this report where the coiling pattern is applicable it is listed under the term — "Coiling". In the subgenus *Asteroarchaediscus* which represents the final stage of evolution of the family the coiling pattern is somewhat zigzag and normally little apparent. Therefore, the form of the test produced by the coiling is substituted in this subgenus and is listed under the term "test form" (*e.g.* — flat, lenticular, round).

EVOLUTIONARY STAGES

Beginning with the ancient *Glomodiscus* the coiling habit of the Archaediscinae shows a marked evolutionary tendency to become more evolute in character. This tendency is operative at the species level and in *Archaediscus* is in company with and accomplished by morphological changes that permit the recognition of evolutionary stages that have chronologic value (Pirlet and Conil, 1974). We differ from Conil in that we prefer to consider these characteristics as simply evolutionary stages (*involutus, concavus, angulatus, evolutus,* and *tenuis*) rather than critera for subspecies.

Table I — General Criteria for Classification of the Archaediscidae (from Pirlet and Conil, 1974)

		Genera	
	subfamilies	lumina free	nodes and stellate flaring
Tubular Chamber smooth, not divided. Wall porous	coiling streptospiral Archaediscinae	*Archaediscus*	*Nodosarchaediscus*
	coiling planispiral Ammarchaediscinae	*Ammarchaediscus*	to be named
Tubular chamber with pseudo-chambers. Wall porous.	coiling streptospiral Tournarchaediscinae	*Tournarchaediscus*	unknown

CORRELATION

The fauna is characterized by *Archaediscus (Archaediscus)* at the angulatus stage, *Archaediscus (?Hemiarchaediscus)* approaching the tenuis stage, and fairly abundant small, species of the subgenus *Nodosarchaediscus (Asteroarchaediscus)*: *parvus, rugosus, postrugosus,* and *syzranicus.* The population also includes *Nodosarchaediscus (Nodasperodiscus),* numerous *Nodosarchaediscus (Neoarchaediscus)* and *Ammarchaediscus (Tubispirodiscus)* and (subgenus A.). This assemblage, while close to the Namurian in age, is in its overall aspect indicative of late V3c reported by Browne and Pohl (1973).

SYSTEMATIC PALEONTOLOGY

Family **Archaediscidae** Cushman, 1928, emend. Conil and Pirlet, 1974

Fusulinina with a proloculus and coiled tubular chamber, usually not divided, but may possess pseudo-chambers or polar septa. The first coils are involute, except among very rare forms. A calcareous wall comprises a dark internal microgranular layer, tending to disappear in the more evolved forms, and a clear, more or less porous radial layer. (Pirlet and Conil, 1974, p. 252).

Subfamily **Archaediscinae** Cushman, 1928, emend. Conil and Pirlet, 1974

Archaediscidae without internal divisions into chambers or pseudochambers; coiling streptospiral. Wall formed of a dark, microgranular internal and external radial layer. The internal layer, pronounced in the primitive forms, tends to disappear among those more evolved. (Pirlet and Conil, 1974, p. 254).

Genus **Archaediscus** Brady, 1873, emend. Conil and Pirlet, 1974

Type species: *Archaediscus karreri* Brady, 1873.

Diagnosis. — Archaediscinae possessing free lumina, without nodosities, or stellate flaring. Internal dark layer pronounced to imperceptible. The external radial layer developed in the first coils only or throughout the test. Coiling involute to evolute (Pirlet and Conil, 1974, p. 254).

Subgenus **Archaediscus** Conil and Pirlet, 1974

Type species: *Archaediscus karreri* Brady, 1873.

Diagnosis. — *Archaediscus* with the dark internal layer moderately to feebly developed, without lateral corner fillings and with the radial layer completely enveloping all the coils except in the immediate vicinity of the aperture. The more ancient forms are involute and the floors of the lumina are convex; the evolved forms tend to become evolute and beginning with the first coils their floors are concave. The walls of certain very evolved forms tend to become very thin without any epaulets or covering. The floors of the lumina then become convex again (Pirlet and Conil, 1974, p. 258).

Archaediscus (Archaediscus) cf. **absimilis** (Sosipatrova), 1962

Pl. 22, figs. 1-3

Planoarchaediscus absimilis Sosipatrova, 1962, pp. 58, 59, pl. 5, figs. 3, 4; Sosipatrova, 1966, pp. 24, 25, pl. 1, figs. 5, 6.

Holotype. — Institute of Geology of Arctic Regions, No. 716/14.

Original description. — The shell is of small dimensions, involute except for the final evolute coil, with parallel lateral sides. The ratio of width to diameter is 0.31-0.33. The diameter of the shell is 0.17-0.32 mm, the width 0.056-0.096 mm. The number of coils is three to four. The proloculus is spherical and relatively large with a diameter of 32μ. The whorls of the second tubular-shaped chamber are freely and glomospirally wound with a displacement of 10-15° from the axial plane. The final coil is planispiral and flat. The height of the opening in the last coil is 0.020 mm. The wall consists of an exterior, bright, glassy radial type layer and an interior dark, granular layer. The thickness of the wall is 6-8μ.

The identifying characteristics of this species are:

1. asymmetric and involute coiling
2. small number of coils
3. rather large proloculus

Remarks and comparisons. — On the basis of coiling, this species, as here described, is close to *Planoarchaediscus abseus* (?), n. sp. from which it is distinguished by its smaller dimensions, smaller number of coils and large proloculus.

Diagnosis. — Test small, discoidal with approximately plano-parallel sides, broadly rounded periphery and slightly uneven surface; coiling involute except for the final whorl with interior coils tightly wound and final two to three approaching the planispiral plane; layering of the wall which appears as parallel bands, extends the length of the test except for the final evolute whorl; flat floored lumina increase in size and breadth and at a rapid rate; wall is bilayered with an exterior bright radial layer and a poorly developed interior dark microgranular layer.

Measurements. — (Based on three specimens). Number of volutions (based on two specimens): 5-6. Diameter: 185.00-262.50μ.

Width (based on two specimens): 72.50μ. Ratio W/D: 0.276-0.32. Proloculus: 20μ. Height of lumen last volution: 18.30-22.50μ. Peripheral wall thickness: 6.25-11.25μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — USSR-Baschkirian (lower part of Makarov horizon).

Remarks. — The distinguishing features of this species are the almost flat plano-parallel sides, the broadly rounded wide outline of the final whorl and the pronounced lateral thickening edging the sides of the test. Sosipatrova's 1962 and 1966 descriptions and illustrations differ. The original description notes three to four coils, a proloculus of 32μ, and wall thickness of 6-8μ. The 1966 description gives three and a half to five coils, a proloculus size of 24-25μ and wall thickness of 9-15μ. Our specimens approach one of Sosipatrova's original illustrations (1962, pl. 5, fig. 4) in which the parallel banding characteristic of our forms is faintly discernible. However, the proloculus is smaller and the coils are numerous in our specimens. The wall thickness of our specimen encompasses the range of both of Sosipatrova's descriptions.

Archaediscus (Archaediscus) chernoussovensis Mamet, 1966 Pl. 22, fig. 4

Archaediscus chernoussovensis Mamet subsp. *angulatus* Conil and Pirlet (in Austin, Conil, Groessens, and Pirlet), 1974, pl. 3, figs. 14-15.

Diagnosis. — Test small, disc-shaped, becoming moderately convex at center of test, periphery broadly rounded, surface uneven; coiling is streptospiral throughout and oscillating, characterized by two definite breaks in the pattern of deflection; concave to flat-floored lumina increase gradually in size and the floors extend to the wall of the succeeding coil forming prominent angular contacts along the entire length of test and pseudo-stellate structure in the center; wall has a well-developed porous layer and a poorly defined inner dark layer.

Measurements. — (Based on one specimen). Number of volutions: 5?. Diameter: 232.50μ. Width: 88μ. Ratio W/D: .382. Proloculus: 17.50μ. Height of lumen last volution: 26.25μ. Peripheral wall thickness: 8.75μ.

Coiling. — Oscillating.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (V2)-early Namurian, USSR-Visean, Belgium-Visean (V2-V3), France-Visean (V3).

Remarks. — Mamet *in* Mamet, Choubert, and Hottinger (1966) changed the name of *Archaediscus karreri* Brady of Rauzer-Chernoussova (1948a, p. 230, pl. 5, figs. 10, 11) to *A. chernoussovensis.* The distinguishing feature of *A. chernoussovensis,* according to Mamet, *et al.,* 1966, is its oscillating mode of coiling. Pirlet and Conil (1974, p. 259) excluded figure 10 as not conforming to Mamet's definitive diagnosis, thus leaving figure 11 as the type specimen. Our form compares well with the type specimen except for a smaller ratio of width to diameter and the pronounced angularity made by the flat floors and their junction with the succeeding whorls. This angularity represents an evolutionary trend in the archaediscids. Because Pirlet and Conil have not yet described the subspecies "*angulatus,*" the authors can not make positive identification.

Archaediscus (Archaediscus) conili Browne, n. sp. Pl. 22, figs. 5-7

Archaediscus aff. *infantus* Shlykova, Conil and Lys, 1964, pp. 116, 117, pl. 17, fig. 319.

Holotype. — Raphael Conil.

Test lenticular and flattened on the sides. Coiling feebly oscillating.

Whorls: Four.

Diameter: 130μ. Width: 70μ.

Ratio W/D: 0.53.

Description. — Small species with few whorls. Fibrous layer, moderately developed, measuring about 25μ in the axial part of test. The internal dark layer is well developed. The proloculus measures 20μ. The profile is lightly deformed by the oscillations of the coiling.

Comments and differences. — Our form differs from the species described in the USSR by proportionally larger lumina, proloculus of greater size and smaller dimensions. We lack sufficient material, however, to make a careful comparison with Shlykova's species.

Diagnosis. — Test small, lenticular, surface smooth; first two whorls involute with final whorl entirely free; coiling streptospiral in the initial whorls; later coils oscillate about a plane as in *Archaediscus (Archaediscus) chernoussovensis;* lumina with slightly convex floors increase in size at a continuous rate and become progressively broader in relation to height; wall is composed of two layers, a fiberous outer layer and a poorly developed inner microgranular dark layer.

Measurements. — (Based on four specimens). Number of volutions (based on two specimens): 4-5. Diameter: 132.50-200μ. Width: 66.25-75μ. Ratio W/D: 0.375-0.50. Proloculus: 18.32-23.75μ. Height of lumen last volution: 12.50-17.50μ. Peripheral wall thickness: 6.25-8.75μ.

Coiling. — Oscillating.

Coiling stage. — Angulatus.

Stratigraphic range. — Belgium — Visean (V3). North America — Visean (late V3C), this report.

Remarks. — Our specimens compare favorably with the form described by Conil and Lys with its smaller size, manner of coiling, larger proloculus, and thinner wall than those of Shlykova (1951). Conil and Lys gave a ratio of width to diameter of 0.53 for their one specimen, but the ratio of the specimen illustrated on plate 17, figure 319 is 0.42 which is within the size range of our forms.

The authors believe that neither Shlykova's description of *A. infantus* nor her illustrations bear resemblance to our forms.

We consider this form to be a new species which we are naming *Archaediscus conili* in honor of Dr. Raphael Conil who first described the form.

Archaediscus (Archaediscus) infantus Shlykova, 1951 Pl. 22, figs. 8, 9

Archaediscus infantus Shlykova, 1951, p. 172, pl. 6, figs. 4, 5, Grozdilova (*in* Dain and Grozdilova), 1953, pp. 98, 99, pl. 3, figs. 6, 7.
Not *Archaediscus* aff. *infantus* Shlykova, Conil and Lys, 1964, pp. 116, 117, pl. 17, fig. 319.

Holotype. — All Union Petrol. Sci. Res. Geol. Prospect. Inst., No. 2220.

Original description. — The shell is involute, lentil shaped with nearly flat parallel sides and narrowly rounded periphery. The ratio of width to the diameter is 0.50-0.58. Coils number four to six, most frequently four to four and a half. The dimensions are small; the width is equal to 0.10-0.16 mm, the diameter 0.19-0.30 mm. The coiling: In the first three coils of the second chamber the central plane of each consecutive coil is turned in respect to the previous or preceding coil by an angle of 90 degrees so that, in section, the second coil in circular form is seen to surround the first coil. In the final two to three coils the central plane of each coil is slightly displaced in relation to the preceding one to the same side by 10 degrees - 15 degrees. Sometimes the central plane of the final coil may be displaced in opposite direction to the common direction of coiling of the exterior coils.

The height of the lumina varies from 13μ to 30μ in the last coils. They are relatively wide with commonly slightly convex or flattened bases.

The wall is smooth with a thickness from 10-15μ.

Remarks. — The form of the test with its almost flat sides and the slightly displaced coiling planes of the final whorls indicates this species is close to *Archaediscus krestovnikovi* Rauzer-Chernoussova, but it differs from the latter in the manner of coiling of the interior coils, by smaller diameter of the test, by the larger ratio of width to diameter, by the average lower clearances of the chamber and by the thick wall.

Diagnosis. — Test small, lenticular with slightly convex sides, surface smooth; initial whorls involute, becoming partially evolute with the final whorl entirely free. Coiling streptospiral with first three whorls tending to encircle the proloculus in axial section; exterior whorls are arranged in sigmoidal fashion except for the final whorl which departs in an opposite direction from the preceding whorls at an angle of approximately 45 degrees; lumina with slightly convex to flat floors increase progressively in size becoming broader in relation to height; wall is composed of two layers; a fibrous outer layer and an inner micrigranular dark layer.

Measurements. — (Based on two specimens). Number of volutions: 4?-5. Diameter: 150-172μ. Width: 78-82μ. Ratio W/D: 0.476-0.52. Proloculus (based on one specimen): 11.50μ. Height of lumen last volution: 14μ. Peripheral wall thickness: 7.00-8.50μ.

Coiling. — Imperfect sigmoidal.

Coiling stage. — Angulatus.

Stratigraphic range. — USSR — Visean (late V3). Belgium — Visean (late V3a).

Remarks. — Our specimens compare favorably with Shlykova's type. They are slightly smaller in size but are similarly proportioned and have a small proloculus.

Shlykova's description referred to the central plane of the final coil being "sometimes" displaced in opposite direction to the common direction of coiling of the exterior coils. She also noted the difference in the coiling manner of the interior coils from that of *A. krestovnikovi* Rauzer-Chernoussova. Her illustrations show the displacement of the final coil which we consider to be representative of imperfect sigmoidal type of coiling (Pirlet and Conil, 1974).

The differences between this species and *Archaediscus (Archaediscus) conili,* n. sp. are referred to under the description of the latter species.

Archaediscus (Archaediscus) krestovnikovi Rauzer-Chernoussova, 1948
Pl. 22, figs. 10, 11

Archaediscus krestovnikovi Rauzer-Chernoussova, 1948b, pp. 10, 11, pl. 2, figs. 18-20; Bogush and Yuferev, 1962, pp. 202, 203, pl. 9, fig. 7; Mamet, 1973, pl. 4, figs. 8, 11.

Not *Archaediscus krestovnikovi* Rauzer-Chernoussova, Shlykova, 1951, pl. 5, figs. 8, 9; Brazhnikova and Vdovenko, 1973, pp. 232-234, pl. 37, figs. 15, 16, 19, 20.

Archaediscus krestovnikovi subsp. *krestovnikovi* Rauzer-Chernoussova, Conil and Lys, 1968, pp. 510-512, text-fig. 2

Archaediscus krestovnikovi var. *krestovnikovi* Rauzer-Chernoussova, Grozdilova and Lebedeva (*in* Dain and Grozdilova), 1953, p. 95, pl. 2, figs. 17-19; Bozorgnia, 1973, pp. 115, pl. 22, figs. 3, 4.

Not *Archaediscus krestovnikovi* var. *krestovnikovi* Rauzer-Chernoussova, Conil and Lys, 1964, pp. 120, 121, pl. 18, figs. 345-351.

Archaediscus krestovnikovi Rauzer-Chernoussova forma *typica,* Bogush and Yuferev, 1966, pl. 11, fig. 13.

Archaediscus krestovnikovi var. *koktjubensis* Rauzer-Chernoussova, 1948b, pp. 10, 11, pl. 3, figs. 1-3; Shlykova, 1951, pl. 5, fig. 11.

Archaediscus koktjubensis Rauzer-Chernoussova, Conil and Lys, 1964, pp. 119, 120, pl. 17, figs. 338-340; Mamet, 1973, pl. 4, figs. 1-7.

Holotype. — Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow, fig. 19, No. 2834/42.

Original description. — (Translated from the Russian in Ellis and Messina, supplement No. 2, 1958).

Diagnosis. — Test small, lenticular with uneven surface, flat to moderately convex sides and moderately rounded to slightly angled periphery; mode of coiling changes markedly from aligned or with slight oscillation of the outer whorls to sigmoidal in the inner whorls which are involute and form thickened coalescing walls; the outer whorls become evolute and approximately or completely planispiral; lumina open and free, expanding at a rather rapid rate and changing in shape from spherical to semi-lunular; wall composed of an outer, clear, coarsely fibrous wall and an inner poorly developed thin, dark microgranular layer.

Measurements. — (Based on two specimens). Number of volutions: Six. Diameter: 172.50-192.50μ. Width: 61.25-75.00μ. Ratio W/D: 0.375-0.40. Proloculus: not determinable. Height of lumen last volution: 16.25-20.00μ. Peripheral wall thickness: 6.25-7.50μ.

Coiling. — Initial sigmoidal only.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (V3) — Namurian (Morrowan R?). USSR — late Visean (Tula-Serpukhov). Belgium — Visean (V2b-V3b). Iran — Visean (V2-V3).

Remarks. — A number of authors have, in the past, incorrectly assigned the species *Archaediscus stilus* Grozdilova and Lebedeva (*in* Dain and Grozdilova, 1953) to this species. Conil and Lys (1968), upon examination of the holotype, separated these two species by their mode of coiling. They recognized the mode of coiling of *A. krestovnikovi* to be that of the "variety" *A. krestovnikovi koktjubensis,* intermediate between oscillating and aligned and sigmoidal only in the inner whorls.

Our specimens average approximately 3/4 the size of the minimal dimensions given by Rauzer-Chernoussova for the type species. The proportions, however, are the same as ours. Bozorgnia's (1973) forms, on the contrary, have a range with minimal dimensions about equal to the maximum of the type and a proportionally greater ratio of width to diameter.

Archaediscus (Archaediscus) miklukhomaklayi Browne, n. sp.
Pl. 22, figs. 12, 13

Hemigordius schlumbergeri (Howchin), Miklukho-Maklay, 1953, p. 129, pl. 6, fig. 5.
Not *Cornuspira schlumbergi* Howchin, 1895, pp. 195-196, pl. 10, figs. 1-3.

Holotype. — Repository not located.

Original description. — Shell lenticular, the first chamber is spheric, the second tube type. Coiling initially archaediscid type, then flat spiral. The wall is calcareous, brownish, sometimes dark. Diameter: 0.15-0.25 mm. Width: 0.05-0.10 mm.

Diagnosis. — Test free, with the greatest thickness through the axis of revolution; composed of a proloculus (not clearly defined in our form) followed by a second tubular chamber which is initially streptospirally coiled, then spiral with the final one to two whorls evolute; lumina, in axial view, are open, semicircular in shape, increase gradually in height and have flat-floored bases which extend to the edges of the wall; wall is yellowish brown in color, composed of a fibrous outer layer and a thin, little discernable, dark, microgranular layer. The fibrous layer tends to thicken toward the center of the test.

Measurements. — (Based on two specimens). Number of volutions: at least three. Diameter 140.00-187.50μ. Width: 58.75-75.00μ. Ratio W/D: 0.40-0.42. Proloculus: Not determinable. Height of lumen last volution: 11.25-13.75μ. Peripheral wall thickness: 8.75-11.25μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — USSR — Carboniferous. Australia — Carboniferous.

Remarks. — Our two specimens appear to be identical to Miklukho-Maklay's 1953 species. Miklukho-Maklay considered her form to be the same as that described by Howchin (1895) as *Cornuspira schlumbergi.* Schubert (1908) erected the genus *Hemigordius* using Howchin's species *C. schlumbergi* as the type species. *Cornuspira* and *Hemigordius* both belong to the family Fischerinidae and do not possess radial walls. Miklukho-Maklay's original description does not mention radial walls and her illustration, though somewhat suggestive of such walls, is not drawn with sufficient clarity. However, she placed the genus *Hemigordius* in the family Archaediscidae which she considered to have "indistinctly porous to coarsely porous walls." In this connection it is interesting to note that *Hemigordius ulmeri* Mikhailov, 1939 was selected by Miklukho-Maklay as the type species for *Propermodiscus,* another archaediscid genus. She has, however, described the latter genus as possessing radial walls.

The question arises as to whether Howchin's *C. schlumbergi* is an archaediscid. Without access to the type specimen this cannot be definitely determined. From the original free-hand drawing of the type specimen it is not possible to tell. In any event, Miklukho-Maklay's *H. schlumbergeri* cannot be the same as that described by Howchin because that form is approximately three times the size of Miklukho-Maklay's specimens, has a smaller ratio of width to diameter and has five volutions.

Both the size of our forms and the ratio of width to diameter compare well with Miklukho-Maklay's species.

While the authors believe a new species should not normally be erected without a minimum of three specimens, in this case of misidentification we are making an exception, naming the species after the original author and using Miklukho-Maklay's figured specimen as the holotype.

Archaediscus (Archacdiscus) ex gr. **moelleri** Rauzer-Chernoussova, 1948
Pl. 22, fig. 14

Diagnosis. — Test small, disc-shaped with compressed nearly parallel lateral sides, well-rounded periphery and relatively smooth surface; coiling sigmoidal with only the final coil evolute; axial section shows perfect sigmoidal coiling with the first one and a half coils wound in a plane at 45 degrees to the axial plane and the final two to three coils turned sharply to a 45 degree angle with the axial plane in the opposite direction, making a 90 degree angle with the plane of the initial coils; lumina dominantly flat-floored and semilunular in shape, increasing progressively and markedly in size and breadth in relation to height; wall has a well-developed clear radial layer and poorly developed inner dark layer.

Measurements. — (Based on two specimens). Number of volutions: four. Diameter: 146.87-160.00μ. Width: 18.75-23.00μ. Ratio: W/D .45-.478. Proloculus: 18.75-23.00μ. Height of lumen last volution: 15.62-16.00μ. Peripheral wall thickness: 6.25-6.30μ.

Coiling. — Sigmoidal.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (V3-late V3c) — Namurian. USSR — Visean (V3). Belgium — Visean (V3). Germany — late Visean. Iran — Visean (V3b).

Remarks. — This species bears resemblance to *Archaediscus pauxillus* Shlykova, 1951 in sigmoidal coiling. However, in that species the initial volution appears to be at 90 degrees to the succeeding one. The angle of deviation between these two volutions in our two specimens varies from about 10° to 40°. The present form is closer in size range to *Archaediscus* "var." *nana* Rauzer-Chernoussova but differs in having sigmoidal coiling while *A. nana* is sigmoidal only in the initial stage.

Our form has advanced to the typical angulatus stage in evolutionary development. It is unfortunate that one of our two forms was thinned so much it was partially destroyed and we have no more criteria on which to base a specific diagnosis.

Archaediscus (Archaediscus) pusillus Rauzer-Chernoussova, Mamet, 1973
Pl. 22, figs. 15-20

Archaediscus krestovnikovi var. *pusillus* Rauzer-Chernoussova, 1948a, p. 232, pl. 16, figs. 4, 5; Grozdilova and Lebedeva (*in* Dain and Grozdilova), 1953, p. 96, pl. 3, figs. 3, 4.
Archaediscus pusillus Rauzer-Chernoussova, Mamet, 1973, pl. 4, fig. 24.

Holotype. — Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow, No. 19.

Original description. — (Translated from the Russian in Ellis and Messina, supplement No. 1, 1958.)

Diagnosis. — Test small with pronounced sutural depression outlining the final whorl, parallel to moderately convex in outline in axial section with a final evolute whorl appearing somewhat detached from the plane of symmetry; initial three coils are involute and streptospirally wound and the final coils evolute and slightly oscillating; completely open lumina increasing in size have slightly convex to flat floors with epaulets extending on to the walls; wall composed of two layers — a fibrous outer layer and a thin, dark microgranular layer.

Measurements. — (Based on 21 specimens). Number of volutions: 3-1/2-5. Diameter: (based on 20 specimens): 158-225μ. Ratio W/D: 0.289-0.411. Width (based on 19 specimens): 58.00-81.25μ. Proloculus (based on 12 specimens): 16.25-25.50μ Height of lumen last volution: 16.66-27.60μ. Peripheral wall thickness (based on 19 specimens): 6.25-12.70μ.

Coiling. — Oscillating.

Coiling stage. — Angulatus.

Stratigraphic range. — USSR — Visean (V3-Tula). France — Visean (V3).

Remarks. — This species is one of the most abundant forms recovered from the fauna. The overall dimensions correspond remarkably well with those of the original description except for the fact the proloculus attains larger dimensions. All of the specimens have reached the angulatus stage but there seems to be some variation in this feature.

We have adopted Mamet's assignment of this form since we consider it to be a definite species with *chernoussovensis* coiling. The specimens do not have the characteristic type of coiling of the species *Archaediscus krestovnikovi* Rauzer-Chernoussova.

Subgenus **HEMIARCHAEDISCUS** Miklukho-Maklay, 1957

Type species: *Hemiarchaediscus planus* Miklukho-Maklay, 1957.

Original description. — Shell flat, lens shaped with slightly circular edges. Test consists of a proloculus and a second pseudotubular chamber, glomerately coiled at the beginning. The final coils are relatively freely coiled in a flat spiral plane. The wall is bright, calcareous, distinctly porous with a clear dark interior layer.

Among the representatives of this genus it is possible to see several new species.

The stratigraphic range is from the beginning of the Visean to the end of the Namurian. The geographic distribution covers Central Asia, Urals, Kazakhstan and the European part of the USSR.

Remarks. — Specimens of this genus have been assigned by other authors to several different genera — *Planoarchaediscus*

Miklukho-Maklay, *Planospirodiscus* Sosipatrova, *Propermodiscus* Miklukho-Maklay, and *Archaediscus* Brady.

Hemiarchaediscus differs from *Planoarchaediscus* in being more symmetrical and in possessing a clear, bright, radial wall. From *Planospirodiscus,* it is differentiated by streptospiral coiling of the initial coils and the high open, evolute final coils.

Miklukho-Maklay's illustration of *Hemigordius ulmeri* Mikhailov, 1939, the type species of *Propermodiscus,* appears to belong to the genus *Archaediscus* Brady, 1873 as emended by Conil and Pirlet (1974, p. 254).

Most authors have equated *Hemiarchaediscus* with *Archaediscus* Brady, believing the tendency to lateral side thickenings is not a criteria for generic designation. We believe this assignment is incorrect.

We suspect that the wall of *Hemiarchaediscus* is, in fact, single-layered and that other genera have been mistakenly assigned to this genus. The possibility exists that petrographic relief along the inner edge of the wall was mistaken for an inner layer. If such is the case *Hemiarchaediscus* would represent a subgenus at a morphological stage of evolution beyond *(Archaediscus)* equivalent to that attained in *Ammarchaediscus (Tubispirodiscus).* If the inner layer is real, *Hemiarchaediscus* is assignable to *Archaediscus (Archaediscus)* and represents an advanced evolutionary stage. A definitive deposition of this question cannot be achieved without access to the original type specimens.

Subgenus ?HEMIARCHAEDISCUS Miklukho-Maklay, 1957

Type species: ?*Hemiarchaediscus planus* Miklukho-Maklay, 1957.

Original description. — Hemiarchaediscus planus Miklukho-Maklay.

Holotype. — No. 16-23 Visean, Pamir.

Diagnosis. — The test is irregular, disc-shape. The first three to three and a half coils are streptospirally wound with the final three to three and a half coiled approximately in one plane.

Dimensions. — Diameter 0.32-0.46 mm (the holotype is 0.35 mm). Width 0.09-0.14 mm (the holotype is 0.12 mm).

Remarks. — The representatives of this genus have been referred to the genus *Propermodiscus* Miklukho-Maklay 1953. Although they are similar to *Propermodiscus* in the mode of coiling of the tubular chamber they cannot be referred to that genus since they lack side thickenings. The manner of coiling of the specimens appears more closely related to the genus *Planoarchaediscus.*

Both have the same type of test structure. They are, however, distinct in wall structure. The walls of *Planoarchaediscus* are thin and brownish with poorly developed porosity. In *Hemiarchaediscus* they are bright and clear with well developed porosity.

Diagnosis. — *Archaediscus,* discoidal to lenticular in shape, initial coils involute with the final coils evolute and freely wound in a flat, spiral plane with side thickenings confined to the initial tangle; lumina open with flat floored bases in the final coils; wall is a clear bright porous to poorly porous layer.

Remarks. — We are tentatively assigning to (?*Hemiarchaediscus*) forms having a single radial layer but otherwise resembling Miklukho-Maklay's genus. If *Hemiarchaediscus* is indeed assignable to *Archaediscus (Archaediscus)* our specimens and those placed in synonymy with (?*Hemiarchaediscus*) represent a separate genus that should be defined and named.

We have purposely given the original description of Miklukho-Maklay's type species *H. planus* because there is no mention made of an inner dark layer although her description of the genus *Hemiarchaediscus* describes its presence.

Archaediscus (?Hemiarchaediscus) swanni Browne, n. sp. Pl. 23, figs. 1-5

Holotype. — USNM (Nat. Mus. Nat. Hist.), No. 244590.

Diagnosis. — Test small with well-rounded periphery and moderately convex sides marked by thickenings which increase toward the center of the test; oscillation of coiling departs only slightly from the plane of symmetry; inner coils involute with the final coil evolute; open lumina increase markedly in size and breadth with each coil changing in shape from nearly spheric to semi-lunular in outline as viewed in thin section; floors of the lumina dominantly flat to moderately convex in shape with extensions on to the wall; initial chamber small and spheric in form; wall is moderately thick, clear, and fibrous without a dark inner layer.

Measurements. — (Based on 11 specimens). Number of volutions (based on four specimens): 4-6?. Diameter: 212.50-295.00μ. Width: 75-93μ. Ratio W/D: 0.30-0.44. Proloculus (based on two specimens): 13.75-15.00μ. Height of lumen last volution: 16.00-27.90μ. Peripheral wall thickness (based on ten specimens): 7.00-11.25μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — Unknown, Visean (late V3c), this report.

Remarks. — *A. (?Hemiarchaediscus) swanni* appears to be an early form of the subgenus. The stage of evolution is somewhat beyond *A. (Archaediscus)* but less advanced than *A. (?Hemiarchaediscus) stilus.* It differs from the latter species in having fewer evolute final coils and possessing marked side thickenings of the wall that are indicative of its nearness to *A. (Archaediscus).* It also is somewhat larger, has a lesser range of width to diameter and a greater range in size of the proloculus. The mode of coiling is intermediate to the gently oscillatory group *stilus* and true planispiral forms assigned to *Ammarchaediscus.*

This species is named in honor of the late Dr. David H. Swann in recognition of his contribution to Chesterian stratigraphy.

Archaediscus (?Hemiarchaediscus) cornuspiroides (Brazhnikova and Vdovenko, 1967) Pl. 23, fig. 6

Archaediscus? cornuspiroides Brazhnikova and Vdovenko (*in* Brazhnikova, *et al.*), 1967, pp. 162, 163, pl. 54, figs. 14-19; pl. 55, fig. 1.

Holotype. — Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow, No. 181.

Original description. — The test is small, strongly compressed along the lateral margins with flat umbilici and is nearly disc shaped. The early coils are involute and the last three to three and a half, sometimes four completely evolute. The surface of all the coils is smooth. The ratio of the width to the diameter ranges from 0.19-0.35. The range in dimensions of the diameter is considerable, from 0.11-0.37, commonly from 0.15-0.26 mm. The width ranges from 0.03-0.08 mm, commonly 0.05-0.07 mm. The number of coils is 5-7½. The proloculus is large and spherical in shape with a diameter of 0.026-0.040 mm. In the first two to three coils the coiling is in differing planes. The last three to four coils are wound in a flat spiral. In saggital sections the flat spiral coiling is quite apparent and shows a resemblance to the cornuspiroid genera. The height of the tubular chamber shows a gradual increase which is sometimes quite discernable in the last one or two coils. A height of 0.03-0.07 mm is attained in the final coil. The wall, with clearly distinct outline, is thin, calcareous and glassy (no porosity being visible). The maximum wall thickness of the final coil is 0.01 mm. Variability is expressed by the considerable range in dimensions and in the displacement of the planes of coiling in the initial coils.

Comparison. — The wall structure and the manner of coiling of the final coils distinguish these specimens from all known Archaediscidae. Because of this they are tentatively referred to the genus *Archaediscus.*

Archaediscus(?) *cornuspiroides,* due to the characteristic coiling of the final coils and its glassy, nonporous wall resembles the cornuspirids. It is pertinent to note also that the structure of these forms is close to that of *Eosigmolina.*

Diagnosis. — Test small, discoidal with plano-parallel sides, surface marked by a lightly impressed suture of the final whorl; coiling aligned; initial coils streptospirally wound and involute with the final two coils evolute, showing a maximum deviation of approximately 10 degrees from the axial plane; lumina with slightly convex floors and semi-lunular outline increase progressively in size with a marked increase from the involute to the evolute whorls; wall clear, bright, and of approximately uniform thickness throughout. The porosity is poorly developed and visible only at high magnifications.

Measurements.—(Based on one specimen). Number of volutions: 5-6? Diameter: 187.50μ. Width: 47.50μ. Ratio W/D: 0.25. Proloculus: 12.50μ. Height of lumen last volution: 18.75μ. Peripheral wall thickness: 6.25μ.

Coiling. — Aligned.

Coiling stage. — Angulatus approaching tenuis.

Stratigraphic range. — North America — Visean (V3c), this report. USSR — late Visean — early Namurian of Dnieper — Donetz Basin.

Remarks. — The authors believe this species should be tentatively classified under the subgenus (*?Hemiarchaediscus*). The original description of this form noted the "non-porous" wall as one of the features by which it resembles the cornuspirids. However, personal communication from Vdovenko confirms the presence of a porous wall, noted only at magnifications of 180x and above. This porosity is clearly visible in photographs sent by her. The tendency toward a glassy wall of uniform thickness is an apparent evolutionary development.

Archaediscus (?Hemiarchaediscus) stilus (Grozdilova and Lebedeva, 1953)
Pl. 23, figs. 7-14

Archaediscus stilus Grozdilova and Lebedeva (*in* Dain and Grozdilova), 1953, (part) pp. 113, 114, pl. 4, fig. 20; Grozdilova and Lebedeva, 1954, pp. 61, 62, pl. 7, fig. 19; Vachard 1975, pp. 56, 57, pl. 8, figs. 2, 5.

Not *Archaediscus stilus* Grozdilova and Lebedeva, Bozorgnia 1973, pp. 112, 113, pl. 17, fig. 6; pl. 19, figs. 11-13, pl. 22, fig. 17; Malpica, 1973, pl. 2, fig. 26.

Planoarchaediscus stilus (Grozdilova and Lebedeva), Sosipatrova, 1962, p. 58, pl. 5, figs. 5, 6.

Planoarchaediscus stilus (Grozdilova and Lebedeva) forma *compressa* Bogush and Yuferev, 1966, p. 160, pl. 11, fig. 7.

Not *Planoarchaediscus stilus* (Grozdilova and Lebedeva) forma *typica* Bogush and Yuferev, 1966, p. 160, pl. 11, fig. 6.

Planoarchaediscus? stilus (Grozdilova and Lebedeva) forma *magna,* Bogush and Yuferev, 1966, p. 160, pl. 11, fig. 8.

Archaediscus cf. ex gr. *stilus* (Grozdilova and Lebedeva) subspecies *angulatus* Conil and Pirlet *in* Austin, Conil, Groessens, and Pirlet, 1974, pl. 3, figs. 9-12.

Holotype. — All Union Petrol. Sci. Res. Geol. Prospect. Inst., No. 3191.

Original description. — The test is disc-shaped, elongated in axial section, involute in the beginning whorls and evolute in the last 2-3. Periphery is round and lateral sides are almost parallel. The surface of the test is smooth or slightly dented. The ratio of the width to the diameter ranges from 0.32 : 1 to 0.45 : 1.

Dimensions (in mm). — Diameter 0.17-0.31, most commonly 0.23-0.31, the width of the test 0.61-0.16 and most commonly 0.095-0.13. The proloculus is spherical with a diameter ranging from 0.010-0.038 mm. The number of coils is 5-6. The coiling of the tubular chamber is comparatively free, with gradual increase in height with growth. The beginning coils are involute, wound in differing planes ($<$ 15-20 degrees to 40 degrees). The exterior 2-3 coils are evolute and spirally flattened. The height of the lumen of the final coil ranges from 0.05-0.038 mm. The wall is glassy, radiant, finely porous, thin and not pronounced in the early coils but tends to be somewhat thicker in the last coils, changing from 0.007-0.019 mm. Due to the test shape and the type of coiling this species bears a relationship to the group *Archaediscus spirillinoides* Rauzer. Differences are observed in the wall structure which in the group *Archaediscus stilus* here described is two layered, consisting of a well-developed glassy, radiant layer and a less clear, inner dark layer. It is, likewise, distinguished by the large ratio of test inflation.

Diagnosis. — Test small to medium in size, ranging in shape from flat, nearly plano-parallel, to moderately convex in outline, with narrowly rounded periphery and slightly irregular to normally smooth surface; interior coils streptospirally wound with the final two to three coils evolute; layered thickening of the wall is apparent on the sides of the test but is confined to the region of the area of the involute coils only; lumina increase in size and shape at a marked pace especially with the change from involute to evolute coiling, beginning lumina semi-circular in shape with the later ones becoming broader in relation to the height; wall is a single clear, porous, radial layer which envelopes the test.

Measurements. — (Based on 23 specimens). Number of volutions: (14 specimens) 5-6. Diameter: 153-290μ. Width: (21 specimens) 44-95μ. Ratio W/D (based on 21 specimens): .30-.44. Proloculus (based on eight specimens): 7.00-31.25μ. Height of lumen last volution: 11.60-26.25μ. Peripheral wall thickness: 5.00-11.60μ.

Coiling. — Aligned.

Coiling stage. — Specimens show evolutionary stages from angulatus approaching tenuis.

Stratigraphic range. — North America — Visean (late V3c), this report. USSR — Visean (V3) — Baschkirian. Morocco — Visean (late V3c).

Remarks. — This species is one of the more abundant in the fauna. It is characterized by its elongated shape in axial section with its involute early whorls which possess lateral side thickenings and its free, evolute, dominantly planispiral final whorls without side thickenings.

We elected to list only the holotype of *A. stilus* Grozdilova and Lebedeva (*in* Dain and Grozdilova), 1953, plate 4, figure 20 in the above synonymy because their other illustration on the same plate (fig. 19) shows a pronounced dark inner layer. Grozdilova and Lebedeva (1954, pl. 7, fig. 19) refigured this holotype. The latter illustration shows what appears as a two-layered wall. The problem cannot be resolved without access to the type specimens.

Our specimens show a series of progressive stages of evolutionary development.

Archaediscus sp. [n. subgenus] Pl. 25, fig. 16

Figured specimen. — USNM (Nat. Mus. Nat. Hist.)

Diagnosis. — Test small, umbilicate in shape with the largest diameter at extremities and the smallest through the axis of coiling, surface uneven; coiling is aligned with the inner coils involute and the outer two evolute; proloculus spherical, of moderate size; lumina of nearly circular to semi-circular outline increase markedly in size from center outward and have convex floors; a finely fibrous wall of approximately equal thickness envelops all the whorls.

Measurements. — (Based on one specimen). Number of volutions: 4?. Diameter: 178.75μ. Width: 47.50μ. Ratio W/D: 0.266. Proloculus: 15μ. Height of lumen last volution: 18.75μ. Peripheral wall thickness: 10μ.

Coiling. — Aligned.

Coiling stage. — Tenuis.

Stratigraphic range. — Unknown — Visean (late V3c), this report.

Remarks. — Because the authors have only one specimen it is not possible to adequately diagnose and define the limits required for naming this new subgenus. We believe this subgenus represents a final and rare stage of development of the genus *Archaediscus*. It differs from the forms we have assigned to the subgenus ?*Hemiarchaediscus* in the following respects:

1. test shape umbilicate with the smallest diameter through the axis of the test
2. floors convex without shoulders or epaulets

3. lumina subcircular in outline throughout the test
4. radial wall of equal thickness well developed at low magnifications (single specimen)

This subgenus resembles *Ammarchaediscus* (subgenus A) sp. Conil, 1974 (*in* Austin, Conil, Groessens, and Pirlet, 1974, pp. 116, pl. 3, fig. 5) except that form is planispiral, completely evolute, and still possesses evidence of an inner layer.

The form figured by Conil (*in* Austin, Conil, Groessens, and Pirlet, 1974, pl. 3, figs. 1, 3) as *Archaediscus* ex gr. *stilus* may belong to our new subgenus. It will be noted we have assigned *A. stilus* to the subgenus ?*Hemiarchaediscus.*

Genus **NODOSARCHAEDISCUS** Conil and Pirlet, 1974

Type species: *Archaediscus maximum* Grozdilova and Lebedeva, 1954.

Diagnosis.—*Nodosarchaediscus* characterized by the presence of nodes angular nodosities in the lumina or by a stellate central part formed by the first whorls or by the combination of both. The internal dark layer is feeble to imperceptible. The external radial layer comprises the large part of the test. The coiling is normally evolute at least in the final coils. Floors are frequently in the form of the letter W (Pirlet and Conil, 1974, p. 264).

Subgenus **NODASPERODISCUS** Conil and Pirlet, 1974

Type species: *Archaediscus saleei* Conil and Lys, 1964.

Diagnosis.—*Nodosarchaediscus* characterized by the presence of nodes in addition to a stellate central part in which the coiling becomes confused due to the occlusion of the lumina and the disappearance of the dark internal layer. The dark internal layer which is feeble to imperceptible in the first coils is completely covered throughout the test by the radial layer (Pirlet and Conil, 1974, p. 264).

Nodosarchaediscus (Nodasperodiscus) gregorii (Dain), 1953
Pl. 23, figs. 15, 16

Archaediscus gregorii var. *gregorii* Dain (*in* Dain and Grozdilova), 1953, p. 108, pl. 4, figs. 12, 13; Grozdilova and Lebedeva, 1954, p. 59, 60, pl. 7, figs. 12, 13.
Planospirodiscus gregorii (Dain), Mamet, 1970, fig. 3 (chart) pl. 7, figs. 9, 10, 13, 14; Mamet, 1973, pl. 4, fig. 34.
Neoarchaediscus gregorii var. *gregorii* (Dain), Bozorgnia, 1973, pp. 135, 136, pl. 30, figs. 7-9.

Holotype.—All Union Petrol. Sci. Res. Geol. Prospect. Inst., No. 2640.

Original description.—The shell is disc-shaped with rounded periphery, strongly compressed, producing parallel lateral sides.

Relation of the width to the diameter 0.30:1-0.40:1, Dimensions (mm). Diameter of shell 0.28-0.38, the width of the shell 0.094-0.12, number of coils 5-6.

The proloculus is spheric. It has a diameter of 0.019 to 0.029 mm. The coiling of the tubular chamber in its initial stage lies in varying planes with a gradual increase in the height of the coils — the first two to three coils involute and the later ones strictly planospiral. The last three to four spiral flat coils are strictly evolute. The lumina of the coils are narrow. They appear to have an irregular outline, making a contour on the wall. The height of the lumen of the last coil is 0.015 mm. The wall is thick, porous. Dain noted the angularity of the walls of this species in his samples from the Donetz Basin. It is expressed by the presence of three projections on the exterior side of the peripheral part of the coil. The thickness of the wall of the last coil is 0.015 to 0.03 mm.

During the past four years this species has been discovered to be of wide geographic distribution. The Ural samples which possess the same characteristics and common dimensions differ from the Donetz-basin samples by free coiling of the tubular chamber and a rather thin, porous wall. Specimens of *Archaediscus gregorii* possess slight variations in dimensions, in the manner of coiling of the tubular chamber (tight or more loosely wound) in test form and wall thickness.

Diagnosis. — Test disc-shaped with plano-parallel sides and rounded periphery; final two to three coils evolute and planispiral; lumina increase moderately in size and are crescentic in shape due to the fact they are dominantly filled with nodes which reduce the fissural openings throughout; extensions of the floors of the lumina extend across the walls of the outermost, evolute whorls; wall of moderate thickness is composed of a fibrous layer and a very thin dark microgranular layer.

Measurements. — (Based on two specimens). Number of volutions: 4-5. Diameter: 220-280μ. Width: 80-88μ. Ratio W/D: 0.31-0.36. Proloculus (based on two specimens): 18.32-33.00μ. Height of lumen last volution: 19.46-20.60μ. Peripheral wall thickness: 11.45-12.60μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (V3c) — Namurian. USSR — Visean (V3c) — Baschkirian. France — Visean (V3bδ). Iran — Visean (V3c) — early Namurian.

Remarks. — Our forms differ from Dain's in being of slightly smaller dimensions but having a similar width to diameter ratio. They match more closely the dimensions given by Bozorgnia (1973). This species is difficult to distinguish from *(Nodasperodiscus) minimus* (Grozdilova and Lebedeva 1953) from which it differs by having a larger ratio of width to diameter, a relatively larger proloculus, lower lumina and a somewhat thicker wall. It differs from *(Asteroarchaediscus) rugosus* Rauzer-Chernoussova, 1948 in that the latter by generic definition, except for a final coil, has occluded lumina, is of wider dimensions and possesses a rugose outline. Assignment of this species to *Planospirodiscus* Sosipatrova by Mamet (1970) is inappropriate. It resembles that genus but *Planospirodiscus taimiricus,* the type species, is planispiral and without stellate center-coiling; we believe *Planospirodiscus* is a subgenus at an evolutionary stage more advanced than ?*Permodiscus* Chernysheva of Pirlet and Conil (1974, p. 280).

Nodosarchaediscus (Nodasperodiscus) minimus (Grozdilova and Lebedeva), **1953** Pl. 23, figs. 17-19

Archaediscus minimus Grozdilova and Lebedeva (*in* Dain and Grozdilova), 1953, pp. 111, 112, pl. 4, fig. 15.
Not *Archaediscus? minimus* Grozdilova and Lebedeva, 1954, pp. 62, 63, pl. 7, fig. 16.
Asteroarchaediscus gregorii (Dain) Brazhnikova, *et al.,* 1967, pl. 21, fig. 4
Planospirodiscus minimus (Grozdilova and Lebedeva) Sosipatrova, 1962, pp. 64, 65, pl. 5, figs. 22-24; Mamet, 1970, pl. 7, figs. 15-18.
Neoarchaediscus incertus (Grozdilova and Lebedeva) Bozorgnia, 1973, pp. 130, 131, pl. 20, figs. 138-139.

Holotype. — All Union Petrol. Sci. Res. Geol. Prospect. Inst., No. 3190.

Original description. — The shell is small, disc-shaped with widely turned peripheral region and parallel lateral sides. The surface is smooth. The ratio of width to diameter varies from 0.30:1 to 0.50:1 — the most frequently encountered ratio being 0.30:1 to 0.40:1. Dimensions (mm): diameter varies from 0.19 to 0.27; the width from 0.076 to 0.095. The number of coils two to five; commonly three. The proloculus is spheric. In consideration of the small dimensions of the species it is comparatively large with a diameter varying from 0.019 to 0.023 mm. The initial one and a half to two coils decline slightly from the plane of symmetry. The final two to three coils are evolute flat and planispiral. The lumina are relatively large with the clearly expressed outline of a small arch. The height of the lumen of the last coil is 0.019 to 0.023 mm. The wall is glassy, radial, and finely porous. The thickness of the wall about equals the height of the lumen.

Archaediscus minimus, n. sp. because of the form of the test and the characteristics of the external coils approaches the genus *Permodiscus* from which it differs by the initial coiling of the tubular chamber and the absence of lateral thickenings.

Distribution. — This species is found in deposits of Baschkirian age on the western slope of the Ural Mountains.

Diagnosis. — Test small, smooth to slightly rugose, flat-sided with narrowly rounded periphery; initial coils tightly wound producing flaring with the final three coils evolute and planispiral; lumina, except for the final whorl, are almost completely filled with chevron-shaped nodes which have reduced the fissural openings to narrow slits; wall is a single fibrous layer.

Measurements. — (Based on six specimens). Number of volutions: 4-5½. Diameter (based on five specimens): 181.00-248.75μ. Width: 52.50-67.50μ. Ratio W/D: 0.249-0.32. Proloculus (based on two specimens): 9.16-11.00μ. Height of lumen last volution: 11.60-25.00μ. Peripheral wall thickness: 5-10μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (V3c) — early Namurian. USSR — Baschkirian. Iran — Visean (V3c) — early Namurian.

Remarks. — Our specimens approximate those of the authors. They possess a slightly greater width than the given width although the author's illustrated figure 15 on plate 4 has the same ratio of width to diameter as our forms the proportions of which match those of Bozorgnia, 1973. The proloculus is slightly smaller than those of the authors. This may be due to the limited number of our forms.

Grozdilova and Lebedeva's illustration of the type is not clear and not diagnostic enough to determine the stellate juvenarium. However, the reference in their description to "the clearly expressed outline of a small arch" in the lumen leads us to believe they were describing nodes and not the crenulate outline of the occluded lumina of the genus *Asteroarchaediscus* Miklukho-Maklay. Moreover, the fact that our specimens match so closely the illustration given by the other authors in the above synonymy and are from the same stratigraphic level lends credence to our assignment.

Subgenus **NEOARCHAEDISCUS** Miklukho-Maklay, 1956

Type species: *Archaediscus incertus* Grozdilova and Lebedeva, 1954.

Original description. — The shells are flat — discus-shaped with more or less parallel sides. The surface of the shell is smooth or somewhat uneven. The beginning chamber is spheric. The second chamber, not divided, coiled at the beginning (frequently with star-shaped structure), is followed by two or three coils turned more or less in one plane and more freely. The wall is calcareous, bright, quite thick, glassy, finely porous, with an interior, thin dark layer.

Diagnosis. — *Nodosarchaediscus* characterized by the confused and stellate central coils. The terminal spires (at least one and a half to two) are free, without nodes or traces of occlusion. The dark layer, thin or imperceptible, is completely covered by the radial layer. (Pirlet and Conil, 1974, p. 268).

Remarks. — Pirlet and Conil (1974) erected the subgenus *Asperodiscus* to include the genera *Neoarchaediscus* and *Rugo-*

sarchaediscus which they separated only at the specific level. The authors agree that the two genera can be differentiated only on the tendency of forms assigned to *Rugosarchaediscus* to be somewhat more convex in shape and to have the terminal spires depart more from the plane of symmetry. These characteristics are evolutionary and intermediate forms exist.

We consider the genus *Rugosarchaediscus* Miklukho-Maklay, 1957, and the subgenus *Asperodiscus* Pirlet and Conil (1974) to be junior synonyms of *(Neoarchaediscus).*

Nodosarchaediscus (Neoarchaediscus) cf. bykovensis Sosipatrova, 1966
Pl. 23, fig. 20; Pl. 24, figs. 1, 2

Neoarchaediscus bykovensis Sosipatrova, 1966, pp. 19, 20, pl. 3, figs. 1, 2.

Holotype. — Institute of Geology of Arctic Regions, 659/3 Bykov Canal, Tixin suite, collection of R. V. Solomina, 1959, specimen 396.

Original description. — The shell is lens-shaped, almost flat with parallel lateral sides and rounded peripheral margin, involute in starting coils and evolute in the last two. The ratio of width to diameter is 0.20-0.31. Diameter 0.24-0.32 mm. Width 0.060-0.075 mm. The number of coils 5½-6.

The proloculus is small with a diameter of 0.019 mm. The tubular chamber is tightly wound with small declination of the axis in the initial coils. The last three coils are more open and planispiral. The height of the lumen in the final coil is 0.22-0.029 mm, giving a height three times the wall thickness. The lumina are semi-lunular in shape with slightly swollen bases.

The wall consists of two layers with the outer, glassy, radial layer pronounced. In the initial coils, the stellate structure is well-displayed. The wall thickness is 0.006-0.009 mm. The characteristic features of this species are:

1. The nearly spiral flat coiling.
2. Stellate structure of the wall in the initial coils.
3. The parallel or slightly swollen sides of the test.

Comparison. — Our species bears the greatest resemblance to *Neoarchaediscus subplanus* (Brazhnikova), known in the suite C4, from which they may be separated by the thinner wall and the more convex sides of the test. In manner of coiling of the tubular chamber *N. bykovensis* bears closer affinity to *Planospirodiscus minimus* (Grozdilova and Lebedeva) from which it differs in the stellate structure of the initial coils, the much greater height of the lumina and the smaller proportion of width to diameter. The present species, with its parallel sides and the spirally flattened coiling of its outer coils is closer to *Neoarchaediscus borealis* Reitlinger from which it differs by having a rather narrow test, high open lumina in the later coils, and a thick wall.
Distribution: Northern Kharaulakh. Baschkirian layer. The location is in the Bykov canal, the upper part of the Tinosh suite. Collection of R. V. Solomena, 1959, Sample 396.

Diagnosis. — Test small, discoidal, with plano-parallel sides, broadly rounded periphery and slightly uneven surface, initial coils involute, tightly wound and displaying stellate structure; final two to three evolute, flat and planispiral except for the final coil which may turn as much as 30° from the plane of symmetry; lumina of the interior coils, often hard to detect due to the tight coiling, are small and somewhat semicircular in shape; lumina of the outer evolute coils change abruptly from tight coiling to free open planispiral coiling and increase progressively in height and breadth, becoming semilunular to somewhat quadrate in shape; wall bilayered with an outer, clear radial layer and a thin, dark microgranular layer.

Measurements. — (Based on six specimens). Number of volutions (based on three specimens): 5-7?. Diameter: 195-251μ. Width: 57.50-70μ. Ratio W/D: 0.22-.34. Proloculus (based on two specimens): 14.00-17.50μ. Height of lumen — Last volution: 18.75-30.00μ. Wall thickness: 5.00-7.50μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (late V3c), this report. USSR — Baschkirian.

Remarks. — Sosipatrova's description made no reference to any declination of the final coil from the plane of symmetry nor do her illustrations show it. One of our specimens (Pl. 23, fig. 20) has a projection extending out from the final coil, but this projection appears to be matrix and not part of a broken coil which lends credence to the fact that slight declination of the final coil is not a specific character.

This species bears close resemblance to *Neoarchaediscus incertus* (Grozdilova and Lebedeva) from which it is separated by a lesser ratio of width to diameter, more evolute planispiral coiling of the outer whorls and an abrupt change from involute to evolute coiling. In our forms the outer planispiral coiling comprises from approximately two to three times the length of the test versus 1 to 1.5 times that of those forms in this fauna which we have assigned to the species *incertus*. Moreover, *(N.)* cf. *bykovensis* has a thinner wall with a final lumen height about three times the wall thickness.

Nodosarchaediscus (Neoarchaediscus) incertus (Grozdilova and Lebedeva) 1954 Pl. 24, figs. 3-6

Archaediscus incertus Grozdilova and Lebedeva, 1954, pp. 60, 61, pl. 7, figs. 14, 15.

Neoarchaediscus incertus (Grozdilova and Lebedeva), Miklukho-Maklay, 1956, p. 11; Grozdilova and Lebedeva, 1960, p. 98, pl. 11, fig. 11; Brenckle, 1973, p. 63 (part) pl. figs. 16-19, 20?, 21?, 22-25; Vachard, 1975, pp. 58-60, pl. 8, figs. 1-3.

Not *Neoarchaediscus incertus* var. *incertus* (Grozdilova and Lebedeva), Conil and Lys, 1964, p. 130, pl. 20, figs. 389-391.
Neoarchaediscus postrugosus (Reitlinger), Hewitt and Conil, 1969, p. 178 (part) pl. 2, fig. 20.
Not *Neoarchaediscus incertus* Bozorgnia, 1973, p. 130, pl. 30, figs. 1-6.

Holotype. — All Union Petrol. Sci. Res. Geol. Prospect. Inst., Leningrad. No. 3686.

Original description. — (Translated from the Russian in Ellis and Messina, supplement No. 1, 1964).

Diagnosis. — Test small, disc-shaped, usually with rugose surface producing lightly serrated edges; periphery broadly rounded and sides plano-parallel to moderately convex; initial coils streptospirally wound with final one and a half to two coils evolute, more open with less departure from the plane of symmetry; open lumina of the outer whorls increase moderately in size, are of semilunular outline and have slightly convex floors extending to the edges of the wall; wall composed of an outer fibrous layer and a poorly developed, frequently absent, inner layer.

Measurements. — (Based on ten specimens). Number of volutions: 5-6?. Diameter: 192.50-273.75μ. Width: (based on nine specimens): 52.50-91.25μ. Ratio W/D: 0.275-0.388. Proloculus (based on two specimens): 7.50-10.00μ. Height of lumen last volution: 12.50-25.00μ. Wall thickness: 7.50-11.25μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — North American — Visean (V3bβ-δ) — lower Namurian. USSR — Visean (late V3c) — Baschkirian. Morocco — Visean (V3c) of Akerchi.

Remarks. — This species has been confused in the literature with a number of similar species. This is perhaps due to the lack of clearly defined illustrations by the original authors. It differs from *N. (Nodasperodiscus) gregorii* (Grozdilova and Lebedeva) primarily in that the species *gregorii* has the lumina filled by nodes.

Bozorgnia (1973) identified specimens which we would assign to *N. (Nodasperodiscus) minimus* (Grozdilova and Lebedeva) as *Neoarchaediscus incertus*. The dimensions of Bozorgnia's specimens match those of *Neoarchaediscus incertus* but the lumina are, as he described them, filled with nodes.

Our forms conform well to the original description given by

Grozdilova and Lebedeva although the specimens are more uniform in size.

Nodosarchaediscus (Neoarchaediscus) latispiralis (Grozdilova and Lebedeva), 1953 Pl. 24, figs. 7-9

Archaediscus latispiralis Grozdilova and Lebedeva (*in* Dain and Grozdilova), 1953, pp. 102-103, pl. 3, fig. 17.
Neoarchaediscus latispiralis (Bogush and Yuferev), 1962, p. 207, pl. 9, fig. 16; Bogush and Yuferev, 1966, p. 160, pl. 11, fig. 23.
Archaediscus aff. *latispiralis* Grozdilova and Lebedeva, Conil and Lys, 1964, p. 122, pl. 18, fig. 360.
Archaediscus? (Rugosarchaediscus) latispiralis Grozdilova and Lebedeva, Bozorgnia, 1973, p. 120, pl. 27, figs. 1-6.

Holotype. — All Union Petrol. Sci. Res. Geol. Prospect. Inst., No. 2292.

Original description. — The test is disc-shaped with broadly rounded periphery and nearly parallel sides, involute with the exception of the last coil. The ratio of the width to the diameter is rather constant within the limited range of 0.40:1-0.50:1.

The exterior surface is predominantly smooth with only slight unevenness. Dimensions (in mm): diameter of the test 0.28-0.36, Width 0.12-0.20, Number of coils: 4-7.

The proloculus is spheric with a diameter of 0.029 mm. The tubular chamber is very tightly coiled initially in planes which are displaced in respect to the axis of coiling. The height of the lumen of the final coil ranges from 0.035-0.058 mm.

The wall is bright, consisting of two layers with the bright, glassy radial layer more pronounced. The wall thickness of the final coil ranges from 0.015-0.022 mm.

This species belongs to the group *Archaediscus baschkiricus* Krestovnikovi and Theodorovich. The distinguishing features of the species are as follows:

1. The presence of two clearly distinct growth stages — the initial globular shape and a later more freely coiled planispiral one.
2. The unique form of the test. This species resembles *Archaediscus baschkiricus* Krest. and Theod. in its early stages of growth. Mature specimens differ in the shape of the test as well as in the manner of coiling of the final whorls.

Diagnosis. — Test small, discoidal to lenticular with well-rounded periphery, surface somewhat uneven; coiling of tubular chamber streptospiral with the initial coils involute and tightly wound with stellate outline formed by small pointed nodes, final one to one and a half coils evolute, more freely wound and open, with less departure from the plane of symmetry; wall two layers with an outer bright well-developed finely fibrous layer and a poorly developed inner dark layer.

Measurements. — (Based on six specimens). Number of volutions: not determinable. Diameter: 122.50-198.75μ. Width: 62.50-86.25μ. Ratio W/D: 0.43-0.51. Proloculus (based on one specimen): 26.66μ. Height of lumen last volution (based on five specimens):

10.00-18.75μ. Peripheral wall thickness (based on five specimens): 8.75-11.25μ.

Coiling. — Oscillating.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (late V3c), this report. USSR — Visean (middle) dominantly Baschkirian. Belgium — Visean (V3bδ). Iran — Visean (V3b to V3c).

Remarks. — Our specimens resemble the type specimen in shape and manner of coiling. The inner coils are so tightly wound that it is difficult to accurately determine the number of volutions. We estimate a range with a minimum of three and a maximum of five. Specimens with the number of whorls in the lower part of this range happen to be better preserved in our material and in axial sections show a marked likeness to the axial section illustrated by Bogush and Yuferev (1966, pl. 11, fig. 23). Likewise, our specimens are closer in size range and lumen height to those of Bogush and Yuferev. Bozorgnia's specimens (1973) are probably the same species or a subspecies. The dimensions are considerably larger than the type specimen, the nodes of the early whorls more pronounced and the final whorls more nearly planispiral.

Nodosarchaediscus (Neoarchaediscus) pohli, Browne, n. sp.
Pl. 24, figs. 10-12

Archaediscus (?) *minimus* Grozdilova and Lebedeva, 1954, pp. 62, 63, pl. 7, fig. 16.

Not *Archaediscus minimus* Grozdilova and Lebedeva, (*in* Dain and Grozdilova), 1953, pp. 111, 112, pl. 4, fig. 15.

Not *Planospirodiscus minimus* (Grozdilova and Lebedeva), Sosipatrova, 1962, pp. 64, 65, pl. 5, figs. 22-24.

Planospirodiscus sulcus (Grozdilova and Lebedeva), Brenckle, 1973, p. 65, pl. 9, figs. 35-37.

Holotype. — USNM (Nat. Mus. Nat. Hist.), No. 244618.

Diagnosis. — Test small with planoparallel to slightly convex sides and well-rounded periphery; initial coils involute, tightly wound and angled, forming a stellate outline; final coils more freely wound, as many as four of which may be evolute; crenulated edges of arch-shaped walls fill the lumina, except for the final two coils, which are open and free; lumen height of final coil nearly double the wall thickness; walls two layered with an outer thick, fibrous layer and a thin dark microgranular layer.

Measurements. — (Based on six specimens). Number of volutions: 5-5½?. Diameter: 202.30-260.00μ. Width: (based on five specimens) 65-88μ. Ratio W/D: 0.29-0.33. Proloculus (based on two specimens): 16-18μ. Height of lumen last volution (based on five specimens): 15.00-20.60μ. Peripheral wall thickness (based on five specimens): 6.90-11.40μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (late V3b) — Baschkirian. USSR — Baschkirian.

Remarks. — The present species has been confused in the literature with *Archaediscus minimus* Grozdilova and Lebedeva (*in* Dain and Grozdilova, 1953) which we now consider to belong to the subgenus *(Nodasperodiscus)*. This is probably due to the somewhat arch-shaped outline of the lumina of the planispiral coils. Our specimens are of similar size range and proportion to *Archaediscus*? *minimus* Grozdilova and Lebedeva, 1954.

We have noted a resemblance of this species to *Planospirodiscus sulcus* in Brenckle (1973, p. 65, pl. 9, figs. 35-37). We do not concur in Brenckle's generic assignment of this species. We would assign it to the subgenus *Neoarchaediscus*. *P. sulcus* has the outer whorls free and open. An examination of the types shows what appears to be stellate central coiling.

The final whorl of *Nod. (Neoarchaediscus) pohli* has a tendency to inflate as does *P. sulcus*, but the lumina of the latter forms are higher and the ratio of width to diameter is greater.

This species and those previously assigned conditionally to *A. minimus* of authors can be readily separated at the subgeneric level. The final two coils of the present species are open and free which distinguishes *(Neoarchaediscus)*. Grozdilova and Lebedeva (*in* Dain and Grozdilova, 1953) described *A. minimus* as having a wall thickness "about as high" as the height of the lumen.

This species is named in honor of the late Dr. E. R. Pohl who collected the material on which this report is based.

Nodosarchaediscus (Neoarchaediscus) sp. Pl. 24, fig. 16

Figured specimen. — USNM (Nat. Mus. Nat. Hist.), No. 244623.

Diagnosis. — Test small with nearly flat, planoparallel sides and angularly rounded periphery; surface rough; proloculus, hard to distinguish, is surrounded by a tightly coiled tubular chamber, streptospirally wound and initially showing stellate structure with the final two coils becoming planispiral; lumina increase slowly in size and become broader and more semicircular toward the peripheral ends; floors of lumina are nearly flat in final whorls and they extend to edges of the walls; wall is thick, clear and fibrous.

Measurements. — (Based on one specimen). Number of volutions: five?. Diameter: 210μ. Width: 75μ. Ratio W/D: 0.36. Proloculus: indeterminable. Height of lumen last volution: 11.45μ. Peripheral wall thickness: 11μ.

Coiling. — Aligned.

Coiling stage. — Angulatus.

Stratigraphic range. — Unknown — Visean (late V3c), this report.

Remarks. — This species in rough outline and size bears resemblance to *Asteroarchaediscus rugosus* (Rauzer-Chernoussova) from which it is differentiated at the subgeneric level. We believe our specimen to be *(Neoarchaediscus)* because the final two to two and half coils are open, lack nodes, and are flat-floored.

Nodosarchaediscus (Neoarchaediscus) timanicus Reitlinger, 1949
Pl. 24, figs. 13-15

Archaediscus timanicus Reitlinger, 1949, p. 163, pl. 1, figs. 7a, b, c; Grozdilova and Lebedeva, (*in* Dain and Grozdilova), 1953, p. 109, pl. 3, figs. 18-20.
Neoarchaediscus timanicus (Reitlinger) Sosipatrova, 1962, p. 62, pl. 5, fig. 11; Brazhnikova, *et al.,* 1967, pl. 25, fig. 3; Vdovenko, 1968, pl. 2, fig. 25; Hewitt and Conil, 1969, pl. 2, figs. 28, 29.

Holotype. — Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow, No. 3278/12.

Original description. — The test is not large with flattened or poorly convex sides and dull, rounded periphery. The last half of the tubular coil is evolute. The dimensions of the diameter range from 0.11-0.25 mm. The width ranges from 0.062-0.11 mm. The ratio of the width to the diameter varies from 0.37-0.55. The proloculus is spherical in shape with an interior diameter of 18-31 microns. The tubular chamber has 5-6 coils, the first two to three of which oscillate sharply from the axis of coiling, with the final coils wound in a nearly flat spiral. The lumina of the chamber are semi-lunular. The height of the lumina of the first coils is equal to the thickness of the wall while the height of the lumina of the last two to three coils exceeds the thickness of the wall. The height of the lumen of the last coil is 24-31 microns. Angular projections are formed by the bending of the early coils with their conjunction with the wall. This feature gradually disappears in the outer coils. The interior coils, due to the angularity of the coiling, are characteristic of the group *Archaediscus* *baschkiricus* of similar stellate contour. The wall is bright, poorly radial and thickened laterally. The thickness of the wall of the last coil is 6.5-12, sometimes 18 microns.

Comparison. — This form has the features characteristic of the group *Archaediscus baschkiricus* and *Archaediscus krestovnikovi.* It is similar to the first by the angularity of the coils and to the second by the well-defined lumina of the beginning coil to the smooth one-two last coils. Evolution shows a tendency to the diminishing of dimensions, thinning of the walls and larger to smaller thickening of the test. The specimens from the upper part of the upper Kayal horizon and the bottom of the Verey have average dimensions for the diameter of 0.11-0.17 mm and for the wall thickness 6-9 microns.

Diagnosis. — Test small with slightly convex sides and rounded peripheral margins; initial two to three coils tightly and streptospirally wound producing serrated outlines; final coils approximate the plane of symmetry with one to one and a half coils evolute; lumina with semilunular outline and slightly convex floors increase moderately in size; wall is clear and fibrous.

Measurements. — (Based on eight specimens). Number of volutions (based on three specimens): 4-6?. Diameter: 170.00-218.75μ. Width: 60.00-87.50μ. Ratio W/D: 0.33-0.41. Proloculus: (based on three specimens) 15.00-18.60μ. Height of lumen final volution: 13.75-17.00μ. Peripheral wall thickness: 7.00-13.75μ.

Coiling. — Slightly oscillating.

Coiling stage. — Angulatus.

Stratigraphic range. — North America Visean (late V3c) — Namurian (Pennington). USSR — Baschkirian with isolated examples in early Vesean.

Remarks. — Our specimens compare favorably with Reitlinger's. The height of the lumina measures from a third to double the wall thickness. Grozdilova (*in* Dain and Grozdilova, 1953) gave a lumen height of double to three times the wall thickness. In the sharply serrated edges of the wall outline of the initial coils the species resembles *(Neoarchaediscus) incertus.* It differs from *N. incertus* by its smaller size, less symmetrical form, a larger ratio of width to diameter, a lesser lumen height, and a generally smaller proloculus.

Subgenus **ASTEROARCHAEDISCUS** Miklukho-Maklay, 1956

Type species: *Archaediscus baschkiricus* Krestovnikov and Theodorovitch, 1936.

Original description. — The tests assume differing shapes, generally with somewhat uneven surface. The coiling is streptospiral, streptospiral to flat spiral or only flat spiral. Due to the sharp turns of the tubular chamber the contour presents a stellate outline. The height of the lumina is several times smaller than the wall thickness between corresponding coils. The wall is thinly porous. (Miklukho-Maklay, 1956, p. 10).

Diagnosis. — *Nodosarchaediscus* characterized by the almost total occlusion of the lumina and the barely discernable to complete disappearance of the internal dark layers. Unless the enrollment is aligned it is difficult to determine. Only the last coil may show a free lumen. The radial layers completely cover all the coils and are well developed. (Pirlet and Conil, 1974, p. 270).

Nodosarchaediscus (Asteroarchaediscus) parvus (Rauzer-Chernoussova), 1948 Pl. 24, figs. 17-20

Archaediscus parvus Rauzer-Chernoussova, 1948a, p. 233, pl. 16, figs. 9-12; Grozdilova (*in* Dain and Grozdilova), 1953, pp. 104, 105, pl. 4, fig. 6; Malakova, 1956, p. 41, pl. 3, figs. 4, 5.

Neoarchaediscus parvus (Rauzer-Chernoussova), Miklukho-Maklay, 1956, p. 11; Mamet 1973, pl. 4, figs. 20, 21.

Neoarchaediscus cf. *N. parvus* (Rauzer-Chernoussova), Brenckle, 1973, pl. 9, figs. 11-15.

Asteroarchaediscus parvus (Rauzer-Chernoussova), Vdovenko, 1968, pl. 2, fig. 21.

Holotype. — Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow, fig. 10.

Original description. — (Translated from the Russian in Ellis and Messina, supplement No. 1, 1958).

Diagnosis. — Test small, discoidal, surface uneven which imparts an irregular or serrated outline to axial sections; sides slightly convex to nearly parallel; periphery sharp and broadly rounded; interior coils involute, streptospirally and tightly wound producing flaring; final coils, one to two of which may be evolute, deviate only slightly from the plane of symmetry; lumina with low fissural openings except for the final coil, filled by irregular to chevron-shaped nodes, formed by the crenulated walls of the coils; wall clear, finely fibrous and moderately thick.

Measurements. — (Based on 12 specimens). Number of volution (based on seven specimens): 4-5. Diameter: 140.00-247.50μ. Width: 55.00-92.50μ. Ratio W/D: 0.335-0.40. Proloculus (based on five specimens): 7.00-11.60μ. Height of lumen last volution: (Based on 10 specimens) 0.00-20.00μ. Peripheral wall thickness: 7.00-18.75μ.

Test form. — Flat to lenticular.

Stratigraphic range. — North America — late Visean — Namurian. USSR — Visean (V3c) Oka — Venev — early Serpukhovian. France — Visean (V3b-V3c).

Remarks. — Our specimens match closely in size those of Rauzer-Chernoussova's type specimens with only two exceeding the given dimensions. The ratio of width to diameter is similar. The lumen height is equal or less than the wall thickness except for the final whorl. The author stated in describing this species "the chamber lumen *usually* equals the wall thickness." Her specimen figure 11, like some of ours, shows a high open lumen in the final coil. This feature appears to be common to the subgenus *Asteroarchaediscus.*

The authors have doubts that the *A. parvus regularis* Suleimanov, 1948 warrants the designation of a subspecies. Due to lack of a sufficient number of forms in our material we can not verify this. However, we do not consider the height of the frequently open lumen of the final whorl diagnostic. The smoother surface of the final whorls seems likewise, not to be a character confined to the subspecies. Some of our specimens have less rough walls than others in the final whorls.

Superficially this species resembles *(Asteroarchaediscus) rugosus* (Rauzer-Chernoussova), 1948 due to shape and roughness of the wall. *(Ast.) rugosus* has larger dimensions and is less symmetrical in outline.

Nodosarchaediscus (Asteroarchaediscus) postrugosus (Reitlinger), 1949
Pl. 25, figs. 1-3

Archaediscus postrugosus Reitlinger, 1949, p. 162, pl. 1, figs. 10a, c; Grozdilova *in* Dain and Grozdilova, 1953, pl. 4, figs. 9, 10.
Asteroarchaediscus postrugosus (Reitlinger) Brazhnikova, *et al.*, 1967, pl. 20, fig. 4 and pl. 21, figs. 2, 3; Aizenverg, Brazhnikova and Potievskaia, 1968, pl. 26, fig. 9; Bozorgnia 1973, p. 138, pl. 30, figs. 10-13, 19.
Neoarchaediscus postrugosus (Reitlinger), Hewitt and Conil, 1969, p. 178, pl. 2, figs. 16-23.

Holotype. — Repository not given — probably Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow No. 327/21.

Original description. — The shell is not large and has flat sides with full rounded periphery. The final coil in typical specimens is evolute and situated symmetrically in the plane of symmetry of the test. The dimensions of the diameter range from 0.17 to 0.34 mm, commonly 0.22-0.29 mm. The width ranges from 0.074-0.14 mm, usually 0.10-0.11 mm. The ratio of the width to the diameter is 0.30-0.54 and most frequently 0.35-0.42. The interior coils are densely wound in ball-shaped form. The lumina of the final coil are high and several times greater than the height of the wall thickness. The height in the final coil is 18-29 microns. Those of the penultimate whorl are much smaller, the height less than the wall thickness. The wall of the interior coils is thick while that of the final two is thin. Wall thickness varies from 6-15 microns.

Comparison. — This form is very characteristic with its interior tightly wound coils similar to *Archaediscus rugosus.* However, the evolute, final coil with its characteristic symmetry, evidenced in all specimens is the reason for considering this form a subsequent stage in the development of *Archaediscus rugosus.* From *Archaediscus parvus* Rauzer it differs by its larger dimensions, its less regular and poorly defined coiling of the interior coils and its rather thick wall. A similar and evidently convergent form which, however, belongs to another genetic line appears to be *Archaediscus parvus regularis* var. Suleimanov. Characteristic of the latter form are the high lumina in the two to three final coils (equal to or exceeding wall thickness), the smooth wall of the final coils (with this species only the final coil is smooth, the interior coils having the characteristic angular protrusion of *Archaediscus rugosus* along the periphery) and the more regular disposition of the interior coils.

Diagnosis. — Test small, lenticular, characteristically convex in outline, although occasional specimens may have a flattened contour, surface normally showing roughness along the sides caused by the angularity of the involute whorls; interior coils involute with the final one to two becoming evolute, all typically tightly wound except for the final coil which is distinguished by its free symmetrical coiling: lumen of the final whorl open and moderately high, remaining ones almost completely closed by prominent nodes which present a stellate outline; wall, without an apparent inner layer, is clear and fibrous.

Measurements. — (Based on seven specimens). Number of volutions (based on three specimens): 5-6?. Diameter: 212.50-235.00μ. Width: 63.75-77.50μ. Ratio W/D: 0.28-0.33. Proloculus: indeterminate. Height of lumen last volution: 18.30-25.50μ. Peripheral wall thickness (based on six specimens): 6.25-8.75μ.

Test form. — Flat to normally lenticular.

Stratigraphic range. — North America — late Visean — Namurian. USSR — late Visean — early Namurian and Baschkirian. Morocco — early Namurian.

Remarks. — *(Ast.) postrugosus* is larger than *(Ast.) rugosus*, generally more symmetrical, has higher open lumen, and a lesser wall thickness in the final evolute coil.

Nodosarchaediscus (Asteroarchaediscus) rugosus (Rauzer-Chernoussova), 1948 Pl. 25, figs. 4-8

Archaediscus rugosus Rauzer-Chernoussova, 1948b, p. 11, pl. 3, figs. 4-6; Grozdilova (*in* Dain and Grozdilova), 1953, pp. 103, 104, pl. 4, figs. 1-3.
Neoarchaediscus rugosus (Rauzer-Chernoussova), Sosipatrova, 1962, pp. 61, 62, pl. 5, figs. 12-14.
Asteroarchaediscus rugosus (Rauzer-Chernoussova), Bogush and Yuferev, 1962, p. 205, pl. 9, fig. 13; Brazhnikova, *et al.*, 1967, pl. 21, fig. 2; Popova, 1973, p. 57, pl. 9, figs. 7, 8; Bozorgnia, 1973, pp. 137, 138, pl. 30, figs. 14-16, 18-20.
Asteroarchaediscus rugosimilis Brenckle, 1973, p. 62, pl. 9, figs. 7-10.
?*Asteroarchaediscus gnomellus* Brenckle, 1973, p. 62, pl. 9, figs. 2-6.
Not *Asteroarchaediscus pustulus gnomellus* Brenckle, Vachard, 1975, pp. 63, 64.

Holotype. — Museum Inst. Geol. Sci. Acad. Sci., USSR, Moscow, fig. 5, No. 2834/49.

Original description. — (Translated from Ellis and Messina, supplement No. 2, 1958).

Diagnosis. — Test small, discoidal with a slightly rough surface and broadly rounded periphery, coils streptospirally wound with the initial coils more tightly wound than the final; involute except for the final one to one and a half coils which may be evolute, showing a tendency not to embrace the preceding coils; serrated nodes formed by the walls of the subjacent coils fill the lumina, with the exception of the final coil. The final coil may be partially or completely closed. In other instances, and not infrequently, it is open and free. Wall consists of a moderately thick, fibrous layer, and a poorly developed, sometimes absent inner dark layer.

Measurements. — (Based on 15 specimens). Number of volutions (two specimens): 4-5. Diameter: 140.00-207.50μ. Width: 65-90μ. Ratio W/D: 0.39-0.56. Proloculus (based on five specimens): 18.32-28.00μ. Height of lumen last volution (based on 15 specimens): 0.00-17.50μ. Peripheral wall thickness (based on nine specimens): 6.87-14.00μ.

Test form. — Flat to lenticular.

Coiling stage. — Angulatus.

Stratigraphic range. — North America — Visean (V3) — Namurian. USSR — Visean (V3) — early Namurian. Iran — Visean (V3) — early Namurian.

Remarks. — The majority of our specimens are under the minimum range limit given by Rauzer-Chernoussova. In all other respects, including ratio of width to diameter they seem similar. Rauzer-Chernoussova described her forms as having a lumen height in the last whorls of 15-20μ, rarely up to 25μ. The photographic illustration of her holotype, figure 5, does not give the appearance of having an open lumen. Her illustration of paratype, figure 4, shows the lumen of the final coil, at least in the northern hemisphere, to be only partially open. The remaining paratype, figure 6 (a saggital section) shows an open final lumen.

Brenckle compared his *Ast. rugosimilis* to *Archaediscus rugosus* Rauzer-Chernoussova. He differentiated them on the basis of the greater height of the lumina in the last volutions of *A. rugosus.* He attributed this greater height to the possibiliy that *A. rugosus* might belong to *Neoarchaediscus.* In Brenckle's description of *Ast. rugo-*

similis, based on six specimens, he stated "a few lumina in the later volution are slightly open but their height does not exceed the thickness of the surrounding wall."

Brenckle, likewise, observed in studying his species *Asteroarchaediscus gnomellus* that while most of his specimens have closed lumina the final lumen in a few specimens was high.

In studying the various species of *(Asteroarchaediscus)* the authors have noted that variability in height of the final lumen in a species seems to be a feature pertinent to the subgenus and can be noted in some other species than those mentioned above.

We believe *(Asteroarchaediscus) rugosimilis* is a junior synonym for *(Ast.) rugosus.* Brenckle's illustrations of *Ast. rugosimilis* compare well with Rauzer-Chernoussova's holotype of *A. rugosus.*

Asteroarchaediscus gnomellus Brenckle was distinguished from *Ast. rugosimilis* on the basis of its somewhat smaller size and greater width to diameter ratio. We now believe *(Ast.) gnomellus* is probably also a junior synonym of *(Ast.) rugosus.* Our specimens encompass the dimensions and width to diameter ratio of both Brenckle's species *Ast. rugosimilis* and *Ast. gnomellus.* We have, however, questioned the placement of *Ast. gnomellus* in the above synonym because Brenckle now feels (personal communication) that while *Ast. rugosimilis* may be synonymous with *Ast. rugosus* our specimens are transitional between his species *Ast. rugosimilis* and *Ast. gnomellus.*

Differences between this species and *(Ast.) postrugosus* are given under the description of the latter species. *(Ast.) rugosus* differs from *(Ast.) parvus* in having nodes that are more sharply serrated or angular. *(Ast.) rugosus* is also less symmetrical with the coils deviating more from the plane of symmetry.

Nodosarchaediscus (Asteroarchaediscus) syzranicus (Chernysheva), 1948
Pl. 25, fig. 9

Permodiscus syzranicus Chernysheva, 1948, p. 156, pl. 2, fig. 10.
Permodiscus syzranicus Chernysheva, Grozdilova and Lebedeva (*in* Dain and Grozdilova) p. 114, pl. 4, fig. 21.

Holotype.—Not given, probably Geol. Res. Inst., Leningrad, No. 2640.

Original description.—(Translated from the Russian in Ellis and Messina, supplement No. 1, 1958).

Diagnosis. — Test lenticular with well-rounded periphery and slightly convex sides; initial coils, deviating slightly from the plane of symmetry, are tightly wound and involute while the final coil is evolute; proloculus indeterminate in this single specimen; lumina are low and filled with nodes except for the final coil which is open and has a high lumen; nodes, formed by the crenulate walls of the preceding coils are numerous, small, finely and sharply serrated; wall, which thickens toward center of the test, is composed of a clear, thinly porous layer, and a little perceptible dark layer.

Measurements. — (Based on one specimen). Number of volutions: five?. Diameter: 197.50μ. Width: 80μ Ratio W/D: 0.40. Proloculus: not determinable. Height of lumen last volution: 16.25μ. Peripheral wall thickness: 11.25μ.

Test form. — Flat to lenticular.

Stratigraphic range. — North America — Visean (late V3c), this report. USSR — Visean (V3c).

Remarks. — This species was placed in the genus *Permodiscus* by Chernysheva due apparently to the side thickenings of the wall and the fact she considered the coiling to be planispiral. Because this form has a barely detectable inner dark layer, is without lateral corner fillings or contreforts (*sensu* Conil) and the lumina are filled by nodes the authors consider the generic designation in error. Moreover, the initial coils, though small, appear to deviate from the planispiral plane.

The distinguishing feature of this species we consider to be the extremely small, finely serrated nodes.

Subfamily **AMMARCHAEDISCINAE** Conil and Pirlet, 1974

Archaediscidae without internal division, with planispiral enrollment. Wall similar to that of the Archaediscinae. (Pirlet and Conil, 1974, p. 271.)

Genus **AMMARCHAEDISCUS** Conil and Pirlet, 1974

Type species: *Ammarchaediscus (Amm.) bozorgniae* Conil and Pirlet, 1974.

Diagnosis. — Ammarchaediscinae possessing free lumina, without nodes or stellate structure. Dark internal layer very pronounced to imperceptible; external radial layer developed in the axial region only or throughout the test. Coiling involute to evolute. (Pirlet and Conil, 1974, p. 271.)

Subgenus A Conil and Pirlet, 1974

Diagnosis.—*Ammarchaediscus* with the dark inner layer moderately to feebly developed, without lateral corner fillings (*sensu* Conil). The exterior radial layer completely envelopes all the coils. Enrollment involute and the lumina cresent shaped in the primitive forms; enrollment more or less evolute and the floors of the lumina concave in the evolved forms. (Pirlet and Conil, 1974, p. 278).

Ammarchaediscus (subgenus **A**) sp. Pl. 25, fig. 10

Figured specimen.—USNM (Nat. Mus. Nat. Hist.), No. 244637.

Diagnosis.—Test small, discoidal with greatest thickening at axis of coiling, surface slightly rough; coiling dominantly planispiral with slight oscillation in one hemisphere; inner coils involute and final two evolute; open lumina of semilunular shape increase progressively in size becoming both broader and higher; floors flat with epaulets or extensions on the walls which are more pronounced on the later whorls; outer fibrous wall, covering all the whorls, thickens approximately three and a half times in width from margin of test to the center where it appears fused by the involute whorls; dark microgranular, inner wall present in inner whorls is little perceptible in outer whorls.

Measurements.—(Based on one specimen). Number of volutions: five?. Diameter: 271.25μ. Width: 105μ. Ratio W/D: 0.387. Proloculus: not determinable. Height of lumen last volution: 23.75μ. Peripheral wall thickness: 8.75μ.

Coiling form.—Planispiral.

Coiling stage.—Angulatus.

Straitigraphic range.—Unknown. North America — Visean — (late V3c), this report.

Remarks.—This species of *Ammarchaediscus* is at an advanced evolutionary stage of the genus *Ammarchaediscus* with the flat floors which appear at the same horizon in the genus *Archaediscus*. It is a good example of the angulatus stage.

This species belongs to Conil and Pirlet subgenus *A* (1974, p. 278, pl. 3, figs. 37-40). Our forms give the appearance of being the same as *Permodiscus vetustus* Chernysheva (1948, fig. 15) and Grozdilova and Lebedeva (*in* Dain and Grozdilova, 1953, pl. 4, fig. 23). The latter specimen was designated as lectotype for the species *P. vetustus* because Chernysheva, who described the species, had never chosen a holotype. Unfortunately, the center coils are not exposed in the specimen selected as holotype so it can not be used.

Subgenus **TUBISPIRODISCUS** Browne and Pohl, 1973

Type species: *Tubispirodiscus simplissimus* Browne and Pohl, 1973.

Diagnosis. — Test free, flattened, concave, discoidal with the narrowest dimension through the axis of revolution; composed of a proloculus followed by a freely coiled undivided chamber which is planispirally enrolled and entirely evolute throughout; periphery well-rounded and surface somewhat uneven with evident sutures; side thickenings absent; wall bright calcareous composed of a single fibroradiate layer only; aperture a circular opening at the end of the tube. (Browne and Pohl, 1973, p. 202).

Ammarchaediscus (Tubispirodiscus) simplissimus (Browne and Pohl), 1973
Pl. 25, figs. 11-13

Tubispirodiscus simplissimus Browne and Pohl, 1973, pp. 202, 203, pl. 25, figs. 10-12; pl. 26, figs. 1-3.

Holotype. — USNM (Nat. Mus. Nat. Hist.), No. 186634.

Coiling form. — Planispiral.

Coiling stage. — Evolutus.

Stratigraphic range. — North America — Visean (V3c).

Remarks. — Because these specimens are the same as those published previously by the authors no description is given.

Ammarchaediscus (Tubispirodiscus) sp. Pl. 25, figs. 14, 15

Diagnosis. — Test small, surface somewhat uneven; initial chamber followed by tubular chamber wound in a planispiral plane, wall a single, bright, fibroradiate, moderately thick layer.

Measurements. — (Based on three specimens). Number of volutions: 4-5½. Diameter: 230-255μ. Width: not determined. Ratio W/D: not determined. Height of lumen last volution: 25.00-39.50μ. Peripheral wall thickness: 9.00-11.60μ.

Coiling form. — Planispiral.

Coiling stage. — Not determined.

Stratigraphic range. — North America — Visean (late V3c), this report.

Remarks. — Because the three sections which form the basis for the above description are all sagittal sections it is presently im-possible to give a complete diagnosis of this species. It differs from the type specimen of *(Tubispirodiscus) simplissimus* Browne and Pohl, in its larger size, having a final lumen height, and wall thickness approximately double that of the type specimen.

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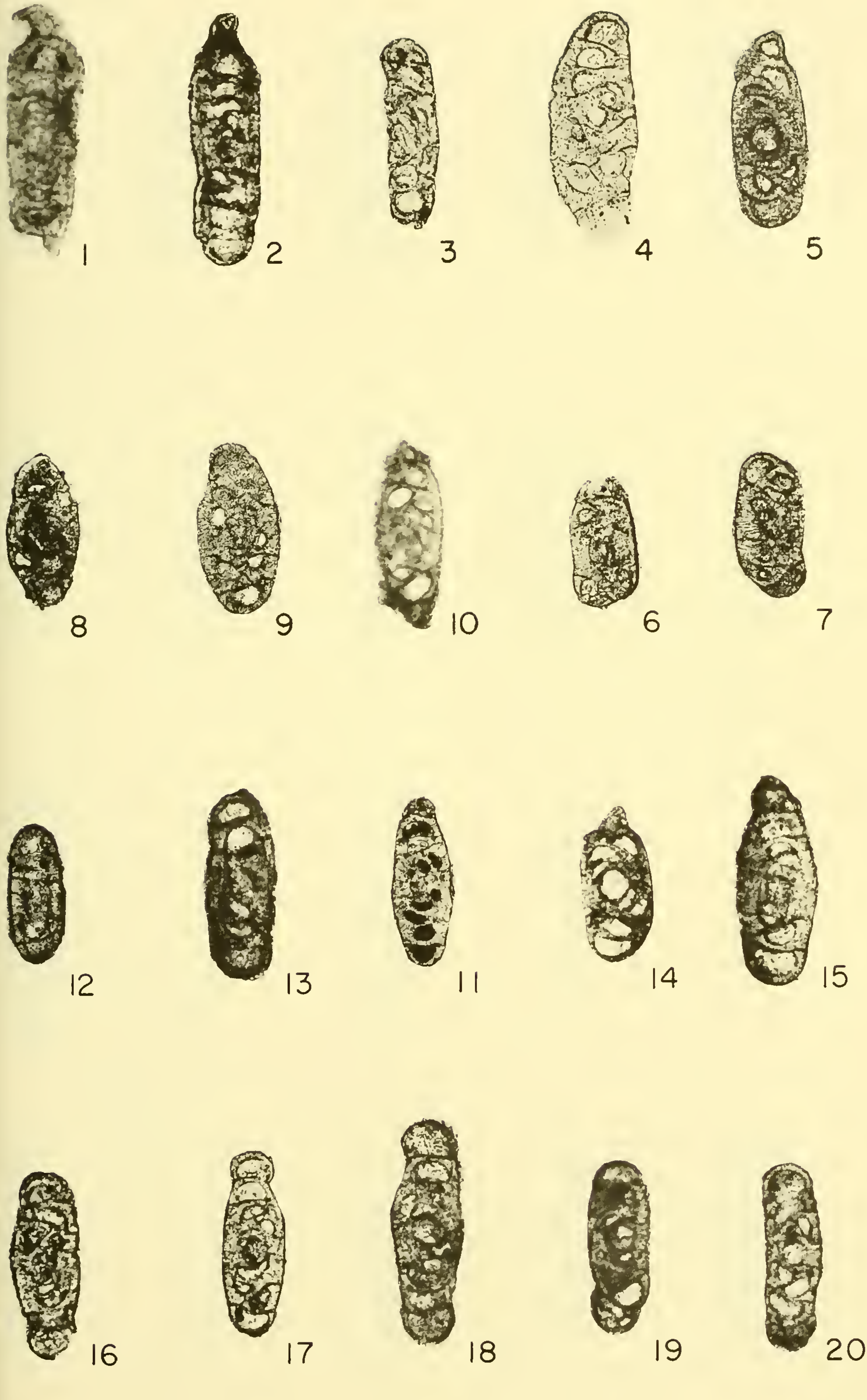
PLATES

EXPLANATION OF PLATE 22
All × 140

Figure		Page
1.	**Archaediscus** cf. **absimilis** (Sosipatrova) .... Axial section, USNM No. 244568.	179
2.	**Archaediscus** cf. **absimilis** (Sosipatrova) .... Axial section, USNM No. 244569.	179
3.	**Archaediscus** cf. **absimilis** (Sosipatrova) .... Tangential section, USNM No. 244570.	179
4.	**Archaediscus (Archaediscus) chernoussovensis** Mamet .... Axial section through proloculus, USNM No. 244571.	180
5.	**Archaediscus (Archaediscus) conili,** n. sp. .... Axial section through proloculus, paratype, USNM No. 244572.	181
6.	**Archaediscus (Archaediscus) conili,** n. sp. .... Axial section, paratype, USNM No. 244573.	181
7.	**Archaediscus (Archaediscus) conili,** n. sp. .... Axial section, paratype, USNM No. 244574.	181
8.	**Archaediscus (Archaediscus) infantus** Shlykova .... Axial section, USNM No. 244575.	182
9.	**Archaediscus (Archaediscus) infantus** Shlykova .... Axial section through proloculus, USNM No. 244576.	182
10.	**Archaediscus (Archaediscus) krestovnkovi** Rauzer-Chernoussova .... Axial section, USNM No. 244577.	184
11.	**Archaediscus (Archaediscus) krestovnikovi** Rauzer-Chernoussova .... Axial section, USNM No. 244578.	184
12.	**Archaediscus (Archaediscus) miklukhomaklayi,** n. sp. .... Axial section, paratype, USNM No. 244579.	185
13.	**Archaediscus (Archaediscus) miklukhomaklayi,** n. sp. .... Axial section, paratype, USNM No. 244580.	185
14.	**Archaediscus (Archaediscus)** ex. gr. **moelleri** Rauzer-Chernoussova .... Axial section, through proloculus, USNM No. 244581.	186
15.	**Archaediscus (Archaediscus) pusillus** Rauzer-Chernoussova ...... Axial section, through proloculus, USNM No. 244582.	187
16.	**Archaediscus (Archaediscus) pusillus** Rauzer-Chernoussova ...... Axial section, through proloculus, USNM No. 244583.	187
17.	**Archaediscus (Archaediscus) pusillus** Rauzer-Chernoussova ...... Axial section, through proloculus, USNM No. 244584.	187
18.	**Archaediscus (Archaediscus) pusillus** Rauzer-Chernoussova ...... Axial section, through proloculus, USNM No. 244585.	187
19.	**Archaediscus (Archaediscus) pusillus** Rauzer-Chernoussova ...... Axial section, through proloculus, USNM No. 244586.	187
20.	**Archaediscus (Archaediscus) pusillus** Rauzer-Chernoussova ...... Axial section, through proloculus, USNM No. 244587.	187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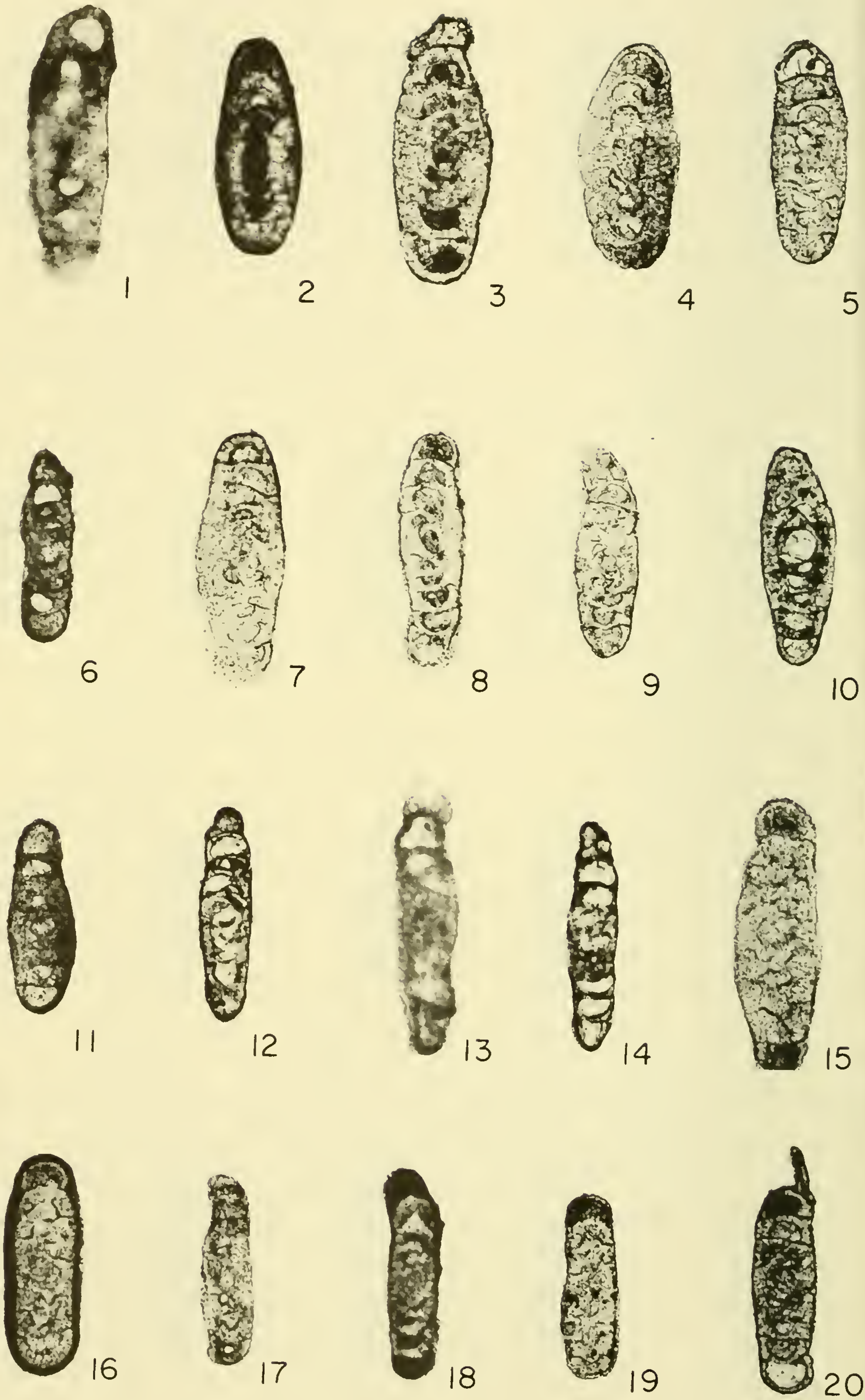
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10
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13
14
15
16
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18
19
20

EXPLANATION OF PLATE 23

Figure | Page

1. **Archaediscus (?Hemiarchaediscus) swanni,** n. sp. 190
   Axial section, paratype, USNM No. 244588.

2. **Archaediscus (?Hemiarchaediscus) swanni,** n. sp. 190
   Axial section, paratype, USNM No. 244589.

3. **Archaediscus (?Hemiarchaediscus) swanni,** n. sp. 190
   Axial section, holotype, USNM No. 244590.

4. **Archaediscus (?Hemiarchaediscus) swanni,** n. sp. 190
   Axial section, through proloculus, USNM No. 244591.

5. **Archaediscus (?Hemiarchaediscus) swanni,** n. sp. 190
   Axial section, paratype, USNM No. 244592.

6. **Archaediscus (?Hemiarchaediscus) cornuspiroides** Vdovenko .. 191
   Axial section, through proloculus. USNM No. 244593.

7-14. **Archaediscus (?Hemiarchaediscus) stilus** Grozdilova and Lebedeva 192
   All axial sections, showing progressive evolutionary tendencies from the more typical angulatus stage of figure 7 to the near tenuis stage of figure 14. 7. USNM No. 244594. 8. USNM No. 244595. 9. USNM No. 244596. 10. USNM 244597. 11. USNM No. 244598. 12. At this magnification radial wall apparent only in central part of test-angulatus stage tending to tenuis stage. USNM No. 244599. 13. At this magnification radial wall apparent only in central part of test-angulatus stage but less radial and tending more towards tenuis stage than figure 10. USNM No. 244600. 14. Near tenuis stage with wall of approximately uniform thickness. Shows tendency of floors to become convex, wall porosity little apparent. USNM No. 244601.

15. **Nodosarchaediscus (Nodasperodiscus) gregorii** Dain 195
   Axial section, through proloculus, USNM No. 244602.

16. **Nodosarchaediscus (Nodasperodiscus) gregorii** Dain 195
   Axial section, through proloculus, USNM No. 244603.

17. **Nodosarchaediscus (Nodasperodiscus) minimus** Grozdilova and Lebedeva 197
   Axial section, through proloculus, USNM No. 244604.

18. **Nodosarchaediscus (Nodasperodiscus) minimus** Grozdilova and Lebedeva 197
   Axial section, USNM No. 244605.

19. **Nodosarchaediscus (Nodasperodiscus) minimus** Grozdilova and Lebedeva 197
   Axial section, USNM No. 244606.

20. **Nodosarchaediscus (Neoarchaediscus) bykovensis** Sosipatrova .. 199
   Axial section, through proloculus, USNM No. 244607.

EXPLANATION OF PLATE 24

All × 140

Figure — Page

1. **Nodosarchaediscus (Neoarchaediscus) bykovensis** Sosipatrova .. 199
   Axial section, USNM No. 244608.
2. **Nodosarchaediscus (Neoarchaediscus) bykovensis** Sosipatrova .. 199
   Axial section, through proloculus, USNM No. 244609.
3. **Nodosarchaediscus (Neoarchaediscus) incertus** Grozdilova and Lebedeva 200
   Axial section, USNM No. 244610.
4. **Nodosarchaediscus (Neoarchaediscus) incertus** Grozdilova and Lebedeva 200
   Axial section, USNM No. 244611.
5. **Nodosarchaediscus (Neoarchaediscus) incertus** Grozdilova and Lebedeva 200
   Axial section, USNM No. 244612.
6. **Nodosarchaediscus (Neoarchaediscus) incertus** Grozdilova and Lebedeva 200
   Axial section, USNM No. 244613.
7. **Nodosarchaediscus (Neoarchaediscus) latispiralis** Grozdilova and Lebedeva 202
   Axial section, USNM No. 244614.
8. **Nodosarchaediscus (Neoarchaediscus) latispiralis** Grozdilova and Lebedeva 202
   Axial section, USNM No. 244615.
9. **Nodosarchaediscus (Neoarchaediscus) latispiralis** Grozdilova and Lebedeva 202
   Axial section, through proloculus, USNM No. 244616.
10. **Nodosarchaediscus (Neoarchaediscus) pohli,** n. sp. 203
    Axial section, through proloculus, paratype, USNM No. 244617.
11. **Nodosarchaediscus (Neoarchaediscus) pohli,** n. sp. 203
    Axial section, through proloculus, holotype, USNM No. 244618.
12. **Nodosarchaediscus (Neoarchaediscus) pohli,** n. sp. 203
    Axial section, paratype, USNM No. 244619.
13. **Nodosarchaediscus (Neoarchaediscus) timanicus** Reitlinger 205
    Axial section, USNM No. 244620.
14. **Nodosarchaediscus (Neoarchaediscus) timanicus** Reitlinger 205
    Axial section, USNM No. 244621.
15. **Nodosarchaediscus (Neoarchaediscus) timanicus** Reitlinger 205
    Axial section, USNM No. 244622.
16. **Nodosarchaediscus (Neoarchaediscus)** sp. 204
    Axial section, USNM No. 244623.
17. **Nodosarchaediscus (Asteroarchaediscus) parvus** Rauzer-Chernoussova 207
    Axial section, through proloculus, USNM No. 244624.
18. **Nodosarchaediscus (Asteroarchaediscus) parvus** Rauzer-Chernoussova 207
    Axial section, USNM No. 244625.
19. **Nodosarchaediscus (Asteroarchaediscus) parvus** Rauzer-Chernoussova 207
    Axial section, USNM No. 244626.
20. **Nodosarchaediscus (Asteroarchaediscus) parvus** Rauzer-Chernoussova 207
    Axial section, through proloculus, USNM No. 244627.


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12
13
14
16
15

EXPLANATION OF PLATE 25

All × 140

Figure | Page

1. **Nodosarchaediscus (Asteroarchaediscus) postrugosus** Reitlinger 208
   Axial section, USNM No. 244628.
2. **Nodosarchaediscus (Asteroarchaediscus) postrugosus** Reitlinger 208
   Axial section, USNM No. 244629.
3. **Nodosarchaediscus (Asteroarchaediscus) postrugosus** Reitlinger 208
   Axial section, USNM No. 244630.
4. **Nodosarchaediscus (Asteroarchaediscus) rugosus** Rauzer-Chernoussova 209
   Axial section, through proloculus, USNM No. 244631.
5. **Nodosarchaediscus (Asteroarchaediscus) rugosus** Rauzer-Chernoussova 209
   Axial section, USNM No. 244632.
6. **Nodosarchaediscus (Asteroarchaediscus) rugosus** Rauzer-Chernoussova 209
   Axial section, through proloculus, USNM No. 244633.
7. **Nodosarchaediscus (Asteroarchaediscus) rugosus** Rauzer-Chernoussova 209
   Axial section, through proloculus, USNM No. 244634.
8. **Nodosarchaediscus (Asteroarchaediscus) rugosus** Rauzer-Chernoussova 209
   Axial section, USNM No. 244635.
9. **Nodosarchaediscus (Asteroarchaediscus) syzranicus** Chernysheva 211
   Axial section, USNM No. 244636.
10. **Ammarchaediscus** (Subgenus A) sp. Conil and Pirlet 213
   Axial section, USNM No. 244637.
11. **Ammarchaediscus (Tubispirodiscus) simplissimus** Browne and Pohl 214
   Axial section, through proloculus, USNM No. 186635.
12. **Ammarchaediscus (Tubispirodiscus) simplissimus** Browne and Pohl 214
   Sagittal section, through proloculus, USNM No. 186636.
13. **Ammarchaediscus (Tubispirodiscus) simplissimus** Browne and Pohl 214
   Sagittal section, through proloculus, USNM No. 186634.
14. **Ammarchaediscus (Tubispirodiscus)** sp. 214
   Sagittal section, through proloculus, USNM No. 244638.
15. **Ammarchaediscus (Tubispirodiscus)** sp. 214
   Sagittal section, through proloculus, USNM No. 244639.
16. **Archaediscus** sp. [new subgenus] 194
   Axial section, through proloculus, USNM No. 244640.

INDEX

Note: Light face type refers to page numbers. Bold face type refers to plate figures.

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By

Norman E. Weisbord

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CONTENTS

SCALPELLID BARNACLES (CIRRIPEDIA) OF FLORIDA AND OF SURROUNDING WATERS

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ABSTRACT

This work is an annotated inventory of the barnacles of the family Scalpellidae occuring in and immediately off Florida as well as in the surrounding waters of the Gulf of Mexico, the Caribbean Sea, and the Western Atlantic Ocean. Some 39 species are described, and data are submitted on their geographic range, depth of water, habitat, and substrate. The type specimen of each taxon described herein is illustrated from the original author's portrayal to facilitate comparison of all species as well as certain of those synonymized. All of the scalpellids discussed are living; however, one of the species, *Scalpellum gibbum* Pilsbry, has also been found in the early Pliocene of Florida, and another, *Arcoscalpellum michelottianum* (Seguenza) *s.s.*, occurs in the Pliocene of Italy and Sicily. It is believed that a number of species now known from the waters surrounding Florida will be found off Florida itself, and that a few more will eventually be discovered as fossils in the Southeastern Coastal Plain of the United States.

INTRODUCTION

This paper is the second of a series dealing with the barnacles of Florida and of the waters around it. The first of the series (Weisbord, 1975) dealt with the orders Acrothoracica and Rhizocephala, and the present one is concerned with the family Scalpellidae.

Most of the information contained in this work has been culled from published sources. Each species is described, and the type of the species re-figured from the author's own illustration. The type locality, the geographic range, the habitat, and the substrate are noted. Synonymies proposed by authors are listed, and it seems from this study that some of the synonymized species may have to be re-assigned to their original nomenclatural status.

Surrounding Florida are the Gulf of Mexico, the Caribbean Sea, and the Western Atlantic Ocean. Many of the scalpellids from these adjacent seas are described in this report even though their presence in Florida has not yet been verified. Nevertheless a number of species first recorded from the Gulf, Caribbean, or Western Atlantic have later been identified in Florida and there is every reason to believe that more of them will be in the future. Only one fossil scalpellid, *Scalpellum gibbum* Pilsbry, has been reported from the mainland of Florida, and this occurs in the *Ecphora* zone of the Jackson Bluff Formation, in Leon County. The age of the Jackson Bluff Formation is late Miocene or early Pliocene.

The present report is in part an updated inventory of the scalpellid species reported within the region under consideration. The generic classification of these species is based on the work of Withers

(1953) and of Newman, Zullo, and Withers (1969) in the Treatise on Invertebrate Paleontology. One of the taxonomic difficulties I have encountered is with the genus *Scalpellum sensu stricto*. Formerly, *Scalpellum sensu lato* included a host of species which today are properly assigned to many different scalpellid genera including *Scalpellum s.s.* Unfortunately all of the species under the "old" use of *Scalpellum* have not been sufficiently studied to determine whether they should be retained in *Scalpellum s.s.* or reassigned to another genus. In this work I employ the genus *Scalpellum* Leach *s.s.* a) for examples meeting the modern diagnosis of the genus; b) for examples named *Scalpellum* by the original author and not yet changed by later taxonomists; and c) for examples whose original generic name of *Scalpellum* is in doubt and which I have questioned, but whose correct identification has not yet been established. Many of the older scalpellid species discussed in the present report fall in the last category, although I think eventually some of them will be found to belong to genera other than *Scalpellum s.s.*

Briefly, *Scalpellum s.s.* of Leach consists generally of 14 plates, usually wholly calcified. The carina is angularly bent, with the umbo removed from the apex. The apical area and carinal side of the scutum are extended and alate, with the umbo removed from the apex, and the extended sides sometimes obscured by the overlapping tergum and upper latus. The inframedian latus is large with the umbo varying in position from middle to basal. As these external characters are not always apparent, especially in the whole animal with closely articulated valves or obscurative integument, careful examination of both the outer plates and inner organs is necessary for definitive identification.

ACKNOWLEDGMENTS

I am greatly indebted to former workers and contemporary cirripedologists for the considerable knowledge contained in, and imparted by their writings. I also wish to thank Katherine V. W. Palmer of the Paleontological Research Institution for editing and attending to matters relative to publication of this paper.

LIST OF SPECIES

Each species discussed in this report is listed in the tabulation below irrespective of the synonymous status of some of them. The latitudes and longitudes are predominantly those given by authors but a few have been obtained from reference points measured to scale in the mid-century edition of the "Times Atlas of the World." English and metric systems are used interchangeably in the body of the report depending more or less on the first usage by the taxonomist, but the depths of water given in the following list are expressed in meters. Considerable data contained in the records of the United States Fish Commission steamer "Albatross" have been adopted from the work of C. H. Townsend (1901).

DESCRIPTION OF SPECIES

Class CIRRIPEDIA Burmeister, 1834

Order THORACICA Darwin, 1854

Suborder LEPADOMORPHA Pilsbry, 1916

Family **SCALPELLIDAE** Pilsbry, 1916

Scalpellum (?) albatrossianum Pilsbry Pl. 26, fig. 1

Scalpellum tenue Annandale, 1905, p. 83; not of Hoek, 1883, p. 119, pl. 4, figs. 20-21, *fide* Broch, 1953, p. 6.

Scalpellum albatrossianum Pilsbry, 1907, pp. 47, 54-55, fig. 19; Annandale, 1908, pl. 3, fig. 10; 1913, pp. 228, 229, 232; 1916a, pp. 128, 130, pl. 6, fig. 9; 1916b, p. 282; Stubbings, 1936, pp. 56, 57, 62, 64, 66, text-fig. 24; Nilsson-Cantell, 1938, pp. 7, 18; 1955, p. 218; Krüger, 1940, p. 60; Broch, 1953, pp. 5, 6-7, 10, 12, 15, figs. 3a-c; Zullo, 1968, p. 211; Lakshmana Rao and Newman, 1972, p. 84; Zevina, 1973a, pp. 847-848.

Not *Scalpellum albatrossianum* Nilsson-Cantell, 1926a, pp. 7-11, text-figs. 2a-j [= *Scalpellum striolatum* G. O. Sars, *fide* Broch, 1953, pp. 6, 7.]

The capitulum of the type is 10.5 mm in length and 5.3 mm in width and is composed of 13 fully calcified plates separated by narrow chitinous sutures. The plates are distinctly marked with lines of growth, and are covered with a thin, shortly and sparsely pilose cuticle.

The tergum is triangular, its occludent margin arcuate, its lateral margin convex below, slightly kinked at the apex of the carina, the basal margin long and nearly straight. The scutum is elongate, its carinal margin deeply sinuated for the apex of the upper latus just below the tergo-lateral angle, which is extended in a narrow acute lobe; the baso-lateral angle is rounded and rests for a short distance against the inframedian latus. The upper latus is irregularly pentagonal in outline; the scutal margin is longest and slightly concave, the tergal a little shorter and convex, the basal margin short and in contact with the summit of the inframedian latus; the umbo is terminal, projecting into a recess of the scutum.

The carina is strongly arched above, less so below; the umbo is

SPECIES	LATITUDINAL RANGE	DEPTH RANGE (METERS)
Scalpellum (?) albatrossianum Pilsbry	37°N - 65°36′N	638 - 3742
Scalpellum (?) antillarum Pilsbry	28°45′N	1719
Scalpellum arietinum Pilsbry	24°26′N - 28°45′N	9 - 68
Scalpellum carinatum Hoek	37°15′S - 62°25′N	1428 - 2028
Scalpellum (?) diceratum Pilsbry	9°24′N - 34°56′N	55 - 340
Scalpellum gibbum Pilsbry	26°41′N - 35°01′N	55 - 91 Also fossil in Florida
Scalpellum (?) giganteum Gruvel	9°02′N - 39°48′N	832 - 1822
Scalpellum (?) gorgoniophilum Pilsbry	23°10′40″N	345
Scalpellum (?) gracilius Pilsbry	16°54′N - 32°40′N	1337 - 2751
Scalpellum hendersoni Pilsbry	24°25′N, approx.	229
Scalpellum idioplax Pilsbry	9°02′N - 27°58′30″N	824 - 1836
Scalpellum latidorsum Pilsbry	39°03′15″N - 39°37′45″N	1812 - 2941
Scalpellum (?) longicarinatum Pilsbry	29°39′N - 64°44′N	538 - 1838
Scalpellum (?) microceros MacDonald	13°52′N	508
Scalpellum (?) micrum Pilsbry	33°S - 30°58′30″N	530 - 823
Scalpellum (?) pentacrinarum Pilsbry	23°10′37″N - 23°10′39″N	60 - 510
Scalpellum (?) portoricanum Pilsbry	9°02′N - 18°31′N	46 - 366
Scalpellum (?) intonsum Pilsbry	28°38′30″N	260
Scalpellum pressum Pilsbry	30°59′30″N - 44°47′N	214 - 549
Scalpellum prunulum Aurivillius	18°05′N	350 - 360
Scalpellum (?) pteryges MacDonald	13°52′N	508

SPECIES	LATITUDINAL RANGE	DEPTH RANGE (METERS)
Scalpellum (?) semisculptum Pilsbry	28°42′N - 64°24′N	512 - 1484
Scalpellum (?) (sinuatum) Pilsbry	34°S? - 38°53′N; 58°15′N?	1463? - 3166; 3422?
Arcoscalpellum aurivillii (Pilsbry)	36°30′ - 64°14′N	743 - 1800
Arcoscalpellum aurivillii incertum (Pilsbry)	52°39′50″N	2904
Arcoscalpellum eximium (Hoek), type	37°21′N, 12°31′W	1829
Arcoscalpellum michelottianum (Seguenza), type	38°06′N, 15°39′E	Plioeene of Italy
Areoscalpellum regina (Pilsbry)	10°10′N - 29°32′N	91 - 676
Arcoscalpellum regium (Thomson)	34°54′N - 43°21′N	1514 - 5312
Arcoscapellum talismani (Gruvel), type	Golfe de Gascogne "Talisman" dragage 136	4255
Arcoscalpellum velutinum (Hoek) *s. l.*	48°38′S - 72°N	63 - 3422
Arcoscalpellum vitreum (Hoek) *s. l.*	63°54′S - 58°20′N	366 - 4331
Calantica superba (Pilsbry)	30°44′N - 31°09′N	644-805
Euscalpellum stratum (Aurivillius)	18°14′N - 26°41′N	91-380
Lithotrya dorsalis (Ellis and Solander)	10°S - 25°30′N	shallow-water borer
Neoscalpellum dicheloplax (Pilsbry)	34°41′N - 45°26′N	2788-5042
Neoscalpellum dicheloplax benthophila (Pilsbry)	34°39′N - 39°33′N	2844-5042
Mesoscalpellum imperfectum (Pilsbry)	34°30′S - 62°40′N	260-2250
Mesoscalpellum, n. sp. Bayer, Voss, and Robins	9°04′N - 9°07′N	664 - 681

apical against but not between the terga; the roof is flat, bounded by low narrow ribs; the sides are wide in the upper half, narrower, and tapering in the lower.

There is no rostrum. The rostral latus is wider than high, triangular in outline. The inframedian latus is suboblong with concave margins, about three times longer than wide, with a slightly raised mucro from which low ribs radiate to the angles of the plate; the upper end is truncated. The carinal latus is about twice as wide as high, with the umbo slightly projecting behind it at the lower fifth of the carinal margin; the carinal margin is slightly concave above the umbo, convex below it.

The peduncle is 3.5 mm in length, and is covered with rounded imbricating scales, in nine rows of about eight scales each.

Type locality. — "Albatross" sta. 2226 (37°N, 71°54′W), 2045 fathoms, *Globigerina* ooze, bottom temperature 36.8°F, about 220 statute miles east of Newport News, Virginia. Among other localities this is the nearest to Florida, which is some 7 degrees of latitude farther south.

Other localities. — Bay of Bengal (9°34′N, 85°43′15″E); "Ingolf" sta. 10 (64°24′N, 28°50′W), 1484 meters, 3.5°C. bottom temperature, about 200 statute miles west of Reykjavik, Iceland; Wandel, 1889 (65°36′N, 56°24′W), 349 fathoms, northwest of Godthaab, Greenland.

Depths range from 349 fathoms (638 meters) in the North Atlantic west of Greenland to 2045 fathoms (3742 meters) in the Western Atlantic off Virginia. The geographic extremes are Greenland in the north and west, and the Bay of Bengal in the south and east.

Scalpellum (?) **antillarum** Pilsbry — Pl. 26, fig. 2

Scalpellum antillarum Pilsbry, 1907, pp. 48, 61-62, fig. 24a-c; Henry, 1954, p. 444; Zullo, 1968, p. 211.

Pilsbry's description is recapitulated as follows:

The capitulum of the type is long oval, 11 mm in length and 5.7 mm in breadth, and is composed of 13 or 14 plates. The plates are sculptured with widely spaced wrinkles conforming with growth lines, and there are some extremely faint radial striae. The cuticle is very thin and somewhat hairy on the carina, sutures, and peduncle.

The tergum is sharply triangular, with nearly straight margins and an erect apex; shortly below the apex there is a sharp recess in the carinal margin in which is nestled the apex of the carina. The scutum is irregular in shape, the lower half wider than the upper; the occludent margin is convex, the lateral margin weakly sigmoid, and the basal margin straight; the apex is acuminate and a little recurved, overlying the lower angle of the tergum. The carina is long and evenly arched, with a length of 10 mm and the diameter at the base 1.1 mm, extending between the carinal latera to the peduncle; the roof is flat, bounded by acute angles, which toward the upper part project a little forming narrow marginal ribs; the sides are narrow.

The upper latus is obliquely spatulate, the basal angle directly above the inframedian latus. The rostrum is represented by a linear vestige almost concealed in the cuticle. The rostral latera are subquadrate, the occludent and scutal margins straight, nearly equal, and at right angles; the basal margin is not much more than half as long as the scutal, and the lateral margin is weakly sigmoid. The inframedian latus is small, narrowly triangular, about half the height of the rostral latera; the umbo is at the obtuse apex. The carinal latus is twice as high as wide, with four unequal sides, no two of them parallel; the umbo is at the lower sixth of the straight carinal margin, and projects slightly beyond the carina; the carinal margin is longest, the basal and lateral margins short and nearly equal; the upper angle is acute.

The peduncle is 4.5 mm in length, with about eight rows of eight narrow, transversely lengthened scales each, the intervals between them hairy.

According to Pilsbry, the peculiar shape of the upper latus and the long carina which passes between and entirely separates the carinal latera, are the more conspicuous features of this species.

Type locality. — "Albatross" sta. 2384 (28°45′N, 88°15′30″W), Gulf of Mexico, 940 fathoms (1719 meters), bottom temperature 39.6°F, bottom of brown and gray mud, about 135 statute miles southwest of Pensacola, Florida, and 140 statute miles southeast of New Orleans, Louisiana.

Remarks. — This species is one of several originally described under the old *Scalpellum sensu lato* that does not fit into the genus *Scalpellum sensu stricto* as defined by modern taxonomists.

Scalpellum arietinum Pilsbry Pl. 26, figs. 3-5

Scalpellum arietinum Pilsbry, 1907, pp. 26, 43-45, fig. 13a-b; 1953, pp. 19-21, fig. 4a-f, pl. 1, fig. 5; MacDonald, 1929, p. 531; Henry, 1954, p. 444; Hulings, 1961, p. 216; Wells, 1966, pp. 89-90; Zullo, 1968, p. 211.

The capitulum of the type is subtrapezoidal, and measures 11.6 mm in length and 7 mm in breadth. There are 14 fully calcified plates, sculptured by growth lines and indistinct radial striae; the occludent margins of the terga and scuta are straight and thus determine the occludent border of the capitulum. The cuticle is thin and inconspicuous, and nearly smooth except on the roof of the carina where it is finely and shortly pilose and crossed by six to eight transverse tufts of longer hairs.

The tergum is triangular and much longer than the scutum. The scutum is about twice as long as wide, its lateral margin concave near the tergolateral angle, convex below; the umbo is nearly terminal, bent inward. The carina is moderately arched and extends a short distance above the prominent umbo; it is 12 mm in length and its diameter near the base is 1.7 mm; the roof is nearly flat, bounded by distinct but obtuse angles, with a low rib on each side running parallel with and near the angles; the lines of growth on the roof are nearly U-shaped; the sides are flat and wide in the upper half, delicately marked with fine longitudinal and radial striae. The basal margin of the carina is deeply rounded, and there is a chitinous space between the carina and the other plates.

The upper latus is pentagonal, the scutal and carinal margins about equal and parallel, the tergal margin slightly longer; the basal margin is shorter and the oblique lateral margin against the inframedian plate still shorter; the umbo is not quite apical, the apex beyond it obtuse, rounded, and white. The rostrum is small triangular, and with equal sides. The rostral latus is low, about five times as long as high, somewhat narrower in front than at the lateral end, and stands out in relief above the surface of the scutum. The inframedian latus is about twice as high as wide and irregularly pentagonal; the umbo is elevated, and from it obtuse ridges radiate to the two basal angles of the plate. The carinal latus is somewhat triangular; its apical half projects free behind and below the carina, flaring strongly outward and noticeably twisted; the apex is acute. In dorsal view the carina is seen to extend between the hornlike latera nearly to the peduncle, the spread from apex to apex of the two carinal latera 6 mm in the type specimen. These laterally flaring, hornlike carinal latera are the distinguishing character of the species.

Type locality. — "Albatross" sta. 2405 (28°45′N, 85°02′W), Gulf of Mexico, 30 fathoms (55 meters), gray sand and broken coral, about 267 statute miles west off Homosassa, Florida.

Other localities.—"Albatross" sta. 2315 (24°26′N, 81°48′15″W), 37 fathoms (68 meters), coral bottom, on spines of *Cidaris tribuloides*, about 10 statute miles south of Key West, Florida; "Triton" sta. 484, off Palm Beach, Florida, on vermetid shell; Cape St. George, St. George Island, Franklin County, Florida, on calico scallop *Aequipecten gibbus,* 30-100 ft, 15 miles south of Alligator Point, Franklin County, Florida.

Scalpellum carinatum Hoek Pl. 27, figs. 3, 4

Scalpellum carinatum Hoek, 1883, pp. 29, 31, 63, 67, 76-77, 102, pl. 3, figs. 7-8; Weltner, 1895, p. 289; 1897, p. 247; Murray, 1896, pp. 385, 397; Gruvel, 1902a, p. 59; 1905, p. 50, fig. 55; 1920, pp. 20, 71, pl. 7, fig. 8; Pilsbry, 1907, pp. 47, 53, figs. 18a, b; Barnard. 1925, pp. 3-4; Broch, 1953, pp. 7, 10, 12, 15.

Scalpellum imperfectum Pilsbry, 1907, pp. 70, 75-77, fig. 30, pl. 4, figs. 15-18 [*fide* Barnard, 1924, p. 47]; Barnard, 1925, pp. 3-4.

Hoek's description of the type is summarized as follows:

The capitulum is 16 mm in length, is covered by a transparent chitinous membrane, and consists of 14 smooth valves separated by broad chitinous interspaces.

The tergum is large, triangular, and flattish, the apex recurved, the carinal margin excavated and concave and divided into a small superior and long inferior part. The scutum is elongated, two and a half times longer than wide, its apex pointed, its basal margin forming a right angle with the occludent margin but passing with a rounded angle into the lateral margin. The lateral margin is slightly hollowed out and is separated from the tergal margin by a smallish shoulder. The umbo is at the uppermost point.

The carina is simply bowed, with a flat roof much increasing in width from the upper to the lower end, and bordered on each side by an indistinct ridge. The umbo is seated at the top of the roof a short distance down from the apex. The part above the umbo is formed by the upward prolongation of the sides of the valve.

The upper latus is irregularly pentagonal, its upper half narrowed, the lower half broad. The umbo is near but not at the apex. The rostrum is elongated, extremely narrowed, enclosed between the two rostral sides of the rostral latera. The rostral latera are convex and fit into the inframedian latus which is wine-glass shaped with a foot. The carinal latus is large and flat; the umbones of the two valves almost touch each other under the middle of the carina and project over the base of the carina.

The peduncle is about 6 mm in length, nearly cylindrical. The scales are highly calcareous and white, placed in about seven longitudinal rows, each row bearing four to six scales.

Type locality. — "Challenger" sta. 235, near the Island of Tristan da Cunha (37°15′S, 12°30′W), depth 1000 fathoms (1829 meters), bottom of rock and shells.

Other localities. — "Challenger" sta. 2111 (35°09′50″N, 74°57′40″W), 938 fathoms (1700 meters), about 22 statute miles east off Cape Hatteras, North Carolina. This is the nearest locality to Florida. "Challenger" sta. 2731 (36°45′N, 75°28′W), 781 fathoms (1428 meters), about 65 statute miles off Norfolk, Virginia, on *Arcoscalpellum velutinum* (Hoek); "Ingolf" sta. 83 (62°25′N, 28°30′W), 1717 meters, 3.5°C bottom temperature in the North Atlantic about 220 statute miles southwest off Reykjavik, Iceland; "Prince de Monaco" Campagne 1895 (38°21′N, 37°41′W), Eastern Atlantic, 2028 meters (1109 fathoms), brownish gray limy mud, about 40 statute miles southwest of Lisbon, Portugal.

Scalpellum carinatum ranges from Iceland in the North Atlantic to Tristan da Cunha in the South Atlantic, and occurs at depths ranging from 1428 meters off Norfolk, Virginia, to 2028 meters off Lisbon, Portugal.

Scalpellum (?) **diceratum** Pilsbry Pl. 27, figs. 5, 6

Scalpellum diceratum Pilsbry, 1907, pp. 26, 45-46, figs. 14a, b; 1953, p. 21, pl. 1, fig. 4; MacDonald, 1929, p. 532; Krüger, 1940, p. 43, fig. 28d; Henry, 1954, p. 444; Ross, Cerame-Vivas, and McCloskey, 1964, p. 312; Cerame-Vivas and Gray, 1966, p. 263; Zullo, 1968, p. 212; Bayer, Voss, and Robins, 1970, p. A43.

Pilsbry's description is summarized as follows:

The capitulum is subtrapezoidal, 13.5 mm in length, 7.8 mm in width, and has a shape similar to that of *S. arietinum* Pilsbry. The ventral margin is nearly straight, but with a low prominence in the middle. The tergum is longer than the scutum, subpentagonal in outline. The scutum has a terminal mucro, a gently convex occludent margin, and a slight indentation to receive the apex of the upper latus.

The carina is strongly arched, 13.5 mm long and 2.8 mm wide near the base, with an acute apical umbo which intrudes between the terga. The roof is convex, the sides bicostate and very narrow, the basal margin rounded. The upper latus is pentagonal, the scutal margin the longest, and the tergal, carinal, and basal margins successively shorter, the margin against the inframedian plate the shortest and less than half the basal margin. The rostrum is small and triangular. The rostral latus has two low ridges running from the apex to the upper and lower angles of the plate. The inframedian latus is narrow and triangular, with the apex strongly curved toward the occludent border and overlying the baso-lateral angle of the scutum near the baso-lateral angle of the inframedian latus. A low rounded rib runs down each side. The umbo is apical. The carinal latus is subtriangular, its apical half projecting free behind and downward below the carina. The spread from tip to tip is 3.75 mm in the type specimen.

The peduncle is 7 mm in length, clothed with rather large, narrow, transversely lengthened scales, in about eight rows of eight or nine scales each.

According to Pilsbry, *Scalpellum diceratum* lives with and is related to *Scalpellum arietinum* Pilsbry, yet is distinct by the differences in the shape of the carina and inframedian latus, and in the terminal umbones of the inframedian, upper latera, and carina of the two species.

Type locality. — "Albatross" sta. 2319 (23°10′37″N, 82°20′06″W), 143 fathoms, off Habana, Cuba, on crinoid arms.

Florida localities. — "Albatross" sta. 2405, (23°45′N, 85°02′W), off West Florida in the Gulf of Mexico, 30 fathoms, about 267 statute miles west of Homosassa; off Palm Beach, on gorgonians, hydroids, and echinoid spines, 30 to 80 fathoms; off Sombrero Key Light; "Triton" sta. 1952, off Cape Florida, 100 fathoms (183 meters), University of Miami collection.

Other localities. — "Albatross" sta. 2324 (23°10′25″N, 82°20′24″W), off Habana, Cuba, 33 fathoms, on *Cidaris* spine; "Albatross" sta. 2317, Straits of Florida (24°25′45″N, 81°46′W), 45 fathoms, temperature 75°F, on spines of *Cidaris;* "Albatross" sta. 2315 (24°26′N, 81°48′15″W), Straits of Florida, 37 fathoms (68 meters); continental shelf off North Carolina, near Cape Hatteras, south of Diamond Shoals (34°56′N, 75°26′W), 46 fathoms (84 meters); "Pillsbury" sta. P-372, in Caribbean Sea about 40 kilometers northwest of Coveñas (9°24′N, 75°44′W), Colombia, 82-100 meters (151-186 fathoms).

Scalpellum (?) *diceratum* Pilsbry is a relatively shallow-water species ranging in depth from 30 to 186 fathoms. Geographically it ranges from North Carolina in the north to Colombia in the south.

Remarks. — Although *Scalpellum* (?) *diceratum* Pilsbry lives with *Scalpellum arietinum* Pilsbry the two are not related, the former lacking the characters pertaining to the genus *Scalpellum sensu stricto.*

Scalpellum gibbum Pilsbry Pl. 27, fig. 7; Pl. 28, fig. 1

Scalpellum gibbum Pilsbry, 1907, pp. 14, 17-18, figs. 4a, b; 1953, p. 19, text-fig. 2; Henry, 1954, p. 444; Ross, Cerame-Vivas, and McCloskey, 1964, p. 312; Ross, 1965, pp. 219-220, figs. 1A, B; Zullo, 1966, pp. 230, 231-232, figs. 2A, B; 1968, p. 212; Cerame-Vivas and Gray, 1966, p. 263; Newman and Ross, 1971, p. 123.

The capitulum of the type is subtetragonal, 7 mm in length and 4 mm in breadth, with a slightly sinuous ventral margin and an angularly bent carinal margin. It is composed of 14 fully calcified plates which are faintly marked by growth lines and separated by narrow chitinous sutures. The tergum is much longer than the scutum, obtusely and narrowly triangular in shape, its occludent margin slightly convex and strongly recurved at the summit; the carinal margin is biconcave, short above, longer and gently curved below. The scutum is twice as long as wide, its umbo at the upper third of the occludent margin; the tergal margin is straight and oblique; the lateral margin is angular, the basal margin slightly concave. The carina is prominently angular near the middle. The roof is convex, bounded by two lateral ribs, accompanied below by a second arcuate rib on each side. The sides are wide, flat, and marked by four or five wrinkles parallel with the growth lines.

The upper latus is rhomboidal, the umbo lying near the scutal margin about midway between the basal and tergal borders. The rostrum is narrow and parallel-sided, with the beaks of the rostral latera meeting over it above the middle. The rostral latus is twice as long as high, its umbo acute, the upper and basal margins parallel, the lateral margin straight. The inframedian latus is convex, pentagonal and much larger than the other lower plates and fully equal to the upper latus; the umbo is nearly central. The carinal latus is claw-shaped, the umbo projecting below the carina; the basal and lateral margins are about equal, the upper margin very short, the carinal margin concave, with a low submarginal rib.

The peduncle is 2 mm in length. It is covered with large imbricating scales, in about 10 rows.

Type locality. — "Albatross" sta. 2388 (29°24′30″N, 88°01′W), 35 fathoms (64 meters), in Gulf of Mexico about 100 statute miles south of Mobile, Alabama, and 40 statute miles southeast off the forward edge of the delta of the Mississippi River.

Florida locality. — "Triton" sta. 441, off Palm Beach (26°41′N, 80°02′W), 30 fathoms (55 meters).

Other localities. — South Carolina, "Miss Kim" sta. 12 (32°28.7′N, 78°47.1′W), 46½ miles off Racoon Key, depth 64 meters, hard sand and shell bottom. North Carolina, near Cape Hatteras, south of Diamond Shoals (35°01′N, 75°25′W), 30 fathoms; off Cape Lookout (34°11′N, 76°08′W), 50 fathoms.

Fossil locality. — *Ecphora* Zone, Jackson Bluff Formation, Leon County, Florida. Late Miocene—early Pliocene.

The geologic range of this species is Mio-Pliocene to Recent. The geographic range is from North Carolina to Florida. The bathymetric range is 30-50 fathoms (55-91 meters).

Scalpellum (?) giganteum Gruvel Pl. 28, figs. 2, 3

Scalpellum giganteum Gruvel, 1901b, pp. 153-156, pl. 17, figs. 1-8, 17; 1902a, p. 51; 1905, pp. 78-79, fig. 88; Pilsbry. 1907, pp. 25, 32-33, pl. 2, fig. 1, pl. 3, fig. 1; Annandale, 1909-1910, p. 132; Bayer, Voss, and Robins, 1970, p. A43.

Gruvel's original description is summarized as follows:

The capitulum of the type is flattish, 45 mm long and 32 mm in breadth, and is composed of 14 calcified plates nearly completely covered with a thick chitinous cuticle. In shape the capitulum is a curvilinear, nearly isosceles triangle, the sides convex and the base slightly concave. The plates are sculptured by prominent growth striae which are clearly vestiges from the cuticle. The tergum is irregularly quadrangular. The scutum is nearly triangular, the lower margin measuring not quite half the length of the plate. The carina is regularly arched; the umbo is at the apex and does not project between the terga; the dorsal margin is convex as are the lateral margins; the basal margin is also strongly convex, the lower angle blunt, not reaching the summit of the carino-lateral plates; the roof of the carina enlarges gradually from the summit to the base.

The upper latus is irregularly quadrilateral. The rostrum is small and oval, the lateral margins hidden, and the remainder entirely masked by the cuticle. The rostral latus is elongated, narrow, larger anteriorly than posteriorly. The inframedian latus is triangular, the lower margin longer than the posterior and the anterior; the apex is directed toward the summit of the capitulum. The carino-lateral latus is elongated, narrow, and with a backward slope; the apex is strongly recurved upward and in front, and does not reach the lower or external margin of the carina; the umbo is nearly at the base.

The peduncle, which is more or less cylindrical, is 45 mm in length and 15 mm in diameter. It consists of six longitudinal and alternating rows of scales, with 10 to 12 transversely elongated scales per row.

Type locality. — Coasts of Cuba, depth 500 fathoms.

Florida locality. — "Albatross" sta. 2658 (28°21′N, 78°37′W), 514 fathoms (940 meters), about 120 miles east off Cape Canaveral. With *Megalasma (Glyptelasma) gracilius* Pilsbry.

Other localities. — "Albatross" sta. 2554 (39°48′30″N, 70°41′W), 455 fathoms (832 meters), on *Scalpellum velutinum* Hoek, about 120 statute miles east off Surf City, New Jersey; West Indies, on Atlantic cable, from capitulum of *Scalpellum velutinum* Hoek; "Pillsbury" sta. 338 (9°58.3′N, 78°30.5′W), 1836-1822 meters, about 80 kilometers northwest off Punta San Blas, Panama, in the Caribbean Sea; "Pillsbury" sta. 364 (9°28.7′N, 76°34.3′W to 9°20.2′N, 76°34.2′W), 933-961 meters, about 90 kilometers northwest off Coveñas, Colombia, in the Caribbean Sea; "Pillsbury" sta. 407 (9°02′N, 77°25.3′W to 9°02′N, 77°28.8′W), 1171-1239 meters, about 40 kilometers east of Punta Mosquito, Panama, in the Caribbean Sea.

The recorded depths of S. (?) *giganteum* range from 832 to

1822 meters. The known geographic range is from off Colombia, South America, to off New Jersey, U.S.A., although Pilsbry (1907, p. 33, pl. 3, fig. 1) mentioned the possibility of a large specimen having been obtained on the "fishing banks" (off Newfoundland?).

Scalpellum (?) gorgoniophilum Pilsbry Pl. 28, figs. 4a, b

Scalpellum gorgoniophilum Pilsbry, 1907, pp. 25, 33-34, fig. 7a, b; Zullo, 1968, p. 213.

Pilsbry's description is summarized as follows:

The capitulum is subrectangular for about two-thirds its length, triangular apically; the type is 9 mm in length, 5 mm in breadth. The plates are lacking in hair and have no noticeable cuticle but are sculptured by coarse growth lines and fine radial striae, with a strong diagonal rib on the scutum and upper latus. The tergum is triangular with gently convex occludent and basal margins. The scutum is large, subtetragonal with parallel lateral margins, a slightly concave tergal margin, and a slightly sinuous basal margin. The carina is relatively short, strongly arched above, hardly convex below, the apex reaching only to the middle of the carinal side of the tergum. The length is 6.8 mm, diameter near the base 1.8 mm. The roof is convex and radially striate with narrow ribs separating it from the sides; the sides are wide and bear a sharply elevated arcuate rib. The umbo is apical.

The upper latus is subtriangular, the lower margins conforming with the margins of the adjoining plates. The carinal latus is pentagonal, curved like a scoop, with the apex projecting outward beyond the carina. The inframedian latus is narrow, obliquely triangular, tapering to the apex which curves toward the scutum and overlies its baso-lateral angle; the umbo is apical. Three unequal faces abut the upper and inframedian latera and the peduncle. Behind the carina the two latera meet only at the base. The rostrum is comparatively large, in the shape of an isosceles triangle. The rostral latus is low and wide, its surface divided by a diagonal rib.

The peduncle is stout and short, measuring about 2.8 mm in length; it is covered with projecting scales in about eight deeply interlocking rows of six or seven scales each. The peduncle is inconspicuously hairy.

The large size of the rostrum, the short carina, and the projecting apices beyond the carina of the carinal latera are the conspicuous characters of this species.

Type locality. — "Albatross" sta. 2338 (23°10′40″N, 82°20′15″W), off Habana, Cuba in 189 fathoms (346 meters), coral bottom, on a gorgonian. The type locality lies in the Caribbean Sea about 110 statute miles southwest of Key West, Florida.

So far as I have been able to determine, the type locality is the only one recorded for this unique species. It is included in this work because of the probability it eventually will be found in Florida waters.

Scalpellum (?) **gracilius** Pilsbry Pl. 28, figs. 5a-c

Scalpellum gracilius Pilsbry, 1907, pp. 47, 51-53, figs. 17a-c; 1911, p. 173; Weltner, 1922, pp. 96, 106; Zullo, 1968, p. 213.

Following is a resumé of Pilsbry's original description:

The capitulum is oval, length 8 mm, breadth 3.3 mm, consisting of 14 fully calcified plates covered with a thin smooth cuticle, and separated by linear sutures. The plates have faint growth lines and a few barely perceptible radial striae.

The tergum is larger than the scutum, triangular in outline, with a slightly convex occludent margin, a straight basal margin, and a weakly sigmoidal carinal margin; the apex is erect. The scutum is longer than wide, the occludent margin convex above, slightly concave near the base, the lateral margin slightly sinuous, the basal margin convex passing into the lateral in a smooth curve; the apex is a little incurved and acuminate. The carina, measuring 6.3 mm in length and 1 mm at the base, is regularly curved, the apex terminal. The roof is rounded, curving into wide sides; the basal margin is convex. The growth lines of the roof curve deeply downward (Pl. 28, fig. 5c).

The upper latus is irregularly pentagonal, the margin against the carinal latus concave, the apex subterminal. The rostrum is reduced to a linear rudiment separating the rostral latera along the upper half of their contiguous borders. The rostral latus is subtriangular. The inframedian latus is narrowly oblong, contracted slightly below the middle, the basal segment much smaller than the upper. The carinal latus is long and narrow, the occludent margin convex at the border of the upper latus, sinuous against the margin of the inframedian latus; the umbo is close to but not at the base of the plate and does not project beyond it. The two plates meet in a short straight suture below the carina.

The peduncle is 1.8 mm in length, closely covered with large transversely lengthened scales in six rows of about five scales each.

Type locality. — "Albatross" sta. 2678 (32°40'N, 76°40'30"W), about 185 statute miles east off Folly Beach, South Carolina, 731 fathoms (1337 meters), bottom temperature 38.7°F.

Other localities. — "Albatross" sta. 2751 (16°54'N, 63°12'W), 687 fathoms, bottom temperature 40°F., blue *Globigerina* ooze, about 20 statute miles southwest off Charlestown, Nevis, Lesser Antilles.

Inasmuch as Florida lies between South Carolina and Nevis it is anticipated that *Scalpellum gracilius* eventually will be discovered also in Florida waters.

Scalpellum hendersoni Pilsbry Pl. 28, fig. 6

Scalpellum hendersoni Pilsbry 1911, pp. 172-173, fig. 1; Zullo, 1968, p. 213.

Pilsbry's original description of the type is summarized as follows:

The capitulum is subquadrate and swollen except for the upper end which is compressed and triangular. The length is 5 mm, the breadth 2.5 mm. The carinal margin is arched, the occludent margin convex. The plates are fully calcified, with widely spaced growth lines and, on the tergum, scutum, and upper latus, a few weak radial striae. The tergum is triangular. The scutum is trapezoidal. The carina, measuring 3.75 mm in length is arcuate, more so in upper third where there is a space between the apical area and the margin of the tergum. The roof of the carina is strongly convex, widening rapidly toward the base which wedges between the carinal latera. The intraparietes are narrow, bounded by a ridge, and visible only in the upper part of the plate.

The upper latus is trapezoidal, with an apical umbo. The rostral latera are triangular, obtuse at the rostral angle. There is no visible rostrum. The inframedian plate is narrow and high, contracting perceptibly at the lower fourth where the umbo is situated. The carinal latera are large and irregular, with the umbo at the lower carinal angle; the two latera meet in a short suture below the carina.

The peduncle is short and is covered with large scales in about seven vertical rows.

Type locality. — Ten miles south of Key West, Florida, in 125 fathoms, on spines of a sea urchin, *Dorocidaris,* associated with the barnacle *Verruca alba* Pilsbry.

Scalpellum idioplax Pilsbry Pl. 29, figs. 2a-c

Scalpellum idioplax Pilsbry, 1907, pp. 47, 48-50, figs. 15a-c; Broch, 1924, pp. 41, 45, 102; 1953, p. 5; Zullo, 1968, p. 213; Bayer, Voss, and Robins, 1970, p. A43.

Pilsbry's description is summarized as follows:

The capitulum is twice as long as wide (18 mm × 9 mm), convex at the ventral and dorsal margins, subtruncate at the base, and triangular at the apex. The cuticle is very thin and smooth. There are 13 fully calcified plates, sculptured with unequal lines of growth and fine, low radial striae.

The tergum is longer than the scutum, triangular, the occludent margin slightly convex, the basal margin slightly concave centrally, and the carinal margin weakly sigmoid. The scutum is longer than wide, the lateral margin irregular, projecting in an angular lobe at the upper lateral angle and deeply excavated below the lobe for the reception of the apex of the upper latus. The apex is acuminate. The carina, measuring 15 mm in length and 3 mm in width at the base, is arched, more so near the terminal mucro than below. The roof is flat, with bordering ribs. The growth striae of the roof are convex upward. The sides are wide, regularly tapering toward the base. The basal margin is slightly concave.

The upper latus is hexagonal-pyriform; the tergal and scutal margins are long, the former hardly convex, the latter concave; the carinal margin is short and straight, that against the carinal latus also short. The carinal latus is twice as high as wide, irregularly triangular, the occludent margin concave in the middle. The umbo projects slightly beyond the carina near the base of the plate; the carinal latera meet below the keel. The inframedian latus is composed of a large upper segment and a small basal segment, the junction narrow. The rostral latus is squarish with straight margins, the lower lateral corner rounded, and the ventral margins of the rostral latera in contact.

The peduncle is 4.3 mm in length, with 10 rows of transversely lengthened scales, about eight scales in a row.

Type locality. — "Albatross" sta. 2140 (17°36′10″N, 76°46′05″W), Caribbean Sea between Jamaica and Haiti, 966 fathoms (1767 meters), sand bottom.

Florida locality.—"Albatross" sta. 2656 (27°58′30″N, 78°24′W), 572 fathoms (1046 meters), bottom temperature 41.2°F, about 135 statute miles east off Melbourne Beach.

Other localities. — "Pillsbury" sta. 338 (9°57.5′N, 78°31′W to 9°58.3′N, 78°30.5′W), 1836-1822 meters, Caribbean Sea, about 80 kilometers northeast off Punta San Blas, Panama; "Pillsbury" sta. 388 (10°16′N, 76°03′W to 10°10′N, 76°08′W) 824-1061 meters, Caribbean Sea, about 70 kilometers southwest of Cartagena, Colombia; "Pillsbury" sta. 407 (9°2′N, 77°25.3′W to 9°2′N, 77°28.8′W), 1171-1239 meters, Caribbean Sea, about 40 kilometers east off Punta Mosquito, Panama.

Range and distribution. — The species has been reported from off Melbourne, Florida, in the Western Atlantic to as far south as northern Colombia, in depths ranging from 824 meters in the Caribbean to 1836 meters off Punta San Blas, Panama, in the Caribbean.

Scalpellum latidorsum (Pilsbry) Pl. 31, fig. 6

Scalpellum regium latidorsum Pilsbry, 1907, pp. 25, 29-31, pl. 2, figs. 2, 3, 7, pl. IV, figs. 10, 11, 12, 14; Fowler, 1912, p. 500; Zullo, 1968, p. 214.

The capitulum of *Scalpellum regium latidorsum* varies from 48 to 60 mm in length and 31 to 38 mm in breadth. It is high domal in outline, with a pointed apex, a moderately convex occludent border, a more convex carinal border, and a slightly concave base. The 14 plates, which abut or are close to one another, are covered with a thin cuticle bearing few hairs, and are sculptured in the upper whorls by a series of fine growth lines interspersed at intervals with stronger growth lines. The tergum is pentagonal in outline, with steep unequal apical margins and a pointed basal angle. The scutum has longer apical margins than the tergum and the basal angle is subrounded. The carina measures 43 mm in length and 9.5 mm in width near the base, and has a flat roof with discrete, widely spaced, V-shaped markings; laterally there are low ribs, and the sides widen gradually toward the base.

The upper latus is subtriangular, with an acute slightly curved apex, a convex tergal margin, a concave scutal margin, and a subangular base. The rostrum is narrow and indistinctly visible through the cuticle. The rostral latus is elongate, with subparallel scutal and basal margins and a sharply convex occludent margin. The inframedian latus is small and triangular, and there is a rooflike chitinous extension above its apex. The carinal latus has a long, strongly recurved umbo and a horn-shaped basal extension sculptured by fairly numerous sinuous concentric striae; above the umbo and the upper margin of the latus there is a chitinous extension of the plate.

The peduncle varies in length from 21 to 36 mm, and has large, transversely lengthened scales thinned at their ends. There are seven rows of about nine scales each.

Type locality. — "Albatross" sta. 222 (39°03′15″N, 70°50′45″W), 1537 fathoms, gray ooze, surface temperature 73°F, bottom temperature 36.9°F, about 210 miles east off Cape May, New Jersey.

Other localities.—"Albatross" sta. 2042 (39°33′N, 68°26′45″W), 1555 fathoms (2844 meters), *Globigerina* ooze, surface temperature 71°F, bottom temperature 38.5°F, about 310 statute miles east off Atlantic City, New Jersey; "Albatross" sta. 2041 (39°22′50″N, 68°25′W), 1608 fathoms (3028 meters), *Globigerina* ooze, surface temperature 72°F, bottom temperature 38°F, about 325 statute miles east off Ocean City, New Jersey; "Albatross" sta. 2210 (39°37′45″N, 71°18′45″W), 991 fathoms (1813 meters), surface temperature 74°F, bottom temperature 38.1°F, *Globigerina* ooze, about 170 statute miles east off Ocean City, New Jersey.

Inasmuch as the carina of this taxon is different from that of *Scalpellum regium regium* Thomson (Pilsbry, 1907, pl. 2) and that *S. regium* itself resembles other species to which the present taxon might be allied, it is suggested that Pilsbry's subspecies *latidorsum* be given specific rank, that is *Scalpellum latidorsum* (Pilsbry) to replace *Scalpellum regium latidorsum* Pilsbry.

Scalpellum (?) longicarinatum Pilsbry — Pl. 29, figs. 3a-c

Scalpellum longicarinatum Pilsbry, 1907, pp. 26, 37-39, figs. 9a-c; Broch, 1924, p. 39; 1953, pp. 4-5, 10, 12, 15, figs. 1a-d; Zullo, 1968, p. 214.

Pilsbry's description is summarized as follows:

This is a strong, robust little species. The capitulum, which is 10 mm in length and 5.4 mm in breadth, is long-oval, widest in the middle, with convex lateral margins, the ventral border less curved than the dorsal. It is composed of 14 fully calcified plates marked by emphatic concentric growth striae with prominent grooves at intervals between them.

The tergum is obliquely elongated, a little longer than the scutum; the occludent and basal margins are slightly convex, the carinal margin slightly concave near the summit but convex below. The scutum is trapezoidal, the occludent margin convex, the apex acuminate and recurved, the tergal margin concave, the carinal margin convex, the basal margin nearly straight. The carina, 9.5 mm in length and 2 mm wide at the base, is evenly arched, with the umbo apical. The roof is flat between strong bordering ribs. The sides are wide and sulcate with deep growth lines. The basal margin is convex.

The upper latus is quadrangular, the scutal and carinal margins parallel, the carinal about half as long as the scutal; the umbo is apical. The rostrum is small and triangular. The rostral latus is trapezoidal with parallel upper and lower margins. The inframedian latus is narrowly triangular, the base half the height; the umbo is apical, and there is an inconspicuous triangular wing at the carinal side of the apex. The carinal latus is irregularly pentagonal, as wide as high, the carinal margin deeply concave; the umbones project a little beyond the carina and are somewhat recurved. The portions of the carinal latera seen in dorsal view are obliquely triangular, the roof of the carina wedging narrowly between them to the peduncle.

The peduncle is 2 mm in length, closely covered with transversely lengthened scales, in about 18 rows of seven or eight scales each.

Type locality. — "Albatross" sta. 2668 (30°58′30″N, 79°38′W), 294 fathoms (538 meters), about 105 statute miles east off St. Andrews Sound, Georgia.

Other localities. — "Albatross" sta. 2415 (30°44′N, 79°26′W), 440 fathoms (805 meters), about 120 statute miles east off mouth of St. Mary's River, between Georgia and Florida; "Albatross" sta. 2663 (29°39′N, 79°49′W), 421 fathoms (770 meters), about 63 statute miles east off Marineland, Florida; "Ingolf" sta. 92 (64°44′N, 32°52′W), between Iceland and Greenland, depth 1838 meters, bottom temperature 1.4°C.

Scalpellum longicarinatum occurs in the Western Atlantic off the east coast of Georgia and Florida, and was reported by Broch (1953) in the North Atlantic between Iceland and Greenland. Depths range from 294 to 1006 fathoms (538 to 1838 meters), the shallowest off Georgia, U.S.A., the deepest west of Iceland.

Scalpellum (?) microceros MacDonald Pl. 29, fig. 1

Scalpellum microceros MacDonald, 1929, pp. 531-532, pl. 2, fig. 1.

MacDonald's description of the type and only specimen is summarized as follows:

The capitulum is trapezoidal, 31 mm in length and 23 mm in width. There are 14 well-calcified valves in close contact, covered with a thin cuticle and sculptured by fine growth striae. The tergum is longer than the scutum and somewhat lanceolate; the occludent margin is straight, the carinal and scutal margins convex. The scutum is strongly convex and twice as long as broad; the occludent and lateral margins are subparallel and the umbo is apical. The carina is well arched, with an acute apical umbo wedged between the terga. The roof is flat and bordered with prominent ridges. The sides are broad and of equal breadth throughout their length, and the basal margin of the carina is almost straight.

The upper latus is pentagonal, the carinal and scutal margins almost parallel, with two parallel shallow grooves along the scutal margin; the lower half of the scutal margin overlaps the scutum, and there is a low ridge running along the tergal margin. The carinal latus is triangular, the apical half projecting upward and considerably beyond the carina. The roof of the carina extends between the carinal latera to the peduncle. The rostrum is small and triangular, and overlaps the apices of the rostral latera. The rostral latus is linear, about seven times as long as broad, with a shallow groove running the length of the surface; the latus stands out prominently above the surface of the scutum. The inframedian latus is small and triangular, with the apex curved toward the occludent border. The umbo is apical, and there is a low ridge along each side.

The peduncle is equal in length to the capitulum and is covered with imbricated scales in about 28 rows.

Type locality.—MCZ collection (13°52′N, 61°7′W), just off the west coast of St. Lucia, 278 fathoms (508 meters). St. Lucia Island lies 1,250 statute miles southeast off Florida's east coast.

Scalpellum (?) micrum Pilsbry Pl. 29, fig. 4

Scalpellum micrum Pilsbry, 1907, pp. 47, 57-58, fig. 21; Barnard, 1924, pp. 17, 46-47; Zullo, 1968, p. 24.

Pilsbry's description of this species is as follows:

The capitulum, measuring 5 mm in length and 2.5 mm in breadth, is oval, with the ventral and dorsal margins about equally convex. There are 14 fully calcified plates separated by linear sutures, the plates marked with faint lines of growth and a few faint radial striae. There is no perceptible cuticle.

The tergum is triangular, the occludent and the scuto-lateral margins convex, and the carinal margin sinuous, concave above, somewhat convex below. The scutum is about twice as long as wide, the occludent and lateral margins subparallel, the basal margin nearly at right angles to them, the upper third of the occludent margin bent backwards; the umbo is acute, terminal and recurved. The carina is 3.2 mm in length, simply arched, with an apical mucro. The roof is rounded, marked with transverse, arcuate lines of growth, the sides narrow; the apex reaches to the upper third of the carinal margin of the tergum; the base of the carina is rounded.

The upper latus is trapezoidal with straight margins, the apex terminal at the scuto-tergal angle. The rostrum is well developed, forming a band about one-fifth as wide as long, and slightly narrower above the base; it extends the whole length of the adjacent latera. The rostral latus is triangular, with the basal angle of the triangle truncated. The inframedian latus is narrow and triangular, its height equal to that of the rostral latus and about double the basal width; the umbo is apical. The carinal latus is irregularly pentagonal, with the upper lateral and carinal margins about equal and straight, the subcarinal margin the longest and concave, the basal margin the shortest; the umbo of the carinal latus projects angularly beyond the carina. The two carinal latera meet below the carina in a straight suture as far up as their umbones.

The peduncle is but 1.3 mm in length; it is covered with large imbricating scales in five rows of five scales each.

Type locality. — "Albatross" sta. 2668 (30°58′30″N, 79°38′30″W), 290 fathoms (530 meters), on a delicate hydroid, bottom temperature 46.3°F, the bottom of gray sand with dead coral. "Albatross" sta. 2668 is in the Western Atlantic about 105 statute miles east off St. Andrews Sound, Georgia.

Other localities. — "Pieter Faure" sta. about 20 miles southeast off East London (33°S, 27°54′E), South Africa, 400-450 fathoms (732-823 meters).

Scalpellum (?) pentacrinarum Pilsbry Pl. 30, figs. 1a-c

Scalpellum pentacrinarum Pilsbry, 1907, pp. 47, 55-57, figs. 20a-c; Gruvel, 1909, p. 208; Zullo, 1968, p. 215; Newman and Ross, 1971, p. 51.

Pilsbry's description of the type is summarized as follows:

The capitulum of this small species is 8 mm in length and 3.7 mm in breadth. It is subtriangular in shape and is composed of 13 fully calcified plates, separated by linear sutures, and without perceptible cuticle. The plates are marked with fine lines of growth, and the scutum, tergum, and upper latus are marked by low radial striae.

The tergum is triangular, with an erect apex. The scutum is long and narrow, widest at the base where it is three-fourths the width of the capitulum at that plate. The lateral margins of the scutum are subparallel, converging slightly above, the occludent margin hardly convex, the carinal margin straight. The straight basal margin makes a right angle with the occludent margin.. A low narrow ridgelet runs from the acute apex of the scutum to the basolateral margin. The carina is irregularly arched and unusually short, measuring 5.2 mm in length and 1.2 mm in width near the base. The roof is rounded, passing directly into the narrow sides, and is marked with faint transverse arcuate growth lines. The base is wedged triangularly between the carinal latera. The apex is terminal and incurved but not inserted between the terga; it reaches only to the lower fourth of the margin of the tergum.

The upper latus is wedge-shaped, with straight scutal and tergal margins and a slightly convex carinal margin; the umbo is terminal at the scuto-lateral angle. There is no rostrum but a lanceolate space between the rostral latera. The rostral latus is quadrangular, at least twice as wide as high, and is divided by a low diagonal riblet into two unequal triangular parts; the rostral margin is concave, the lateral somewhat irregular. The inframedian latus is narrow, sinuous, and as high as the adjacent latera, its umbo at the acute apex. The carinal latus is triangular, higher than wide, the apex curved toward the inframedian latus. The two latera almost meet at the base below the carina. The almost concrescent inframedian and carinal latera are a distinguishing character of the species.

The peduncle, 3.7 mm in length, is covered with wide imbricating scales in six rows of about 15 scales each. The scales of adjacent rows interlock only a little.

Type locality. — "Albatross" stations 2319-2350 (23°10′37″N, 82°20′06″W to 23°10′39″N, 82°20′21″W), off Habana, Cuba, on a pinnule of *Pentacrinus*. Depths within the relatively small area encompassed by "Albatross" stations 2319 to 2350 vary from 33 fathoms (60 meters) to 279 fathoms (510 meters), the bottoms mostly of coral with rare sand, and the recorded bottom temperatures 58° to 79.1°F, the latter at the 33 fathom depth.

The Habana type locality lies about 110 statute miles southwest of Key West, Florida.

Scalpellum (?) **portoricanum** Pilsbry Pl. 29, figs. 5a-c

Scalpellum (species?), Bigelow, 1901, p. 179. [*Fide* Pilsbry, 1907, p. 35.]
Scalpellum portoricanum Pilsbry, 1907, pp. 26, 35-36, figs. 8a-c; 1953, p. 19; U.S. Naval Inst., 1967, p. 194; Broch, 1953, pp. 4, 9, 10; Zullo, 1968, p. 215; Bayer, Voss, and Robins, 1970, p. A43.
Scalpellum (Scalpellum) portoricanum Pilsbry, Calman, 1918a, pp. 121-122.

Pilsbry's description of the type and only specimen is summarized as follows:

The capitulum, measuring 12 mm in length and 7.7 mm in breadth, is rhombic-oblong, with a nearly straight occludent margin and a more convex carinal margin. It is composed of 14 wholly calcified plates which are covered with a thin and sparsely pilose cuticle, and are marked weakly with lines of growth.

The tergum is larger than the scutum and has slightly convex basal and carinal margins, straight occludent and lateral margins, the latter shorter, and an erect apex. The scutum is trapezoidal, more than twice as long as wide, the occludent and lateral margins subparallel, the basal margin straight, and the umbo apical, not projecting beyond the occludent outline. The carina, 11.3 mm long and 2.2 mm wide at the base, is gently arched, its umbo apical, against but hardly between the terga. The roof is flat, bounded by low lateral ribs, and faintly marked with arcuate growth lines; the sides are narrow and concave, the basal margin a little concave.

The upper latus is pentagonal, with a superior, terminal, and acute apex. The rostrum is small and triangular. The rostral latus is narrow, the scutal and basal margins more or less parallel. The inframedian latus is triangular, the apex curving ventrad around the end of the rostral latus and between the lower angles of the upper latus and scutum. The carinal latus is irregularly triangular and projects backward beyond the carina; the umbo is recurved and flares outward in the shape of a subspiral horn.

The peduncle is 7 mm in length, with about 13 rows of transversely lengthened scales, about six scales in a row.

Type locality. — "Fish Hawk" sta. in Mayagüez Harbor, Puerto Rico (18°13′N, 67°09′W), depth between 25 and 76 fathoms (46-129 meters).

Florida localities. — Off Palm Beach, 75 fathoms (137 meters), at several "Triton" stations.

Other localities. — "Pillsbury" sta. 340 (9°13.5′N, 77°46′W), 307-366 meters, about 40 kilometers northeast of Sasardi Viejo, Panama, Gulf of Darien; "Pillsbury" sta. 445 (9°02.3′N, 81°23.8′W), 342-346 meters, about 70 kilometers west of Belén, Gulf of Mosquitos, Panama; C/S "Henry Holmes" sta. at 18°31′N, 66°19′W, 180 fathoms (329 meters), about 30 kilometers west-northwest of San Juan, Puerto Rico.

Scalpellum (?) **intonsum** (Pilsbry) Pl. 29, figs. 6d, e

Scalpellum portoricanum intonsum Pilsbry, 1907, pp. 25, 36-37, figs. 8d, e; Henry, 1954, p. 444; Zullo, 1968, p. 214.

Pilsbry described this taxon from three individuals recovered with a large beam trawl in the Gulf of Mexico at Albatross station 2401. Concerning it he wrote:

> They [the specimens] are smaller than the Porto Rican type, rather densely hairy, and differ from typical *S. portoricanum* somewhat in shape. The capitula measure 9.5, 9.7, and 7 mm. long. The occludent margin of the scutum is distinctly convex, that of the tergum straight or even a trifle concave. The summit is erect, not recurved. The inframedian latus is longer and narrower than in *S. portoricanum*. The rostrum is narrower. The umbones of the carinal latera project less and are situated higher. The valves are sculptured with concentric grooves at subequal intervals. The two larger examples are evidently adult. (Fig. 8d, e).

Type locality. — "Albatross" sta. 2401 (28°38′30″N, 85°52′30″W), 142 fathoms (260 meters), Gulf of Mexico, about 85 statute miles west of Bayport, Florida, and about 108 statute miles south of St. Andrews, Florida. The bottom is green mud and broken shells.

Because the subspecies *intonsum* seems to me to be distinguishable from *S. portoricanum s.s.*, and because *S. portoricanum* resembles somewhat a number of other species, I am inclined to raise the rank of *intonsum* to species.

Scalpellum pressum Pilsbry Pl. 30, figs. 2a, b

Scalpellum pressum Pilsbry, 1907, pp. 14, 23-24, figs. 6a, b; Broch, 1924, pp. 22, 28, 29, 30 [= *S. stroemii* M. Sars, *fide* Broch, 1924, p. 28.]; Zullo, 1968, p. 215 [= *S. stroemii* Sars, *fide* Zullo, p. 215.]

Pilsbry's original description of *S. pressum* is summarized as follows:

The capitulum, measuring 8 mm in length, 4 mm in breadth and 1.8 mm in thickness, is compressed, is widest above the middle, and tapers toward the base which is obliquely truncated. There are 14 plates, irregularly marked with concentric wrinkles and a few weak radial striae. The occludent border is convex above, much less so below.

The tergum has a convex occludent margin, a recurved apex, and a carinal margin which is a little concave below the apex and nearly straight where it is in contact with the carina. The scutum is trapezoidal, with a slightly convex occludent margin which is subparallel with the short lateral margin, a slightly concave tergal margin, and a straight basal margin. The carina is moderately arched, with the umbo projecting a little near the apex. The roof is convex and marked by a few faint longitudinal striae. The parietes are narrow, the intraparietes a little wider.

The upper latus is pentagonal, the umbo not quite terminal. The rostrum is long, narrowly wedge-shaped, blunted at the projecting apex. The rostral latus is broadly triangular. The inframedian latus is more than twice as high as wide, with the umbo on the rostral margin below the middle. The scutal margin is slightly shorter than that against the upper latus. The carinal latus is about twice as wide as high, its umbo projecting slightly behind the base of the carina; below it there is a nearly straight margin almost as long as the basal margin and about one-third the length of the plate; the upper margin is oblique. The dorsal margins of the two carinal latera meet below the umbones in a straight suture.

The peduncle is about one-third to one-half the length of the capitulum or about 3 mm. It is covered with eight rows of large imbricating scales, eight to ten scales in a row.

Type locality. — Le Have Bank (the center of which is about 43°02′N, 64°01′W), 300 fathoms (549 meters).

Georgia-Florida locality. — "Albatross" sta. 2668 (30°58′30″N, 79°38′30″W), 294 fathoms (538 meters), about 105 statute miles east off St. Andrews Sound, Georgia, bottom of gray sand and dead coral, bottom temperature 46.3°F.

Other localities. — U.S. Fish Commission sta. 1124, off Martha's

Vineyard; "Albatross" sta. 2470 (44°47′N, 56°33′45″W), off Nova Scotia, 224 fathoms (410 meters), bottom of gray mud, bottom temperature 40.2°F.; "Albatross" sta. 2527 (41°59′N, 65°35′30″W), off Georges Bank, 117 fathoms (214 meters), bottom of sand and gravel.

In working up *S. pressum*, Pilsbry recognized its general similarity to *S. stroemii* M. Sars. However, as the original of *S. stroemii* was not illustrated by M. Sars, Pilsbry communicated with G. O. Sars from whom he received two specimens with the notation that "they may be regarded as typical". One of these "typical" specimens was figured by Pilsbry (1907, p. 22, pl. 1, figs. 6, 7) and may be compared with the type of *S. pressum* on Plate 30, figure 2.

Concerning the relationship of *S. pressum* to the *S. stroemii* complex, Pilsbry wrote as follows:

> This species [*S. pressum*], which seems to be somewhat abundant off our northeastern coast, resembles the form which Aurivillius has called *S. septentrionale*. It differs from that, however, by the narrower base of the capitulum, the greater compression, and the position of the umbo of the carina, which is much nearer the apex. The inframedian lateral plate is longer than in any of the related forms, and the rostrum has the long and narrow shape figured by Aurivillius for *S. septentrionale* and *S. obesum*. The capitulum of *S. pressum* is more lengthened than that of *S. stroemii*, chiefly by reason of the elongation of the plates of the lower whorl.

The latitudinal range of *S. pressum* is between 31° North and 45° North in the Western Atlantic Ocean.

Scalpellum prunulum Aurivillius Pl. 30, figs. 3, 4

Scalpellum prunulum Aurivillius, 1894a, p. 669; 1894b, pp. 62-64, pl. 5, figs. 3-4; Gruvel, 1905, p. 63 [as *Scalpellum primulum*], fig. 70; Nilsson-Cantell, 1921, pp. 104, 205.

Aurivillius' original German description of the exoskeleton is translated as follows:

> Capitulum with 14 plates. Carina gently arched. Rostrum rudimentary covering only the posterior 1/3 of the rostral latera. Umbones of the scutum and latera as in *Sc. erosum*, those of the inframedian lying at the apices.
>
> Peduncle with 8 elongated rows, each provided with 5-6 moderately distant scales, the outer ends of which are interspersed with adjacent scales.
>
> The color of the specimens in alcohol is brownish yellow between the white plates and scales.
>
> Dimensions. Length of animal 6 mm., length of capitulum 4 mm, breadth 2.5 mm.
>
> [Type] locality. Sea of the Antilles, off St. Martin [18°05′N, 63°05′W], depth 350-600 meters.

Gruvel (1905) added that the 14 plates are slightly separated and are covered by a thin and smooth cuticle. The umbo of the carina is at the apex. The umbones of the carinal latera are at the base and project beyond the dorsal margin and above the carina. The umbones of the inframedian latera are at the base.

Scalpellum (?) pteryges MacDonald Pl. 30, fig. 5

Scalpellum pteryges Macdonald, 1929, pp. 532-533, pl. 2, fig. 4.

The capitulum is trapezoidal, 23 mm in length and 15 mm in breadth, with an approximately straight occludent border and a markedly convex carinal border. There are 14 smooth plates separated by narrow chitinous sutures and marked by fine, closely spaced growth striae.

The tergum is large, subquadrangular with straight occludent and basal margins, and very convex carinal margin. The scutum is marked by a prominent ridge running from the acuminate apex to the basal-lateral angle. The carina is profoundly arched, its acute apical umbo intruded between the terga. The roof is slightly convex, bordered by low ridges. The sides are moderately wide, tapering toward the apex and having a shallow sulcus running the entire length. The basal margin is deeply rounded.

The upper latus is pentagonal, with the scutal margin longest, the tergal, carinal, basal, and that bordering on the inframedian latus successively shorter. The umbo is acute and apical, and there is a low ridge running from the apex to the carinal-basal angle. The carinal latus is somewhat triangular, with the base in two parts: a long upper lateral margin, and a shorter margin lying against the inframedian latus. The apical portion of the carinal latus is considerably curved downward, the apex itself being very acute. The winglike latera, viewed dorsally, show the carina extending between them almost to the peduncle. Toward the apex the latera appear twisted outward. The rostral latus is raised slightly above the scutum. The length of the valve is three times as long as wide. The apex is beaked and a ridge runs from the apex to the basal-lateral angle. The rostrum is small and triangular, the apex projecting outward from the apices of the rostral latera. The inframedian latus is triangular, higher than wide, the margins slightly raised, and the apex curved toward the occludent border.

The peduncle has about 13 rows of scales and is 10 mm in length.

Type locality.—"Enterprise" sta. (13°52′N, 67°7′W), off St. Lucia, attached to cable at a depth of 278 fathoms (508 meters).

Scalpellum (?) semisculptum Pilsbry Pl. 31, figs. 7a-c

Scalpellum semisculptum Pilsbry, 1907, pp. 48, 62-64, figs. 25a-c; MacDonald, 1929, p. 535; Broch, 1953, pp. 4, 7. 10, 12, 15; Henry, 1954, p. 44; Zullo, 1968, p. 216.

Pilsbry's description is summarized as follows:

The capitulum of the type, which is 16 mm in length, 7.7 mm in breadth, is suboval, twice as long as wide, with the occludent and carinal borders nearly equally convex. There are 13 fully calcified plates joined by linear sutures, the plates marked with lines of growth and fine radial striae, excepting the carinal latera which have distinct radial riblets. The cuticle covering the capitulum is very thin and smooth.

The tergum is large and triangular, the occludent margin strongly arched, the acute summit somewhat recurved; the scutal margin is a little longer than the occludent; the carinal margin is convex except near the apex where it is concave. The scutum is rhomboidal, about twice as long as wide, with an acute apical umbo; the occludent and lateral margins are subparallel and slightly convex; the tergal margin is concave, the basal straight. The carina is 12.5 mm in length and 2.5 mm in diameter at the base. It is long and regularly arched, its apical umbo at about the upper fourth of the tergum. The roof is flat between low but robust bordering ribs; the sides are narrow below, wider above; the basal margin is convex.

The upper latus is trapezoidal, with a concave scutal margin and a short carinal margin; the tergal and basal margins are straight and about equal in length. The umbo is terminal and there is a narrow rib extending from it to the baso-carinal angle. The plate is finely and sharply striate radially. There is no rostrum, or merely a sunken linear rudiment. The rostral latus is as high as wide, the basal margin much shorter than the others; the umbo projects a little at the upper occludent angle, and from it a narrow diagonal rib runs to the lower lateral angle, the surface below this rib being radially striate. The two rostral latera rise in a low welt at their occludent margin. The inframedian latus is almost linear, curving above slightly toward the the rostral border; the umbo is not visible but is probably apical. The carinal latus is irregularly trapezoidal, the obtuse umbo at about the lower third of the carinal margin and not projecting beyond the carina. The plate is sculptured with strong radial riblets. In dorsal view the carinal latera are seen to be strongly tricostate, and meet in an irregular suture.

The peduncle is 3 mm in length, closely covered with large, projecting, transversely lengthened scales, in about eight rows of eight scales each.

Type locality. — "Albatross" sta. 2397 (28°42′N, 86°36′W), 280 fathoms (512 meters), gray mud, bottom temperature 46.1°F, surface temperature 65°F, Gulf of Mexico, about 280 statute miles west of Bayport, Florida, and due south of Destin, Florida.

Other localities. — Broch reported this species at "Ingolf" sta. 10 (64°24′N, 28°50′W), 1484 meters (807 fathoms), bottom temperature 3.5°C, about 240 statute miles west of Reykjavik, Iceland. Broch stated that although the single Icelandic specimen was smaller (10 mm) than Pilsbry's type (16 mm), it agreed well with his description.

Scalpellum (?) sinuatum Pilsbry Pl. 30, figs. 7a-c

Scalpellum sinuatum Pilsbry, 1907, pp. 47, 50-51, figs. 16a-c; Fowler, 1912, p. 500; Barnard, 1924, pp. 17, 40-43; Nilsson-Cantell, 1955, p. 219; Zullo, 1968, p. 216.

Arcoscalpellum sp., cf. *A. sinuatum* (Pilsbry), Newman and Ross, 1971, pp. 81-82, pl. 9 D, text-figs. 40A-H.

The capitulum of Pilsbry's type is trapezoidal, about twice as long as wide, and measuring 13.5 mm in length and 7 mm in width. It is composed of 14 nearly smooth plates with no hairs.

The tergum is triangular in shape, with a convex occludent margin, a slightly recurved apex, and a slight prominence on the carinal margin just above the apex of the carina. The scutum has a slightly convex occludent margin and a pointed lateral margin with a broad excavation below it to accommodate the apex and carinal margin of the upper altus. The carina is long and arcuate with an apical umbo. The roof is flat between two moderate rounded ribs. The sides are wide above, tapering to the base.

The upper latus is subtriangular with a deep notch in the lower margin; the scutal margin is longer than the tergal and the mucro is at the scuto-tergal angle. The rostrum is small and subtriangular, lying between the umbones of the rostral latera. The rostral latus is nearly as high as wide, its basal margin shorter than the scutal, its lateral margin convex. The inframedian latus is wineglass-shaped, its upper margin concave and nestled into the upper latus; the umbo is median, and the base of the plate is expanded. The carinal latus is irregularly triangular, projecting a little beyond and above the carina, the umbo slightly recurved at the base of the carina; the two latera meet in a short suture below the carina.

The peduncle is 5 mm in length, with ten rows of large scales, about six scales in a row.

According to Pilsbry, the adult *Scalpellum sinuatum* is notable for the prominent notch in the lower margin of the upper latus which is "unlike any known form of the same group". Also characteristic is the "very small, nodule-like rostrum visible only between the apices of the rostral latera".

Type locality. — "Albatross" sta. 2037 (38°53′N, 69°23′30″N), 1731 fathoms (3166 meters), *Globigerina* ooze, bottom temperature 38°F, surface temperature 76°F, about 305 statute miles east of mouth of Delaware Bay and 7 degrees of latitude north of Florida.

Other localities. — "Pieter Faure" sta. of 14 July 1903, in the Eastern Atlantic, 40 miles south-southwest of Cape Point, South Africa, 800-900 fathoms; "Pieter Faure" sta. of 19 August 1903, 43 miles nearly due west of Cape Point, 900-1000 fathoms (The stations off Cape Point lie between 34 and 35 degrees South and 18 and 17 degrees East); "Eltanin" sta. 18 (58°15′N, 48°36′W), 3404-3422 meters, southwest off Kap Farvel, Greenland.

Barnard (1924), who identified *S. sinuatum* off Cape Point, stated, "The identification of these specimens has caused me considerable difficulty, and other workers may differ from my conclusions". Nilsson-Cantell (1955) did not list *S. sinuatum* as occurring off Cape Point but that may have been because he listed only those species recovered at depths below 3000 meters whereas the greatest depth recorded by Barnard was 1829 meters (1000 fathoms) off Cape Point. Newman and Ross (1971) determined that certain skeletal features of their *Arcoscalpellum* sp. from Greenland waters are similar to those from off the Delaware coast, yet the absence of the sinus in the basicarinal margin of the upper latus persuades them that their Greenland taxon may be distinct from Pilsbry's type of *S. sinuatum* which is also nearly twice as large. It would thus seem to this writer that the type locality of *S. sinuatum* is as yet the only one known for the species.

Arcoscalpellum aurivillii (Pilsbry) Pl. 27, figs. 1a, b

Scalpellum aurivillii Pilsbry, 1907, pp. 48, 64-66, figs. 26a-b; Fowler, 1912, p. 500; MacDonald, 1929, p. 535; Withers, 1953, pp. 9, 10, figs. 11a, b, as *Arcoscalpellum;* Broch, 1953, pp. 4, 7, 12, 15; Zullo, 1968, p. 211.

The capitulum of the type is rhombic-oblong, 15.3 mm in length, 7.5 mm in breadth, and is composed of 13 fully calcified plates, separated by linear sutures, and marked with fine, irregular lines of growth, and minute, inconspicuous radial striae.

The tergum is triangular with a convex occludent margin, a straight scutal margin, a weakly sigmoidal carinal margin which is concave above and convex below, and a slightly recurved umbo. The scutum is longer than wide, its acute apex recurved within the ventral border; the lateral margin is concave below the tergo-internal angle, convex in the middle, and slightly recessed at the basal angle; the basal margin is nearly straight. The carina is 13.5 mm in length, 2.2 mm in diameter at the base. It is simply arched, more strongly so above, and its umbo is terminal; the roof is flat with distinct bordering ribs; the sides are moderately developed near the umbo, narrow elsewhere; the basal margin is straight, as are the lines of growth across the roof.

The upper latus is trapezoidal, the scutal margin much the longest and concave; the other margins are straight, the carinal the shortest; the apex is produced in a small triangle above and beyond the umbo, which is acute and marginal, on the scutal side. There is no rostrum. The rostral latus is quadrangular, the ventral and scutal borders straight, the basal short where it comes in contact at the upper interior angle with the upper latus; the carinal margin is in contact with the carinal latus, but the suture is more or less covered by the extremely narrow inframedian latus, which overlies the borders of the plates. The inframedian latus is narrowly triangular, the umbo apical; it overlies the suture instead of occupying a space between the rostral and carinal latera, and is often abnormal. The carinal latus is twice as high as wide, quadrangular, the umbo at its lower third not projecting beyond the carina; the basal and rostral margins are subequal, straight, and at right angles; the carinal margin is nearly straight, projecting a little in the lower third; the two latera meet below the carina; from the umbo of the carinal latus a conical raised and radially costulate area extends to the basal margin.

The peduncle is 5 mm in length. It is compactly covered with narrow transverse scales in eight rows of about eight scales each.

Type locality.—"Albatross" sta. 2731 (36°45'W, 74°28'W), 781 fathoms (1428 meters), growing on *Scalpellum velutinum* Hoek, about 90 statute miles east-southeast of Virginia Beach, Virginia.

Other localities.—"Albatross" sta. 2728 (36°30'N, 74°33'W), 850 fathoms (1555 meters), gray ooze, about 83 statute miles east off Currituck, North Carolina. This locality is the nearest one to Florida which is some 6 degrees of latitude to the south; "Albatross" sta. 2710 (40°06'N, 68°01'30"W), 984 fathoms (1800 meters), green mud, about 320 statute miles east off Point Pleasant, New Jersey; "Albatross" sta. 2529 (41°03'30"N, 66°14'W), 662 fathoms (1211 meters), gray mud, bottom temperature 38.7°F, about 290 statute miles east off Montauk Point, New York; U.S. Fish Commission sta. 1123, off Martha's Vineyard; "Tjalfe" sta. 408 (64°14'N, 55°55'W), 839 meters (453 fathoms), northwest off Godthaab, Greenland.

Arcoscalpellum aurivillii (Pilsbry) is a Western Atlantic and North Atlantic species ranging geographically from off the coast of North Carolina in the south to Greenland in the north, and occurring in waters with reported depths of 406 fathoms to 984 fathoms.

Arcoscalpellum aurivillii incertum (Pilsbry) Pl. 27, fig. 2c

Scalpellum aurivillii incertum Pilsbry, 1907, p. 67, fig. 26c; Withers, 1953, pp. 9, 10, fig. 11c, as *Arcoscalpellum;* Zullo, 1968, p. 214.

Although this subspecies was recovered in the Northeast Pacific, it is mentioned here because of its possible relationship to *Scalpellum aurivillii aurivillii* Pilsbry which is a Western Atlantic species and, therefore, within the purview of this work.

Pilsbry's description of *S. a. incertum* was as follows:

A single example (Cat. No. 32871, U.S.N.M.), evidently very closely related to *S. aurivillii,* was found growing on the peduncle of one of a series of *S. regium* var., said to be from *Albatross* Station 3342, off British Columbia, in 1,588 fathoms. Having been preserved probably in formaldehyde, the apices of the valves are more or less eroded, especially those of the terga. Allowing for this the length of the capitulum would be 24, breadth 13.5 mm; length of the peduncle 7.5 mm. Length of the carina 22, diameter at base 3 mm. The plates are pale cream-colored, smoothish, except for narrow, widely spaced growth-arrest marks. On the roof of the carina the growth lines arch downwards. The upper latus is larger than in *S. aurivillii,* its length being twice the breadth, and its carinal margin is decidedly longer than in *S. aurivillii.* On the right side of the capitulum there is no inframedian latus and no indication that there ever was one, and on the left side only a small basal triangular plate; but the absence of these plates may be due to the action of the formalin, though I can not positively affirm that this is the case. The rostral latus is comparatively lower and wider, its greatest height only half the width. No rostrum. In other characters of the plates there is no important divergence from *S. aurivillii,* except for size, which is much greater than that of any of the series of apparently adult examples of that species. . .

Type locality.—"Albatross" sta. 3342 (52°39′30″N, 132°38′W), 1588 fathoms (2904 meters) gray ooze and coarse sand, bottom temperature 35.3°F, surface temperature 57°F; about 30 miles west off Moresby Island, British Columbia, Canada.

Arcoscalpellum regina (Pilsbry) Pl. 30, fig. 6

Scalpellum regina Pilsbry, 1907, pp. 25, 31-32, pl. II, figs. 4-6; Calman, 1918a, pp. 112-113; Barnard, 1925, pp. 1, 2-3; U.S. Naval Inst., 1967, p. 194; Henry, 1954, p. 444; Zullo, 1968, p. 216; Kaufmann, 1971, pp. 73-85, figs. 1-4.

Following is a summary of Pilsbry's description:

The capitulum, measuring 43 mm in height and 34 mm in breadth, is moderately compressed, high domal in outline, acuminate at the apex, subtruncate at the contact with the peduncle. The capitulum is covered with a densely and shortly pilose cuticle. There are 14 plates separated by wide chitinous sutures in adults but in contact in immature specimens. The plates are weakly sculptured with widely spaced low wrinkles along the lines of growth.

The tergum is divided into two areas by a straight apico-basal ridge, the carinal area about half as wide as the scutal. The scutum is twice as long as wide, its occludent margin arcuate, its acuminate apex a little recurved, its basal and lateral margins straight, and the tergal margin straight immediately below the apex. The carina, 40 mm in length and 6 mm in diameter at the base, is gently arched, separated from the scuta and latera by a wide chitinous space. The umbo is terminal at the apex which intrudes slightly between the scuta. The roof is slightly convex, marked with V-shaped lines of growth, the sides narrow throughout, and the base wedged between the carinal latera.

The upper latus is subpentagonal with slightly concave tergal and scutal margins and subrounded carinal and basal margins; the umbo is at the apex. The rostrum is small and triangular and separates slightly the rostral latera. The rostral latus is low, the upper and lower margins parallel. The inframedian latus is small and triangular with the basal margin the longest; the umbo is apical. The carinal latus is irregular in shape. The convex posterior margins project beyond the carina, and the two latera meet below it. The umbo is elevated, acute, and curved toward the scutal margin. A prominent ridge runs from the umbo to the scutal end of the plate and there are two or three inconspicuous ridges to the basal margin.

The peduncle is 26 mm in length and is covered with large scales clothed in a velvety cuticle. There are 10 rows of about 12 scales each in the figured type but more in old individuals.

Type locality. — "Albatross" sta. 2376 (29°03′N, 88°16′W), Gulf of Mexico about 95 miles southeast of Pascagoula, Mississippi, and southwest of Pensacola, Florida, in 324 fathoms (593 meters), bottom of gray mud, bottom temperature 46.5°F.

Additional localities in Gulf of Mexico. — Provided by Henry A. Spivey of Florida State University who obtained the data from Jack Rudloe, Gulf Specimen Co., Panacea, Florida. Trawl between 29°32′N, 86°57′W and 29°25′N, 87°15′W, about 53 statute miles south of Pensacola, Florida, 216-228 f.; trawl at 29°24′N, 87°12′W, about 46 statute miles southeast of Gulf Beach, Florida, 230-248 f.; trawl between 29°16N, 87°42′W and 29°25′N, 87°23′W, about 67 statute miles south of Orange Beach, Florida, 198-300 f.; "Eric Wakefield" sta. at 29°07′N, 88°10′W, trawl, about 107 statute miles southeast of Biloxi, Mississippi, 370 f.

Among a cluster of numerous specimens of *Arcoscalpellum regina* attached to each other and collected in the Gulf of Mexico off one or the other of the Florida locations mentioned above, there are two measuring over 130 mm in length when fully extended. The capitulum of one is about 55 mm in length and 45 mm in width, and the capitulum of the other about 50 mm in length and 38 mm in width. The maximum diameters of the peduncle are 30 mm and 28 mm, respectively.

Other localities. — Off the Caribbean coast of Colombia at the following stations — "Oregon" sta. 4882 (10°16′N, 75°54′W), 30 km west of Isla Barú (10°10′N, 75°36′W), 300 fathoms; "Oregon II" sta. 267 (11°12′N, 74°21′W), 14 km west of Santa Marta, 240 fathoms; "Oregon II" sta. 268 (11°26′N, 74°14′W), 21 km west of Santa Marta, 280 fathoms; "Oregon II" sta. 287 (11°35′N, 73°26′W), 57 km west of Riohacha, Colombia (11°34′N, 72°57′W), 250 fathoms; "Oregon II" sta. 288 (11°27′N, 73°42′W), 87 km west-southwest of Riohacha, 220 fathoms; "Oregon II" sta. 289 (11°24′N, 73°47′W), 95 km west-southwest of Riohacha, 150 fathoms; Brazil — "Norseman" sta. (7°37′S, 34°26.5′W), 50-150 fathoms, 55 statute miles northeast off Pernambuco.

To judge from the localities at which this species is reported, *Arcoscalpellum regina* (Pilsbry) has a latitudinal range of some 36 degrees and a longitudinal range of some 54 degrees, from the northern Gulf of Mexico to the Western Atlantic off the bulge of Brazil.

Arcoscalpellum regium (Thomson) Pl. 31, figs. 1-5

Scalpellum regium Thomson, 1878, vol. 2, pp. 11-14, figs. 2-3; Hoek, 1883, pp. 22, 27, 29, 65, 96, 100, 104, 105, 106-109, 111, 122, 124, 126, pl. 4, figs. 3-5, pl. 9, fig. 12, pl. 10, figs. 1-2; Aurivillius, 1894b, p. 89; Weltner, 1897, p. 249; Gruvel, 1905, p. 77, figs. 86A-B; 1912, p. 2; 1920, pp. 30, 85, pl. I, fig. 7; Pilsbry, 1907, pp. 25, 28-29, pl. 3, figs. 4-5; Fowler, 1912, p. 499; Krüger, 1940, p. 225; Nilsson-Cantell, 1955, p. 219; Newman and Ross, 1971, p. 71.

Scalpellum regium Thomson was recovered with a trawl on June 17, 1873 at a depth of 2850 fathoms, adhering to a concretionary mass containing a large percentage of peroxide of manganese. Thomson's excellent description is repeated in full.

Scalpellum regium (Fig. 2) is one of the largest of the known living species of the genus. The extreme length of a full-sized specimen of the female is 60 mm., of which 40 mm. are occupied by the capitulum and 20 mm. by the peduncle. The capitulum is much compressed, 25 mm. in width from the occludent margin of the scutum to the back of the carina. The valves are 14 in number; they are thick and strong, with the lines of growth strongly marked, and they fit very closely to one another, in most cases slightly overlapping. When living, the capitulum is covered with a pale brown epidermis, with scattered hairs of the same color.

The scuta are slightly convex, nearly once and a half as long as broad. The upper angle is considerably prolonged upwards, and, as in most fossil species, the centre of calcification is at the upper apex. A defined line runs downwards and backwards from the apex to the angle between the lateral and basal margins. The occludent margin is almost straight; there is no depression for the adductor muscle, and there is no trace of notches or grooves along the occludent margin for the reception of the males; the interior of the valve is quite smooth. The terga are large, almost elliptical in shape, the centre of calcification at the upper angle. The carina is a handsome plate, very uniformly arched, with the umbo placed at the apex; two lateral ridges and a slight median ridge runs from the umbo to the basal margin; the lower part of the valve widens out rapidly, and the whole is deeply concave. The rostrum, as in *Scalpellum vulgare*, is very minute, entirely hidden during life by the investing membrane. The upper latera are triangular, the upper angle curving rather gracefully forwards; the umbo of growth is apical.

The rostral latera are long transverse plates lying beneath the basal margins of the scuta. The carinal latera are large and triangular, with the apex curved forward very much like the upper latera, and the infra-median latera are very small, but in form and direction of growth nearly the same.

The peduncle is round in section and strong, and covered with a felting of light-brown hair. The scales of the peduncle are imbricated and remarkably large, somewhat as in *S. ornatum*, Darwin. About three, or at most four, scales pass entirely round the peduncle. The base of attachment is very small, the lower part of the peduncle contracting rapidly. Some of the specimens taken were attached to the lumps of clay and manganese concretions, but rather feebly, and several of them were free, and showed no appearance of having been attached. There is no doubt, however, that they had all been more or less securely fixed, and had been pulled from their places of attachment by the trawl. On one lump of clay there were one mature specimen and two or three young ones, some of these only lately attached. The detailed anatomy of this species will be given hereafter, but the structure of the soft parts is much the same as in *Scalpellum vulgare*.

In two specimens dissected there was no trace of a testis or of an intromittent organ, while the ovaries were well developed. I conclude, therefore, that the large attached examples are females, corresponding, in this respect, with the species otherwise almost nearly allied, *S. ornatum*.

In almost all the specimens which were procured by us, several males, in number varying from five to nine, were attached within the occludent margin of the scuta, not imbedded in the chitinous border of the valve, or even in any way in contact with the shell, but in a fold of the body-sac quite free from the valve. They were ranged in rows, sometimes stretching — as in one case where there were seven males on one side — along the whole of the middle two-thirds of the edge of the tergum.

The male of *Scalpellum regium* (Fig. 3) is the simplest in structure of these parasitic males which have yet been observed. It is oval and sac-like, about 2 mm. in length by 9 mm. in extreme width. There is an opening at the upper extremity which usually appears narrow, like a slit, and this is surrounded by a dark, well-defined, slightly raised ring. The antennae are placed near the posterior extremity of the sac, and resemble closely in form those of *S. vulgare*. The whole of the sac, with the exception of a small bald patch near the point of attachment, is covered with fine chitinous hairs arranged in transverse rings. There is not the slightest rudiment of a valve, and I could detect no trace of a jointed thorax, although several specimens were rendered very transparent by boiling in caustic potash. There seems to be no oesophagus nor stomach, and the whole of the posterior two-thirds of the body in the mature specimens was filled with a lobulated mass of sperm-cells. Under the border of the mantle of one female there were the dead and withered remains of five males, and in most cases one or two of the males were not fully developed; several appeared to be mature, and one or two were dead — empty, dark-colored chitine sacs.

Type locality. — "Challenger" sta. 61 (34°54′N, 56°38′W), 2850 fathoms (5212 meters), bottom of gray ooze, temperature 1.5°C, about 840 statute miles south of Grand Bank, Newfoundland, and 1140 miles east of Cape Lookout, North Carolina.

Other localities. — "Challenger" sta. 63 (35°29′N, 50°53′W), 2750 fathoms (5030 meters), bottom of gray ooze, about 1120 statute miles east off Cape Hatteras, North Carolina, and southeast off Cape Race, Newfoundland; "Albatross" sta. 2226 (37°N, 71°54′W), 2045 fathoms (3740 meters), bottom of *Globigerina* ooze, bottom temperature 36.8°F, about 220 miles east of Newport News, Virginia, seated on a slender gorgonian stem and on a pebble, and attached to *Scalpellum albatrossianum* Pilsbry. This locality is the one nearest to Florida; "Albatross" sta. 2228 (37°25′N, 73°06′W), 1582 fathoms (2893 meters), bottom of brown mud, temperature 36.8°F, 235 miles east of Newport News, Virginia; "Albatross" sta. 2533 (40°16′30″N, 67°26′15″W), 828 fathoms (1514 meters), bottom of brown ooze, temperature 38.7°F, about 340 statute miles east of New York City and 240 statute miles southwest of Cape Sable, Nova Scotia; "Albatross" sta. 2575 (41°07′N, 65°30′W), 1710 fathoms (3128 meters), bottom of gray ooze, temperature 37.1°F, about 220 statute miles east of Nantucket, Massachusetts, and about 150 statute miles south of Cape Sable, Nova Scotia; "Prince de Monaco Cruise of 1910" (43°21′N, 10°02′W), 2779 fathoms (5083 meters), northwest off Cape Finisterre (42°54′N, 9°16′W), Spain.

The latitudinal range of *A. regium* is from about 34° North to 43° North, the longitudinal from 10° West to 73° West. Depths range from 828 to 2850 fathoms (1514 to 5212 meters).

Arcoscalpellum velutinum (Hoek) Pl. 32, figs. 1, 2

This name is applied to a taxon variously identified by authors as *Scalpellum michelottianum* Seguenza (1876); *Scalpellum velutinum* Hoek (1883); *Scalpellum eximium* Hoek (1883); *Scalpellum sordidum* Aurivillius (1898); *Scalpellum erectum* Aurivillius (1898); and *Scalpellum alatum* Gruvel (1900). My own feeling, based on comparing the illustrations of the types (Pl. 32) and on their original descriptions, is that *S. michelottianum*, *S. velutinum*, and *S. eximium* are distinct species, and that *S. sordidum*, *S. erectum*, and *S. alatum* may perhaps be synonymous with one or the other of the six species listed above. The synonymy proposed by authors is the following:

Scalpellum michelottianum Seguenza, 1876, pp. 381-386, 422, 423, 426, 427, 432, 464, 481, pl. 6, figs. 15-25, pl. 10, figs. 26, 26a; Alessandri, 1894, pp. 263-265, pl. 1, figs. 6a-6m, *pars*; 1897, p. 47; 1906, pp. 251-252; Pilsbry, 1907, p. 32; Withers, 1953, as *Arcoscalpellum*, pp. 101, 225-229, pl. 37, figs. 1-10, pl. 64, fig. 4; Newman, Zullo, and Withers, 1969, as *Arcoscalpellum*, p. R277; Newman and Ross, 1971, as *Arcoscalpellum*, p. 71, figs. 34A-J, pl. IX,B; Rao and Newman, 1972, as *Arcoscalpellum*, pp. 76-80, figs. 5, 11A-B. [Plate 32, figs. 5(15 to 25)].

Scalpellum velutinum Hoek, 1883, pp. 22, 25, 27, 31, 65, 96-99, 100, 104, 105, 126, pl. 4, figs. 10-11; pl. 9, figs. 7-9; 1914, p. 4; Weltner, 1895, p. 289; 1897, p. 251; 1922, pp. 75, 92, 94, 106, pl. 3, fig. 10; Murray, 1896, pp. 386, 397, 453; Gruvel, 1902a, pp 31, 50, 52, 57, 136-137, pl. 2, figs. 3c 14; pl. 3, figs. 1, 27-31; pl. 4, figs. 6, 11-22; 1902c, p. 523; 1905, pp. 73-74, fig. 83; 1912, p. 2; 1920, pp. 27, 28, 69, 71, 73, 77, 85, pl. 1, figs. 8-10; pl. 7, fig. 4; Annandale, 1905, p. 83; 1908, pl. 4. fig. 7; 1911, pp. 588, 589; *non* 1913, pp. 228-229 (= *S. annan-*

dalei Calman); 1916a (?), pp. 128-129, pl. 6, figs. 6-7; Pilsbry, 1907, pp. 25, 26-27, 64, 75, pl. 3, figs. 2-3; 1908, as *Scalpellum (Arcoscalpellum)*, pp. 105, 109, figs. 1i, j; Fowler, 1912, p. 499; Calman, 1918a, pp. 108-109; Broch, 1924, p. 39; 1953, p. 9; Barnard, 1925, pp. 1-2; Nilsson-Cantell, 1927, pp. 743-745, text-fig. 1; 1928, p. 4; 1931a, pp. 1-2; 1938, pp. 8, 18, 21; Stubbings, 1936, pp. 2, 28, 29, 30, 67; 1967, p. 234; Krüger, 1940, as *Arcoscalpellum*, pp. 46, 63, 113, 139, 141, 265, figs. 28a, 143a-c; Withers, 1953, as *Arcoscalpellum*, pp. 97, 196, 228; Tarasov and Zevina, 1957, p. 24, figs. 9, 11; Bassindale, 1964, p. 31, fig. on p. 54; U.S. Naval Inst., 1967, p. 194; Zullo, 1968, as *Arcoscalpellum*, p. 213; Newman, Zullo, and Withers, 1969, as *Arcoscalpellum*, p. R277; Newman and Ross, 1971, as *Arcoscalpellum*, p. 73; Collins and Mellen, 1973, as *Arcoscalpellum*, p. 363.

Scalpellum eximium Hoek, 1883, pp. 22, 25, 31, 98, 100-102, pl. 4, figs. 6-7; pl. 9, figs. 10-11; Weltner, 1897, p. 247; Gruvel, 1905, p. 73; 1912, p. 2; Annandale, 1913, p. 229; Barnard, 1925, p. 1; Withers, 1953, as synonymous with *Arcoscalpellum michelottianum* (Seguenza), p. 225; Newman and Ross, 1971, p. 72. [Pl. 32, figs. 3-4.]

Scalpellum sordidum Aurivillius, 1898, pp. 190-191; Gruvel, 1905, p. 73; 1912, p. 2; 1920, pp. 27-28, pl. 1, fig. 15, as *S. velutinum* forma *sordidum;* Barnard, 1925, p. 1; Withers, 1953, as synonymous with *Arcoscalpellum michelottianum* (Seguenza), p. 225; Newman and Ross, 1971, p. 72.

Scalpellum erectum Aurivillius, 1898, p. 192; Gruvel, 1905, p. 73; 1920, pp. 27-28, as *S. velutinum* forma *erectum;* Withers, 1953, as synonymous with *Arcoscalpellum michelottianum* (Seguenza), p. 225; Newman and Ross, 1971, p. 72.

Scalpellum alatum Gruvel, 1900, p. 192; 1905, p. 73; 1912, p. 2; Barnard, 1925, p. 1; Withers, 1953, as synonymous with *Arcoscalpellum michelottianum* (Seguenza), p. 225; Newman and Ross, 1971, p. 72.

TYPE LOCALITIES

The taxon *Scalpellum michelottianum* Seguenza is a fossil form wholly reconstructed by Seguenza from numerous but discrete and separated valves and scales first found near the town of Messina (38°13′N, 15°33 E), in Sicily. These external components of the species have since been discovered abundantly in the Plaisancian, Zanclian, and Astian stages (lower to upper Pliocene) in Sicily and Italy. In Sicily they are common in the Pliocene of Messina Province at Salice, Soppo, Trapani, and Gravitelli; in Italy proper they have been reported from Reggio (38°06′N, 15°39′E) in the Province of Calabria. To my knowledge *S. michelottianum* has not been reported living in the waters surrounding Italy.

The holotype of *Arcoscalpellum velutinum* (Hoek) was recovered at "Challenger" sta. 3 (37°2′N, 9°14′W), 900 fathoms, in *Globigerina* ooze, off Cabo São Vicente, Portugal. The paratype was recovered at "Challenger" sta. 335 (32°24′S, 13°5′W), 1425 fathoms (2606 meters), bottom temperature 2.3°C, in *Globigerina* ooze, about 270 statute miles north of Tristan da Cunha.

The type of *Scalpellum eximium* Hoek was taken at "Challenger" sta. 135, between Nightingale Island (37°28′S, 12°32′W) and Tristan da Cunha (37°15′S, 12°30′W). First sounding 1000 fathoms (1829 meters), shells and rock on bottom; second sounding 1100 fathoms (2012 meters).

The type of *Scalpellum sordidum* Aurivillius was recovered during the "Prince de Monaco Campagne 1887", sta. 161 (46°04′40″N, 46°42′15″W), 1267 meters, soft gray mud, off Newfoundland.

The type of *Scalpellum erectum* Aurivillius was recovered during the "Prince de Monaco Campagne 1887", sta. 227 (38°23′N, 28°26′37″W), 1135 meters, bottom of rock, gravel, and broken shells, near south coast of Pico, Azores.

The type of *Scalpellum alatum* Gruvel was recovered during the "Campagne du Talisman" at Cap Cantin (32°33′N, 9°17′W), Morocco.

In this work the name *Arcoscalpellum velutinum* (Hoek) has preference for the reason that this species, according to Pilsbry, occurs in the Western Atlantic along the east coast of North America from Newfoundland southwestward to off South Carolina. *A. velutinum* has not been reported from Florida, but inasmuch as it occurs within two or three degrees of latitude south of South Carolina, it is possible that *A. velutinum* will eventually be discovered in the deeper waters off Florida's east coast.

Hoek's description of his *Scalpellum velutinum* is summarized as follows:

The capitulum of the type is 33 mm in length, is covered by a velvety hirsute membrane, and consists of 14 valves which touch each other. The carina is gently arched, its flat roof widening from the umbo to the base, its apex penetrating between the two terga. The tergum is large and narrowish, the carinal and scutal margins moderately convex, the occludent margin excavated, the umbo narrowly rounded at the apex. The scutum is tumid, its length twice the breadth, the apex of the umbo sharply pointed.

The upper latus is triangular, the basal margin slightly convex, the scutal and tergal margins nearly equal, the umbo at the apex. The rostrum is small and totally covered by membrane; it is triangular in shape, with the apex separated from the two scuta by the umbones of the rostral latera which touch each other in front of the rostrum. The rostral latus is broad and low, the basal margin almost parallel with the scutal margin. The inframedian latus is small and triangular.

The carinal latus is robust and irregular in shape; the carinal margin is divided into an upper hollowed out portion to receive the convex margin of the upper latus, and a lower convex portion beneath the middle of the carina; from the umbo arises a ledge which divides the valves into a true lateral and carinal part. Between the latter and the carina a distinct cavity or kind of bag is formed.

The peduncle is robust, nearly cylindrical, 12 mm in length. The scales are covered by a membrane, the edges of the scales only being calcareous. There are about 12 scales in each obliquely longitudinal row, of which there are about 10.

Type locality. — "Challenger" sta. 3 (37°2′N, 9°14′W), 900 fathoms (1646 meters), off Cabo São Vicente, Portugal.

Paratype. — "Challenger" sta. 335 (32°24′S, 13°5′W), about 270 statute miles north of Tristan da Cunha, depth 1425 fathoms (2606 meters).

Range and distribution. — The taxon *Arcoscalpellum velutinum* or its congeners is reported from the Atlantic Ocean, the Mediterranean Sea, the Indian Ocean, off both the west and east coast of Africa, the Gulf of Oman, and Indonesia. As noted by Nilsson-Cantell (1927), however, the descriptions of the internal parts of many of the synonymized species are lacking, and that in the absence of those characters the identification of a taxon as *Arcoscalpellum velutinum* may be suspect. Nevertheless *A. velutinum s. l.* has been reported from as far north as 72° in the Atlantic to as far south as the Kerguelen Archipelago (48°37′S). Depths range from 63 meters, to 3422 meters off the southern tip of Greenland. Details are as follows:

Northern and Western Atlantic: Off southern tip of Greenland, "Eltanin" sta. 18 (58°15′N, 48°36′W), 3404-3422 meters; Newfoundland (46°04′40″N, 46°42′15″W), 1267 meters, soft gray mud; Numerous stations from Newfoundland southwestward to South Carolina (consult Pilsbry, 1907, p. 27); "Eastward" sta. 7552 (33°39.5′N, 75°41′W), 301 meters, about 150 statute miles east off Crescent Beach, South Carolina; "Albatross" sta. 2678 (32°40′N, 76°40′30″W), 371 fathoms (679 meters), about 285 statute miles east off Fort Sumter, South Carolina. This locality is the nearest one to Florida.

Eastern and Southern Atlantic: Off Ireland (51°22′N, 12°W), 695-720 fathoms; Off Liston, Portugal (38°21′N, 9°41′37″W), 2028 meters, brownish gray limy mud; Off Cabo São Vicente (Cape St. Vincent), Portugal (37°2′N, 9°14′W) 1615 meters; Gibraltar, "Michael Sars" sta. 24 (35°34′N, 7°35′W), 1615 meters. Azores (38°47′N, 30°16′W), 1331 meters; (38°26′N, 26°30′45″W), 1165 meters, argillaceous sand; "Michael Sars" sta. 53 (34°59′N, 33°1′W), 2865 meters, about 275 statute miles southwest of Faial Island, Azores. Canary Islands (29°06′30″N, 13°02′45″W), 1098 meters, sandy clay; Fuerteventura (28°25′N, 14°W), 2000 meters. "Challenger" sta. 335 (32°24′S, 13°5′W, 1425 fathoms (2606 meters), about 270 statute miles north of Tristan da Cunha; South Africa (34°32′S, 17°49′E), about 40 statute miles southwest of Cape Town, on water-logged pumice stone and phosphate nodule, depth 612 fathoms (1119 meters).

Mediterranean Sea: Monaco, 515-2028 meters.

West Africa: Morocco - Mogador (31°30′N, 9°48′W), 1050 meters; Sidi Moussa (33°N, 8°50′W); Cap Cantin (32°33′N, 9°17′W), 1350-1590 meters, as *S. alatum*; Cap Noun, 1255 meters, as *S. alatum*; Spanish Sahara (Los Pilones (25°48′N, 14°40′W), 882 meters.

Gulf of Oman: 430 fathoms (786 meters).

East Africa: "Valdivia" sta. 257 (1°48.2′N, 45°42.5′E), depth 1644 meters, bottom temperature 4.6°C, just off Mogadishu, Somalia; Gulf of Aden (12°20′N, 52°30′E), Socatra Island; "Colonia" sta. Aden-Zanzibar cable.

Indian Ocean: "Investigator" sta. 232 (7°17′30″N, 76°54′-30″E), 40 fathoms (73 meters), off Trivandrum, India; Nicobar Island, India (6°39′N, 93°12′E), 880 fathoms (1610 meters); (6°12′N, 93°52′E), 600-1300 fathoms (1097-2378 meters).

Indonesia: "Recorder" sta. off south coast of Bali (8°46′S, 114°44′E), 400 fathoms (732 meters); "Patrol" sta. southeast of Sumba (10°45′S, 120°50′E), 700 fathoms (1280 meters); "Patrol" sta. south off Sumba (11°S, 121°30′E), 500 fathoms (914 meters); "Patrol" sta. off Sawu (11°S, 122°E), 600 fathoms (1097 meters).

The living *Arcoscalpellum velutinum* is a deep water species which attaches itself to varying substrates, among them telegraph cables, pumice stone, phosphatic nodules, and corals.

Arcoscalpellum vitreum (Hoek) Pl. 33, fig. 1

This species has also been known under several names: *Scalpellum talismani* Gruvel, *Scalpellum formosum* Pilsbry, and *Scalpellum bellum* Pilsbry, the last as replacement for *Scalpellum formosum* Hoek.

The following synonymy is adopted from Newman and Ross (1971) with a few additions.

Scalpellum vitreum Hoek, 1883, pp. 22, 35, 65, 115-116, pl. 5, fig. 14; Weltner, 1897, p. 251; Gruvel, 1902b, p. 54; 1905, pp. 84-85, fig. 94; Pilsbry, 1907, p. 60; Nilsson-Cantell, 1955, p. 219; Tarasov and Zevina, 1957, p. 142; Utinomi, 1958, pp. 283-286, figs. 1-2.

Scalpellum talismani Gruvel, 1900, pp. 193-194; 1902b, p. 86, pl. 2, figs. 3D, 6, 7; 1905, p. 86, fig. 96; 1920, p. 23 [see Pl. 33, fig. 2, this report.]; Nilsson-Cantell, 1955, p. 219; Broch, 1953, p. 8, fig. 4; Zullo, 1968, p. 211.

Scalpellum formosum Pilsbry [not Hoek], 1907, pp. 47, 58-60, figs. 22a-c; Weltner, 1922, pp. 95-96; Fowler, 1912, p. 500; Stubbings, 1936, pp. 55-56, text-fig. 24, *pars;* Nilsson-Cantell, 1938, p. 21; 1955, p. 219.

Scalpellum bellum Pilsbry, 1908, p. 111 [new name for *S. formosum* Pilsbry, 1907, *non* Hoek, 1907]; Zullo, 1968, p. 211.

Scalpellum sp. cf. *bellum* Bayer, Voss, and Robins, 1970, p. A43.

Arcoscalpellum vitreum (Hoek), Newman and Ross, 1971, pp. 87-91, 195, 197, pl. 8 E, F, text-figs. 44-47.

Hoek's original diagnosis was as follows. "Surface of the valves smooth, not covered by membrane, beautifully striated. Valves thirteen. Carina simple, only slightly bowed, with the roof flat. Umbo of the carina at the apex. Upper latus trapeziform. Infra-median latus small, triangular. Other valves of the lower whorl well-developed. Peduncle short."

The capitulum of the type is elongate-ovate, 13.5 mm in length. The tergum is slightly smaller than the scutum, with the carinal margin considerably longer than that of the scutum. The scutum is quadrilateral. The carina has a flat roof which is wider below than above, and in the superior half the sides are distinctly furrowed. The four margins of the upper latus are nearly straight. The rostral latus is almost triangular. The inframedian latus has the umbo at the superior extremity. The carinal latus is large and almost trapeziform; it has the umbo at one-fourth the total length from the inferior extremity, and the part above the umbo is slightly excavated. The peduncle is 3.5 mm in length and is covered with a membrane through which are visible imperfectly seven longitudinal rows, each of them composed of about eight rather large scales.

Broch (1953) synonymized *Scalpellum bellum* Pilsbry with *Scalpellum talismani* Gruvel, and stated that neither Gruvel nor Pilsbry "mentioned a membraneous interspace between the strongly and evenly arched carina and tergum-latus superiorus . . . probably because this interspace is also lacking in the smaller specimen from [Ingolf] St. 20." This gap is clearly shown by Broch on what he believed to be *S. talismani*. However, the gap is also at least suggested on the drawing of the type *S. vitreum* by Hoek, and is definitely portrayed on the sketches of *S. vitreum* by Newman and Ross.

Type locality.—"Challenger" sta. 237 (34°37′N, 140°32′E), off Yeddo, Chiba Prefecture, Japan, depth 1875 fathoms (3429 meters), mud bottom, temperature 1.7°C. The species was also listed (as *Scalpellum formosum* Pilsbry) by Weltner in 1922 from Sagami Bay, Japan, at a depth of 366 meters.

Other localities.—"Eastward" sta. 7617 (33°58.7′N, 45°42′W), about 125 statute miles east of Fort Fisher, South Carolina, depth 2280 meters. This Western Atlantic occurrence is the nearest one to Florida; "Albatross" sta. 2205 (39°35′N, 71°18′45″W) south of Martha's Vineyard, depth 1073 fathoms (1963 meters), 38.1° bottom temperature; "Albatross" sta. 2097 (37°56′20″N, 70°57′30″W), 1917 fathoms (3506 meters), *Globigerina* ooze; Type of *S. formosum* Pilsbry, about 230 statute miles east of Chincoteague, Virginia; Cap Ghir (30°40′N, 9°54′W), Morocco, depth 2125 meters; Golfe de Gascogne, 4255 meters; Indian Ocean and Malay Archipelago (Nilsson-Cantell, 1938); "Ingolf" sta. 20 (58°20′N, 40°48′W), southeast off Cape Farewell, Greenland, 3192 meters, 1.5°C bottom temperature; "Eltanin" sta. 18 (58°15′N, 48°36′W), southwest off Cape Farewell, Greenland, depth 3404 to 3422 meters; "Eltanin" sta. 791 (63°54′S, 83°03′W), 4531 meters, off Bryan Coast, Ellsworth Land, Antarctica.

Arcoscalpellum vitreum and the species synonymized with it by authors ranges in depth from 366 meters to 4531 meters, ranges latitudinally from 58° north to 63° south, and occurs in the Northwest Pacific (Japan), the Malay Archipelago, the Indian Ocean, and in the Eastern and Western Atlantic.

Should the *Scalpellum* sp. cf. *bellum* of Bayer, Voss and Robins (1970) be confirmed as one of the synonymous species under *Arcoscalpellum vitreum,* the range of *A. vitreum* can be extended to include "Pillsbury" sta. 345 (9°59.6′N, 77°33′W to 10°11.5′N, 77°21′W) at depths of 2434-3111 meters and "Pillsbury" sta. 346 (9°54.5′N, 77°03′W to 9°51′N, 76°58′W) at depths of 2983-2970 meters. These stations are in the Caribbean Sea about midway between Punta San Blas, Panama, and Cartagena, Colombia.

Calantica superba (Pilsbry) Pl. 33, figs. 3a-c

Scalpellum (Calantica) superbum Pilsbry, 1907, pp. 9, 11-13, figs. 3a-c.
Scalpellum [= *Calantica*] *superbum* Pilsbry, Zullo, 1968, p. 216.

The capitulum of the type from "Albatross" sta. 2669 is 46 mm in length and 34 mm in width. The capituli of two specimens from "Albatross" sta. 2415 measure 35 $\times$ 28 mm and 28 $\times$ 22 mm, respectively. The capitulum of the type is somewhat triangular, wide and thick at the base, and is composed of 13 strong white plates without perceptible cuticle. The plates are sculptured with radiating striae crossed by growth lines.

The tergum is in part concealed under the margins of the scuta and carina, the visible part divided equally by a median ridge from apex to base; the summit is erect, only a trifle recurved. The carina is somewhat curved, its apex not inserted between the terga; the roof is strongly carinate along the median line, sloping and sculptured with radial striae on each side of the keel; the sides are narrow and incurved, and at the base the roof is wide.

The rostrum is triangular, with an incurved apex and a strong median longitudinal rib. The rostrolateral plate is obliquely triangular, with incurved apex, the surface sculptured with several coarse low radial ribs, numerous fine radial striae, and curved coarse radial growth wrinkles; the base of the plate overlies the adjacent bases of the rostrum and inframedian latera. There is no subrostrum. The median lateral plate is oblique, triangular, much wider than high, its apex incurved and twisted; a strong flat-topped rib runs from the apex to the basal margin which in the middle rests on the peduncle. The carinal latus is oblique and triangular, its apex curved under the apices of the inframedian latera. The surface of the carinal latus is ribbed. The subcarina is triangular, usually asymmetrical, and with an incurved apex.

The peduncle of the two specimens from "Albatross" sta. 2415 measures 12 and 15 mm respectively, in length. The peduncle is covered with large, strongly imbricating white scales.

Type locality. — "Albatross" sta. 2669 (31°09′N, 79°33′W), 352 fathoms (644 meters), gray sand and dead coral, bottom temperature 43.7°F, about 105 statute miles east off Sea Island, Georgia.

Other localities. — "Albatross" sta. 2415 (30°44′N, 79°26′W), 440 fathoms (805 meters), bottom temperature 45.6°F, on branching white coral, bottom of coral and coarse sand with shells and Foraminiferida, about 120 statute miles east off mouth of St. Marys River, boundary between Georgia and Florida.

Euscalpellum stratum (Aurivillius) Pl. 33, figs. 4-7

Scalpellum stratum Aurivillius, 1893, p. 132; 1894b, pp. 65-67, pl. 3, figs. 10-11, pl. 8, fig. 8; Weltner, 1897, p. 250; Gruvel, 1905, p. 58, fig. 62.

Scalpellum (Smilium) stratum (Aurivillius), Pilsbry, 1907, p. 13.

Euscalpellum stratum (Aurivillius), Krüger, 1940, p. 82, fig. 84b1; Pilsbry, 1953, pp. 21-23, pl. 1, fig. 7; Withers, 1953, p. 171.

Aurivillius' original description in German is translated as follows:

Diagnosis. Capitulum with 15 calicified plates. Carina simply arched, the roof flattened below. Subcarina small, equilaterally triangular. Rostrum extending to the muscle margin of the scuta, convex, pointed below, widest near the middle where it is almost angular. Rostrolatera triangular, measuring in length one third of the rostrum. Laterals and inframedian quadrilateral, their scutal margins about one third the length of the scutum. The umbo lies in the lower angle of these plates.

The peduncle is crossed by 14 diagonal rows of about 14-15 rhomboidal scales.

Color of specimens in alcohol. Light brown, on the capitulum only between the margins of the plates, on the peduncle clearly visible between the rows of scales.

Dimensions. Length of animal 9 mm. Length of capitulum 5.5 mm; breadth across rostrum — 3 mm.

Locality and occurrence. Sea of the Antilles, near Anguilla, 360-680 meters in depth. Various specimens (A. Goës). RM.

The above description was added to by Gruvel (1905) who stated that the carina was rounded at the base; that the apices of the terga and scuta were pointed and nearly straight; that the infralaterals were not in immediate contact with the capitulum; and that the peduncle was straight, uniform, and about half the length of the capitulum.

Pilsbry (1953) further remarked that the Florida specimens were covered with a thin transparent cuticle, and that the species was separable from all other scalpellid barnacles by the long rostrum.

Type locality. — Near Anguilla (18°14′N, 63°05′W), Leeward Islands, depth 360-680 meters.

Florida localities. — Off Palm Beach (26°41′N, 80°02′W) at many "Triton" stations, between 50 and 100 fathoms, most abundant at about 75 fathoms (137 meters). "Triton" sta. 378, off Boynton Beach Inlet (26°32′N, 80°04′W), 50 fathoms (91 meters). Off Cape Florida (southern tip of Key Biscayne), 100 fathoms (183 meters), on *Rochinia crassa.*

Lithotrya dorsalis (Ellis and Solander) Pl. 34, figs. 1-3

Lepas dorsalis Ellis and Solander, 1786, p. 197, pl. 15, fig. 5.
Litholepas de Mont Serrat, Blainville, 1824, pl., fig. 5. [*Fide* Darwin, 1851, p. 351.]
Lithotrya dorsalis G. B. Sowerby I, 1822, unnumbered page; Gray, 1825, p. 101; Darwin, 1851, pp. 335, 336, 341-343, 346, 347, 351-356, 363, pl. 8, figs. 1, 1a′-1c′; Chenu, 1858, p. 77; Hoek, 1883, p. 29; Weltner, 1897, p. 251; Bigelow, 1901, p. 179; Gruvel, 1902a, pp. 249, 255, 259; 1902c, p. 524; 1905, pp. 98-99, fig. 108; 1907, pp. 162-163; Jennings, 1915, p. 287; Pilsbry, 1927, p. 27; 1953, p. 23, pl. 1, fig. 8; Nilsson-Cantell, 1931b, p. 105; 1933, pp. 504-505; 1939, p. 3; Cannon, 1947, pp. 89, 92, 97; G. L. and N. A. Voss, 1955, pp. 212-213.
Lithotrya dorsalis (Ellis and Solander), Pilsbry, 1907, p. 6; Krüger, 1940, pp. 22, 72, 126, 129, 225, 338, 459, figs. 71, 74, 78a-c, 101a, 127; Newell, Imbrie, Purdy, and Thurber, 1959, pp. 207, 211, fig. 12; Newman, Zullo, and Withers, 1969, p. R272, fig. 115.10; Southward, 1975, p. 3.

Ellis described this species as follows:

Tab. 15.

Fig. 5. Lepas *dorsalis,* testa quinquevalvi corpus tegente basi squamosa, valvulis lateralibus laevibus; dorsali rotundata transversum rugosa, stipite squamuloso.
From Musquito shore.

The following is taken from Darwin's description of the hard parts.

The capitulum is half an inch in width and height; the entire length of the animal with contracted peduncle is about an inch and a half. The valves are dirty white, with the enveloping membrane yellow.

The scuta are triangular, internally concave, with a small roughened internal knob or tooth at the rostral angle of both valves;

the tergal margin is straight, overlapping about one third the entire width of the terga.

The terga are irregularly oval, internally slightly concave, with straight scutal margins, and with the lower part of the carinal margin, immediately over the latera, slightly hollowed out. Exteriorly, toward the bottom of the valves, a narrow ridge is exposed, which runs down to the basal angle at about one third the entire width of the valve, from the scutal margin.

The carina slightly overlaps the terga; it is internally concave, generally with a large upper portion freely projecting, without any central crest or ridge. The carina is nearly as wide as the middle part of the terga, the inner growing or corium-covered surface, with its basal margin, protuberant and arched. The dorsum of the carina is marked by strong concentric growth ridges separated by wider interspaces.

The rostrum is small and narrow, with deeply sinuous sides and a rounded basal margin; in width the rostrum equals about two and a half of the uppermost scales of the peduncle, and about half as wide as the latera.

The latera are small, oblique, and parallel with the carinal margin of the terga; the longer axis is equal to five of the uppermost scales of the peduncle and to nearly half the width of the carina.

The peduncle varies in length, generally twice, but on one of Darwin's specimens thrice as long as the capitulum. The upper part of the peduncle is as wide as the capitulum, the lower part attenuated. The calcified scales in the uppermost whorl are only slightly larger than those in the second whorl, and the scales in the succeeding three or four whorls are considerably larger than those below, which latter gradually decrease in size until, low down on the peduncle they are barely visible to the naked eye. In the lower part they appear as calcareous beads, standing apart from each other — smooth, translucent, and furnished with a conical fang. The upper scales vary somewhat in outline, the most usual shape being triangular, with the lower margin arched and protuberant; this margin, in the two or three upper whorls, is crenated with teeth which are first conical and sharp but after molting become mere notches. The scales in the uppermost whorls are nearly quadrilateral, the imbedded portion or fang produced into a blunt rounded point.

The basal calcareous cup of the peduncle is well developed, is composed of swirling overlapping growth lamellae, and attains a diameter of as much as half an inch. Before the cup is formed, there is a column of small flat discs attached to the side of the burrow.

Type locality. — Northeast (Mosquitia) coast of Honduras.

Florida localities. — Sambo Shoals (south of western group of Florida keys) where *L. dorsalis* occupies borings in corals or aeolian rocks; Soldier Key in Biscayne Bay, in intertidal rocks.

Other localities. — Great Bahama Bank, intertidal shoals; San Salvador; Cuba; Jamaica; Puerto Rico (Ensenada Honda, Culebra, Aguadilla); Barbados; Venezuela (Rio Tocuyo); Netherlands Antilles: Curaçao (Westpuntbaai; Caracasbaai); Bonaire (Kralendijk); Klein Bonaire, east coast; Solomon Islands; Philippines; Chagos Archipelago; Farquhar Atoll.

Neoscalpellum dicheloplax (Pilsbry) Pl. 34. figs. 4a-c

The names applied to this taxon by one author or another are the following:

Scalpellum debile Aurivillius (1898); *Scalpellum edwardsii* Gruvel (1900); *Scalpellum dicheloplax* Pilsbry (1907); *Scalpellum dicheloplax benthophila* Pilsbry (1907); and *Scalpellum alboranense* Gruvel (1920). Since *Neoscalpellum dicheloplax* (Pilsbry) is found nearest to Florida it is selected as the taxon most appropriate for this work. It is anticipated that the dictates of biogeography and details of external and internal morphology will play a role in ultimately determining which of the taxa should be combined and which separated.

The synonymy proposed by authors is as follows:

Scalpellum debile Aurivillius, 1898, p. 189; 1938, p. 71; Gruvel, 1905, p. 27; 1920, pp. 31-32, 73, pl. 5, figs. 13-15, pl. 7, fig. 1; Nilsson-Cantell, 1955, p. 218; Belloc, 1959, p. 2; Newman and Ross, 1971, pp. 96-99, text-figs. 49-50, as *Neoscalpellum.*

Scalpellum edwardsii Gruvel, 1900, p. 189; 1902b, p. 63, pl. 2, figs. 3B, 16; 1902c, p. 523; 1905, pp. 28-29, fig. 27; Newman and Ross, 1971, p. 96.

Scalpellum dicheloplax Pilsbry, 1907, pp. 70-73, fig. 28a-c; Fowler, 1912, p. 500; Hoek, 1914, p. 4; Gruvel, 1920, p. 32, pl. 7, fig. 2; Withers, 1926, p. 102; 1928, pp. xi, 13, fig. 36, as *Neoscalpellum;* Zullo, 1968, p. 212 and p. 214, as *Mesoscalpellum;* Newman, Zullo, and Withers, 1969, p. R224, fig. 94-11, as *Mesoscalpellum;* Newman and Ross, 1971, p. 96, as *Neoscalpellum.*

Scalpellum alboranense Gruvel, 1920, p. 33, pl. 5, figs. 4-6; Belloc, 1959, p. 4; Newman and Ross, 1971, p. 96.

TYPE LOCALITIES

The type locality for each of the species enumerated above is the following:

Scalpellum debile Aurivillius

"Princesse-Alice" sta. 749 (38°54′N, 23°27′W), 5005 meters, between Lisbon, Portugal and Terceira Island, Azores.

Scalpellum edwardsii Gruvel

"Talisman" dragage 136 (near the Azores), 4255 meters.

Scalpellum dicheloplax Pilsbry

"Albatross" sta. 2711 (38°59′N, 70°07′W), 1544 fathoms (2824 meters), about 255 statute miles east off Cape May, New Jersey. Nearest locality to Florida.

Scalpellum dicheloplax benthophila Pilsbry

"Albatross" sta. 2042 (39°33′N, 68°26′45″W), 1555 fathoms (2844 meters), about 310 statute miles east off Atlantic City, New Jersey.

Scalpellum alboranense Gruvel

"Prince Monaco" sta. 650 (36°54′N, 20°46′15″W), 4400 meters, white foraminiferal ooze, between Lisbon, Portugal and Ponta Delgado, Azores.

Pilsbry's description of his *Scalpellum dicheloplax* is summarized as follows:

The capitulum, measuring 44 mm in length and 31 mm in width, is ovate and strongly compressed, and consists of 13 imperfectly calcified plates, all of them biramose or V-shaped and with a smooth cuticle.

The tergum is V-shaped, having a curved occludent branch about twice as long as wide and a long, slender curved carinal branch about twice the length of the occludent branch. The scutum has a wide convex occludent segment and a narrow, curved calcified tergal segment. The surface is sculptured by low, narrow, widely spaced riblets which are parallel with the basal margin. The occludent margin is strongly convex. The umbo is terminal at the apex and overlies the base of the tergum. The carina is strongly arched, more so above than below, and has a length of 42 mm and a diameter of 4.5 mm at the base. The umbo is turned inward but is not quite terminal, a flattened continuation of the sides extending beyond it. The roof is deeply channeled, with high bordering ribs. The sides are of nearly equal width throughout.

The upper latus is broadly V-shaped in the upper calcified portion, the two branches subequal, somewhat curved, the lower part of the broader half with two prongs. Another slender branch rises at the apex and runs toward the tergum in a direction at right angles to the tergal branch. There is no rostrum. The rostral latus is V-shaped, the basal branch shorter and wider. The inframedian latus has a calcified portion with a modified wineglass shape, being very narrow below the middle and expanded at the base, the upper part composed of two diverging branches, the one directed toward the scutum the longer of the two. The umbo is at or below the lower fourth in the adult stage but is higher in the young. The carinal latus is broadly V-shaped, the carinal branch the larger and curved. The umbones are recurved and project below and beyond the carina.

The peduncle is 24 mm in length and is clothed with large strongly projecting scales in 7 rows of about 12 scales each.

Type locality. — "Albatross" sta. 2711 (38°59′N, 70°07′W), 1554 fathoms (2842 meters), about 255 statute miles east of Cape May, New Jersey. Although Florida lies nearer to the type locality of this taxon than do the other four congeners, it is still remote, lying 8° of latitude to the south and 10° of longitude to the west.

Range and distribution. — In addition to the type localities specified above, the following localities have been cited for the *Neoscalpellum dicheloplax* group:

As *Scalpellum dicheloplax*: "Michael Sars" sta. 10 (45°26′N, 9°20′W), 4700 meters, bottom of *Globigerina* ooze, attached to stones, lying west of the Bay of Biscay; "Albatross" sta. 2221 (39°05′30″N, 70°44′30″W), 2788 meters, and "Albatross" sta. 2222 (39°03′15″N, 70°50′45″W), 2810 meters, both stations about 205 statute miles east of Avalon, New Jersey.

As *Scalpellum dicheloplax benthophila*: "Chain 50" sta. 81 (34°41′N, 66°28′W), 5042 meters and "Atlantis II" sta. 93 (34°39′N, 66°26′W), 5007 meters, both stations lying northwest of Bermuda between Bermuda and Cape Hatteras, North Carolina.

As *Scalpellum debile*: "Prince Monaco" sta. 652 (46°56′N, 22°22′W), 4261 meters, white foraminiferal ooze, east of Azores, between Ponta Delgado and Cabo São Vicente, Portugal.

As *Scalpellum alboranense*: "Prince Monaco" sta. 650 (38°54′N, 21°06′W), 5005 meters, white *Globigerina* ooze, east off Azores between Faial and Lisbon, Portugal.

Recapitulating, the *Scalpellum dicheloplax* complex are deep water taxa ranging in recorded depth from 2788 meters east of Avalon, New Jersey, to 5042 meters between Cape Hatteras and Bermuda. Geographically the farthest north locality is the Bay of Biscay in the Eastern Atlantic, and the farthest south is the Western Atlantic between Cape Hatteras and Bermuda, or roughly between 46° north and 34° north. This is a fairly narrow latitudinal zone of occurrence and lends support for those who advocate the uniting of the *S. dicheloplax* complex in the Western Atlantic with the earlier-named *S. debile-edwardsii* complex in the Eastern Atlantic.

Neoscalpellum dicheloplax benthophila (Pilsbry) Pl. 34, fig. 5

Scalpellum dicheloplax benthophila Pilsbry, 1907, p. 73, fig. 28d; Zullo, 1968, p. 211; Newman and Ross, 1971, pp. 96, 97, 99.
Scalpellum dicheloplax bentophila [sic] Pilsbry, Gruvel, 1920, pl. 7, fig. 9; Nilsson-Cantell, 1938, p. 7.
Scalpellum (Arcoscalpellum) dicheloplax Pilsbry, subsp. *benthophila* Pilsbry, Weltner, 1922, p. 67.

Concerning the legitimacy of this subspecies, Pilsbry wrote the following:

The capitulum is more lengthened than in *S. dicheloplax,* its length twice the breadth. The carina is less arcuate with wider sides, and separated from the tergum by a much narrower chitinous suture. The plates of the lower whorl are completely calcified, and the inframedian lateral plate is narrower, with central umbo. The scuta, terga, and upper lateral plates are V-shaped, with comparatively shorter, wider branches than in *S. dicheloplax.*
Length of capitulum 15, width 7.5; length of peduncle, 4.5 mm.
The much more extensive calcification of the plates in the single example of this subspecies, as compared with *S. dicheloplax,* may be due to youth; but the narrower shape of the whole capitulum, the narrower inframedian latera, and the reduction of the chitinous space between carina and tergum are features which render it advisable to distinguish this form by name. It requires comparison with specimens of *S. dicheloplax* of equally small size which are unfortunately not yet in our possession.

The views of other authors concerning the possible synonymy of the subspecies *benthophila* with *S. dicheloplax* Pilsbry and other earlier-named species are given on the preceding pages under *Neoscalpellum dicheloplax* (Pilsbry).

Type locality. — The type locality of *Neoscalpellum dicheloplax benthophila* is "Albatross" sta. 2042 (39°33′N, 68°26′45″W), 1555 fathoms (2844 meters), about 310 statute miles east off Atlantic City, New Jersey, bottom of *Globigerina* ooze, bottom temperature 38.5°C.

Other localities. — "Chain 50" sta. 81 (34°39′N, 66°26′W), 5042 meters (2757 fathoms) and "Atlantis II" sta. 240 (34°39′N, 66°26′W), 5007 meters (2738 fathoms). These two stations are about 570 statute miles east off Cape Lookout, North Carolina, and latitudinally are about 5° north of Florida waters; "Valdivia" sta. 240 (6°12.9′S, 41°17.3′E), 2959 meters (1618 fathoms), bottom temperature 2°C, about 140 statute miles northeast of Dar es Salaam; "Michael Sars" sta. (45°26′N, 9°20′W), 4700 meters (2569 fathoms), about 140 statute miles north off La Coruña, Spain, in the North Atlantic.

Summarizing, *Neoscalpellum dicheloplax benthophila* (Pilsbry) has been reported from the Western Atlantic, North Atlantic, and Indian Ocean off the east coast of Africa, at depths ranging from 2844 meters to 5042 meters.

Mesoscalpellum imperfectum (Pilsbry) Pl. 33, figs. 8, 9; Pl. 34, fig. 6

Scalpellum imperfectum Pilsbry, 1907, pp. 70, 75-77, fig. 30, pl. 4, figs. 15-18; Fowler, 1912, p. 500; Annandale, 1913, p. 233; Barnard, 1924, pp. 17, 47; MacDonald, 1929, pp. 534, 537, pl. 2, fig. 3; Broch, 1953, pp. 9, 10, 12, 15, fig. 12; Stubbings, 1961, pp. 11-13, text-fig. 2; 1967, p. 234; Zullo, 1968, p. 213.

Scalpellum (Mesoscalpellum) imperfectum Pilsbry, 1908, p. 110.

Mesoscalpellum imperfectum (Pilsbry), Newman and Ross, 1971, p. 119, text-fig. 62.

Pilsbry's description of the skeletal elements is summarized as follows:

The capitulum of the type is 29 mm in length, 20 mm in breadth. It is composed of 13 valves, the upper ones imperfectly calcified, joined by wide chitinous sutures. The occludent and carinal margins are regularly convex, and the apex is obtuse. The cuticle is thin and smooth, and the plates are weakly marked with growth lines.

The tergum is shaped like an inverted V, the two branches somewhat curved, that along the occludent margin truncate at the apical end, the carinal branch much longer and tapering to an acute lower end. The apex is strongly recurved and acute, but a chitinous border projects beyond it along the occludent margin, and there is a small wing on the carinal side of the apex. The growth lines on the carinal branch are deeply V-shaped. The scutum is triangular, narrow above, with a small wing or triangular projection on the lateral side of the apex. The umbo is apical. The carina, measuring 27 mm in length and 5 mm in width at the base, is widely separated from the other plates and is abruptly bent at the umbo. The roof is flat, bounded by angles or low ribs; the sides are moderately wide in the middle, narrowing above and below; the base is almost squarely truncate.

The upper latus is pyriform-polygonal, widely separated from the other plates. The umbo is at the upper third of the plate. There is no rostrum. The rostral latus is narrow, the scutal and basal margins subparallel, the umbones at the upper front angle, and in contact. The inframedian latus is narrow, tapering somewhat toward the base which itself is expanded; the umbo is at the lower third. The carinal latus has the shape of a horn, curved at the apex which extends well beyond the carina.

The peduncle is 14 mm in length, composed of eight rows of five scales each.

Type locality. — "Albatross" sta. 2731 (36°45′N, 74°28′W), 781 fathoms, (1428 meters), attached to *Arcoscalpellum velutinum* (Hoek), about 100 statute miles east of Norfolk, Virginia. This is the locality nearest Florida.

Other localities. — "Albatross" sta. 2741 (37°44′N, 73°56′W), 852 fathoms (1558 meters), about 90 statute miles east off Cedar Island, Virginia; "Albatross" sta. 2196 (39°35′N, 69°44′W), 1230 fathoms (2250 meters), on echinoderm spine, about 255 statute miles east off Beach Haven, New Jersey; "Pieter Faure" sta., 38 miles southwest off Cape Point, South Africa, at approximately 34°30′S, 17°45′E, 755 fathoms (1381 meters); "Ingolf" sta. 63 (62°40′N, 19°05′W), off the south coast of Iceland; "Atlantide" sta. 120 (2°09′N, 9°27′E), 650-260 meters, about 45 statute miles west off Equatorial Guinea; ? Galapagos Islands in the Eastern Pacific.

The recorded depth range of *Mesoscalpellum imperfectum* is 260 to 2250 meters (143 to 1230 fathoms). The farthest north record is Iceland, the farthest south off the southern tip of Africa, thus occurring in polar, temperate, and tropical latitudes of the Western and Eastern Atlantic. Newman and Ross (1971) stated that MacDonald's Galapagos locality in the Eastern Pacific is in need of confirmation.

Mesoscalpellum sp. Bayer, Voss, and Robins

Scalpellum (Mesoscalpellum), n. sp. Bayer, Voss, and Robins, 1970, p. A43.

This taxon, undescribed, was reported by the authors as occurring in the Gulf of Mosquitos, Panama, at "Pillsbury" sta. 447 (9°07.4'N, 81°07.4'W to 9°04'N, 81°13.8'W), depths 664 to 681 meters. "Pillsbury" sta. 447 lies northwest of San Cristóbal, Panama, the coordinates of which are 8°52'N, 80°56'W.

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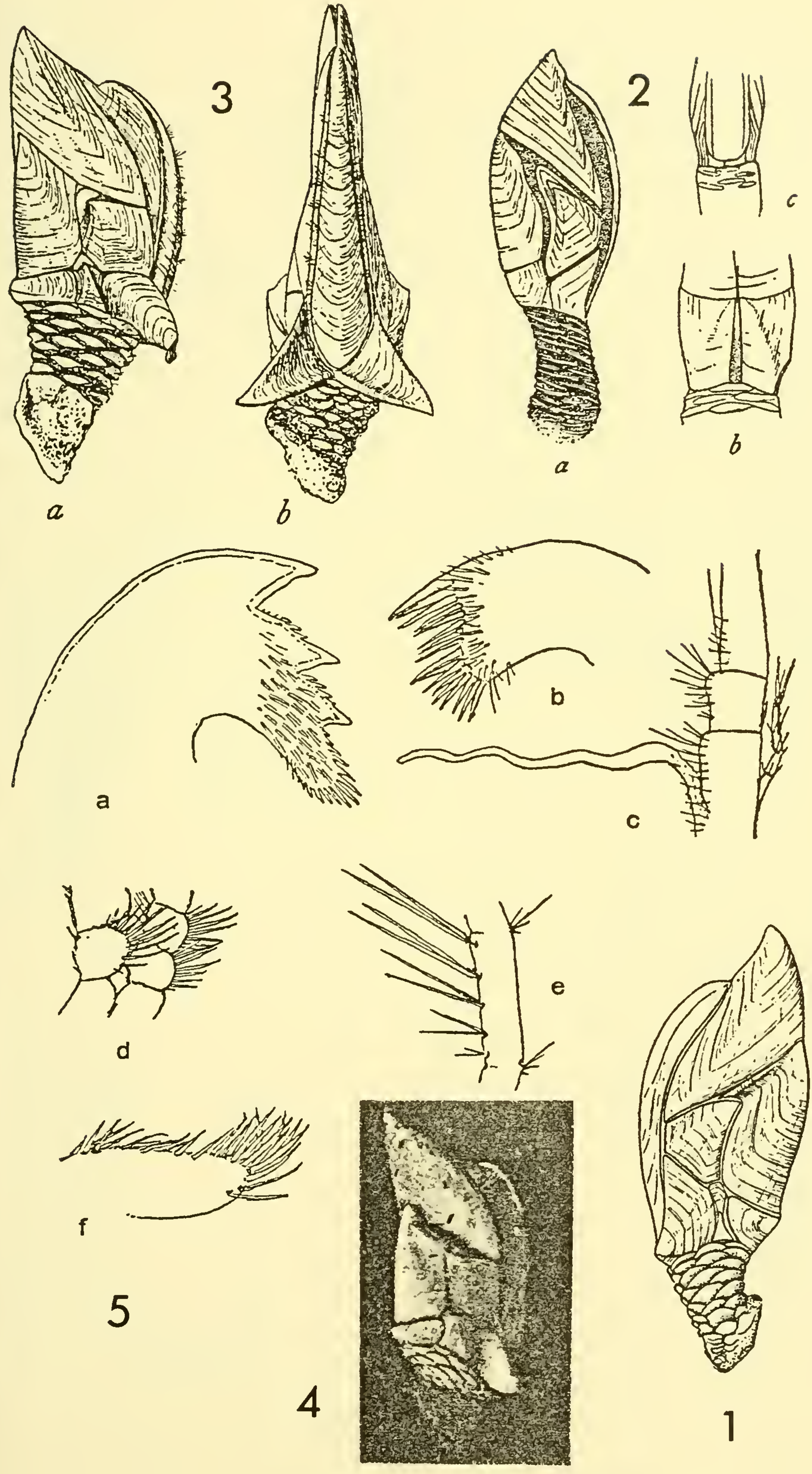
PLATES

EXPLANATION OF PLATE 26

Figure		Page
1.	**Scalpellum** (?) **albatrossianum** Pilsbry	237
	Holotype × 4. Dimensions: capitulum 10.5 mm × 5.3 mm; peduncle length 3.5 mm; carina length 9 mm; diameter at base 1.7 mm.	
2.	**Scalpellum** (?) **antillarum** Pilsbry	240
	2a. Holotype × 3. Dimensions: capitulum 11 mm × 5.7 mm; carina length 4.5 mm; diameter at base 1.1 mm. 2b. Details of rostrum. 2c. Details of carina.	
3-5.	**Scalpellum arietinum** Pilsbry	242
	3a,b. Holotype. 3a. Lateral view × 3; 3b. Dorsal view × 4. Dimensions: capitulum 11.6 mm × 7 mm; peduncle length 6 mm; carina length 12 mm; diameter near base 1.7 mm. 4,5. Specimens from off Palm Beach, Florida. 4. Lateral view of whole animal, dimensions not given. 5a. Mandible; 5b. Maxilla. 5c. Protopodite of cirrus VI, penis, and caudal appendage. 5d. Segments of cirrus I. 5e. Segment of cirrus V. 5f. Palpus.	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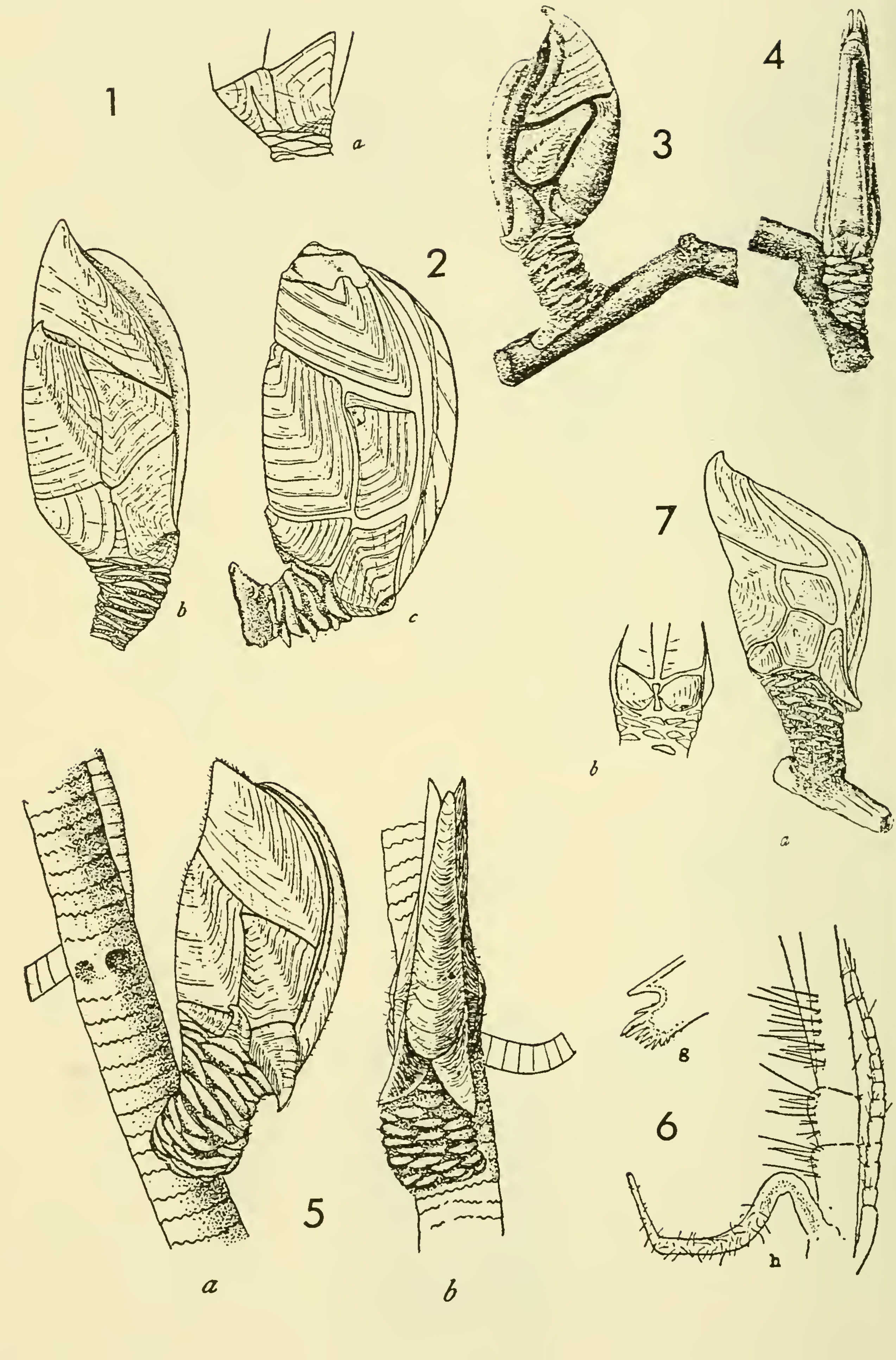
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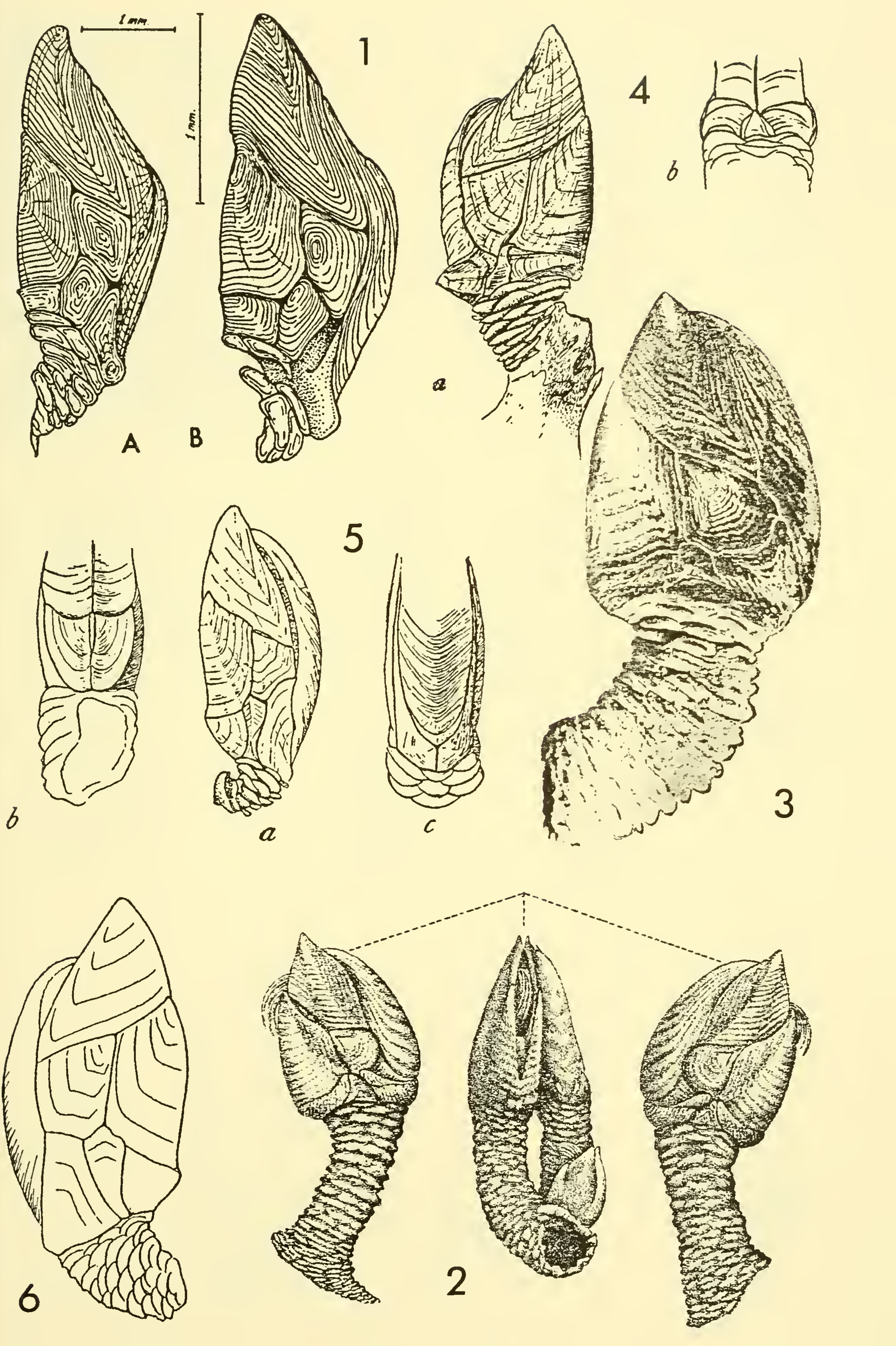
EXPLANATION OF PLATE 27

Figure		Page
1.	**Arcoscalpellum aurivillii** (Pilsbry)	267
	1a,b. Holotype, lateral views X 3. Dimensions: capitulum 15.3 mm × 7.5 mm; peduncle length 5 mm; carina length 13.5 mm, diameter at base 2.2 mm.	
2.	**Arcoscalpellum aurivillii incertum** (Pilsbry)	268
	2c. Holotype × 2, lateral view. Dimensions: capitulum 24 mm × 13 mm; peduncle length 7.5 mm; carina length 22 mm, diameter at base 3 mm.	
3, 4.	**Scalpellum carinatum** Hoek	243
	Holotype × 3. 3. Lateral view. 4. Carinal view. Dimensions: capitulum length 16 mm; peduncle length about 6 mm. From Hoek (1883).	
5, 6.	**Scalpellum** (?) **diceratum** Pilsbry	244
	5a,b. Lateral and carinal views of holotype × 3. Dimensions: capitulum 13.5 mm × 7.8 mm; peduncle length 7 mm; carina length 13.5 mm, diameter near base 2.8 mm. 6. Specimen from off Palm Beach, Florida. 6g. Third tooth and lower point of mandible. 6h. Base of cirrus VI, penis, and caudal appendage.	
7.	**Scalpellum gibbum** Pilsbry	246
	Holotype. 7a. Lateral view × 4.5. 7b. Detail of rostrum. Dimensions: capitulum 7 mm × 4 mm; peduncle length 2 mm.	

EXPLANATION OF PLATE 28

Figure		Page
1.	**Scalpellum gibbum** Pilsbry	246
	Hypotypes collected off South Carolina by Zullo (1966b). 1A. Adult. 1B. Juvenile.	
2, 3.	**Scalpellum** (?) **giganteum** Gruvel	247
	2. Gruvel's types from off Cuba, depth 500 fathoms, × about ½. Dimensions: capitulum 45 mm × 32 mm; peduncle 45 mm × 15 mm. 3. Specimen from fishing banks off Maine? Dimensions: capitulum 47 mm × 35 mm × 20 mm; peduncle length about 37 mm. After Pilsbry (1907).	
4.	**Scalpellum** (?) **gorgoniophilum** Pilsbry	249
	Holotype. 4a. Lateral view × 4. 4b. Detail of rostrum. Dimensions: capitulum 9 mm × 5 mm; carina length 6.8 mm, diameter near base 1.8 mm; peduncle length 2.8 mm.	
5.	**Scalpellum** (?) **gracilius** Pilsbry	250
	Holotype. 5a. Lateral view × 4. 5b. Details of rostrum. 5c. Details of carina. Dimensions: capitulum 8 mm × 3.3 mm; carina length 6.3 mm, diameter at base 1 mm; peduncle length 1.8 mm.	
6.	**Scalpellum hendersoni** Pilsbry	251
	Holotype × 10. Dimensions: capitulum 5 mm × 2.5 mm; carina length 3.75 mm.	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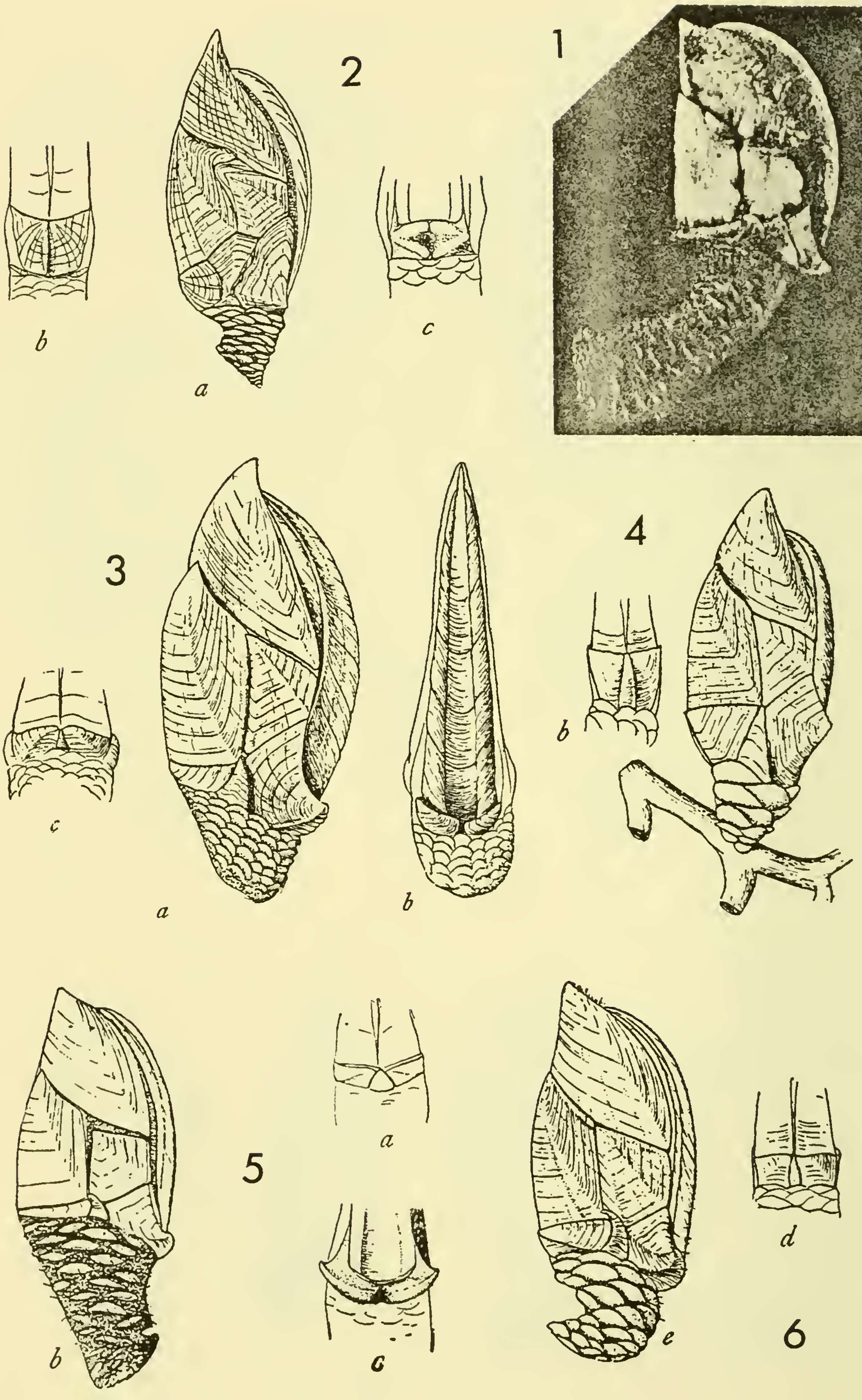
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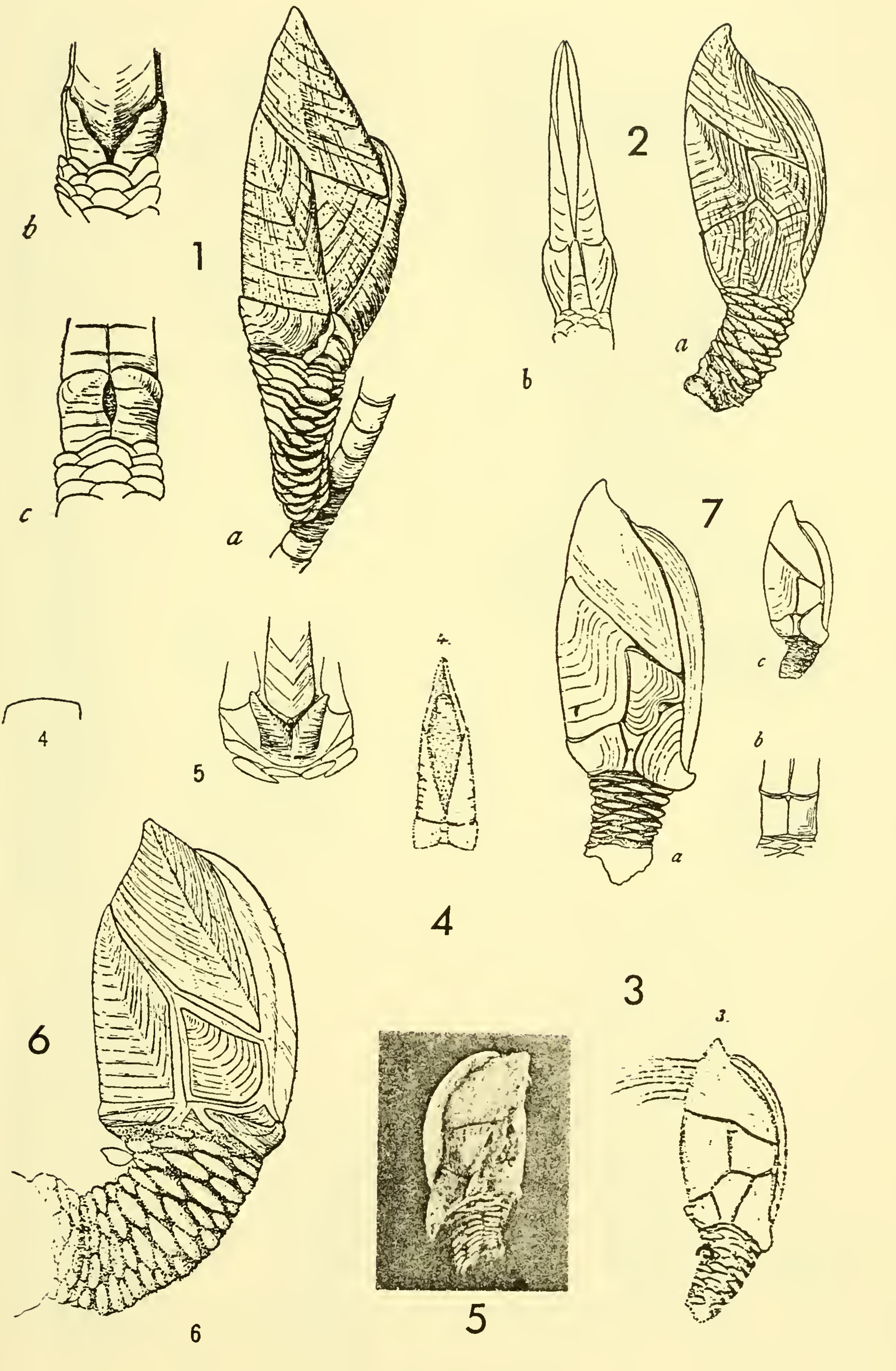
EXPLANATION OF PLATE 29

EXPLANATION OF PLATE 30

Figure		Page
1.	**Scalpellum** (?) **pentacrinarum** Pilsbry	257
	Holotype. 1a. Lateral view $\times$ 6. 1b. Dorsal view. 1c. Ventral view. Dimensions: capitulum 8 mm $\times$ 3.7 mm; peduncle length 3.7 mm; carina length 5.2 mm, diameter near base 1.2 mm.	
2.	**Scalpellum pressum** Pilsbry	260
	Holotype. 2a. Lateral view $\times$ 5. 2b. Ventral view. Dimensions: capitulum 8 mm $\times$ 4 mm $\times$ 1.8 mm; peduncle length 3 mm.	
3, 4.	**Scalpellum prunulum** Aurivillius	262
	Holotype. 3(3). Lateral view of capitulum. 4(4). Capitulum from below. Dimensions: length of whole specimen 6 mm; capitulum 4 mm $\times$ 2.5 mm.	
5.	**Scalpellum** (?) **pteryges** MacDonald	263
	Holotype. Dimensions: capitulum 23 $\times$ 15 mm; peduncle length 10 mm, about 13 rows of scales.	
6.	**Arcoscalpellum regina** (Pilsbry)	269
	Holotype. 6(4). Diagrammatic section of carina. 6(5). Detail of base of carina. 6(6). Lateral view. Dimensions: capitulum 43 mm $\times$ 30 mm; peduncle length 26 mm; carina length 40 mm, diameter at base 6 mm.	
7.	**Scalpellum** (?) **sinuatum** Pilsbry	265
	7a. Holotype, lateral view $\times$ 3. 7b. Rostral view. 7c. Topotype $\times$ 3. Dimensions of holotype: capitulum 13 mm $\times$ 7 mm; peduncle length 5 mm.	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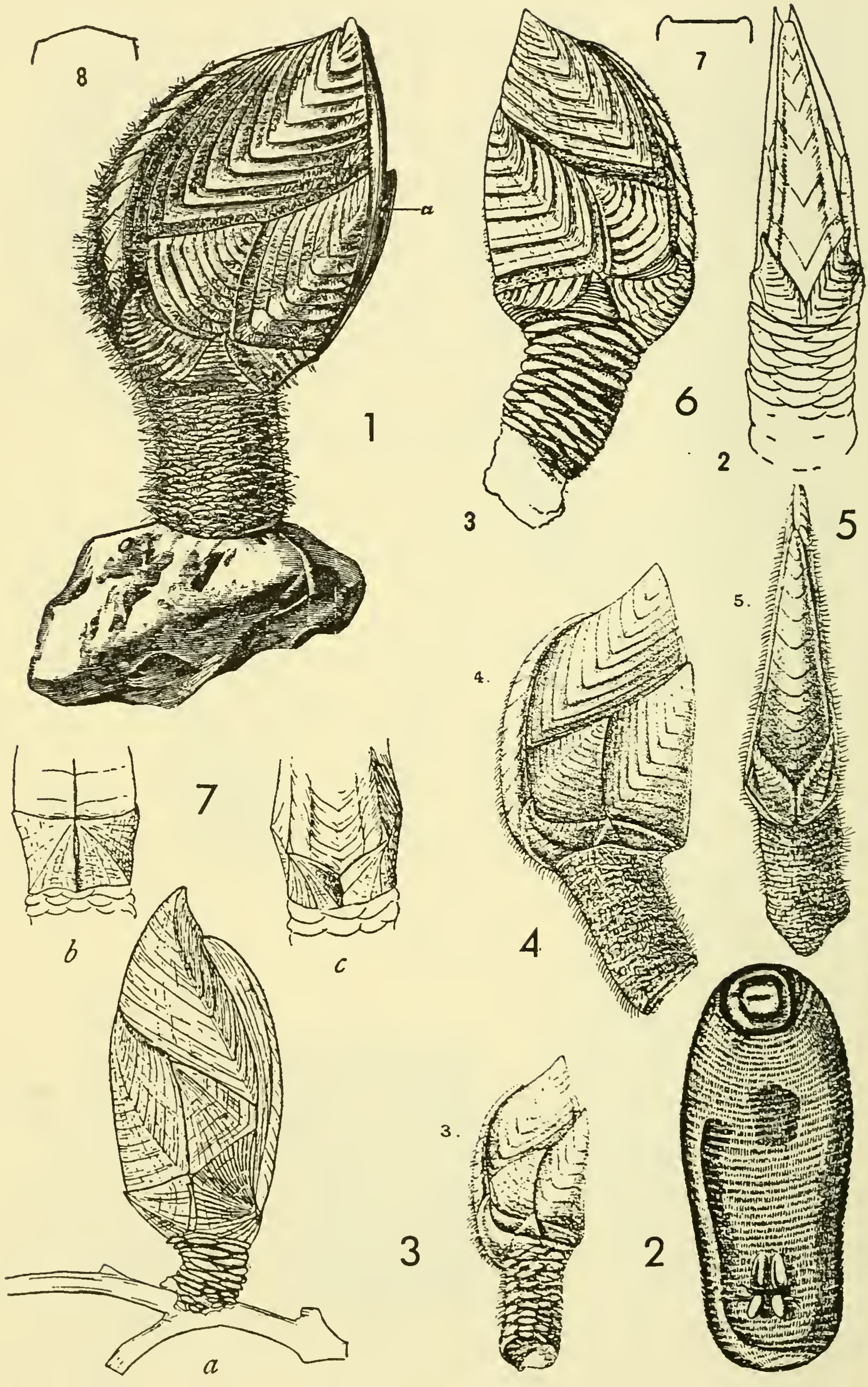
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1
7
6
2
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4.
4
7
b
c
3.
3
2
a

EXPLANATION OF PLATE 31

Figure | Page

1-5. **Arcoscalpellum regium** (Thomson) 271

1. Holotype, female. Dimensions: length 60 mm; capitulum 40 mm × 25 mm; peduncle length 20 mm; 1a, males lodged within edge of scutum. 1(8). Diagrammatic section of carina, after Pilsbry (1970). 2. Male of *Arcoscalpellum regium* × 20. 3(3). Lateral view of young specimens, natural size, after Hoek (1883). 4(4). Lateral view of fully grown specimen, natural size, after Hoek (1883). 5(5). Carinal view of fully grown specimen, natural size, after Hoek (1883).

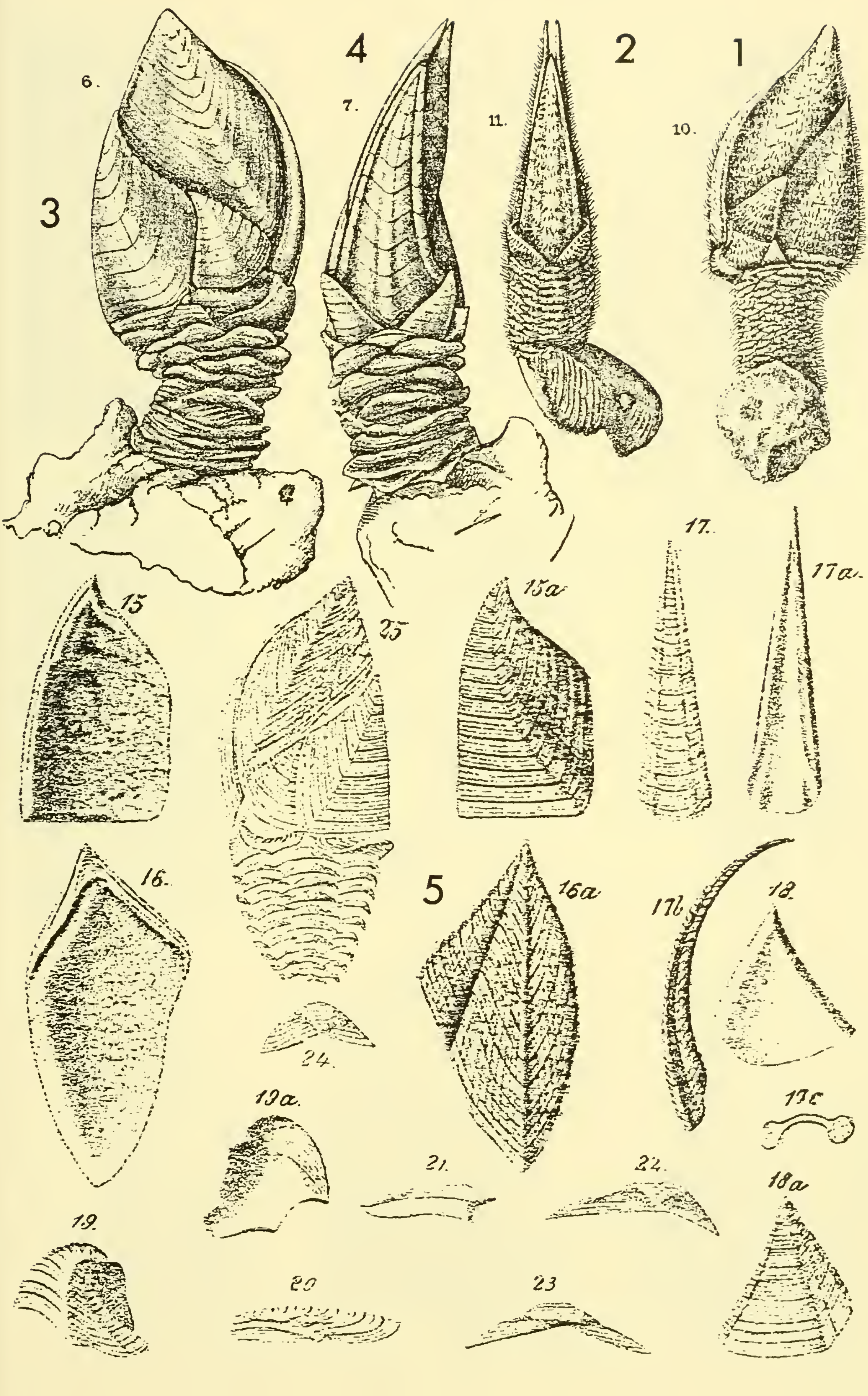
6. **Scalpellum latidorsum** (Pilsbry) 253

Holotype. 6(2). Dorsal view, natural size. 6(3). Lateral view, natural size. Dimensions: length of 6(3) 70 mm; capitulum 42 mm × 28.5 mm; carina length of 6(2) 38 mm, diameter near base 11 mm. 6(7). Diagrammatic section of carina.

7. **Scalpellum (?) semisculptum** Pilsbry 264

7a. Holotype × 3. 7b. Details of rostrum. 7c. Details of carina. Dimensions: capitulum 16 mm × 7.7 mm; peduncle length 3 mm; carina length 12.5 mm, diameter at base 2.5 mm.

Explanation of Plate 32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15a
17.
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19a.
17c
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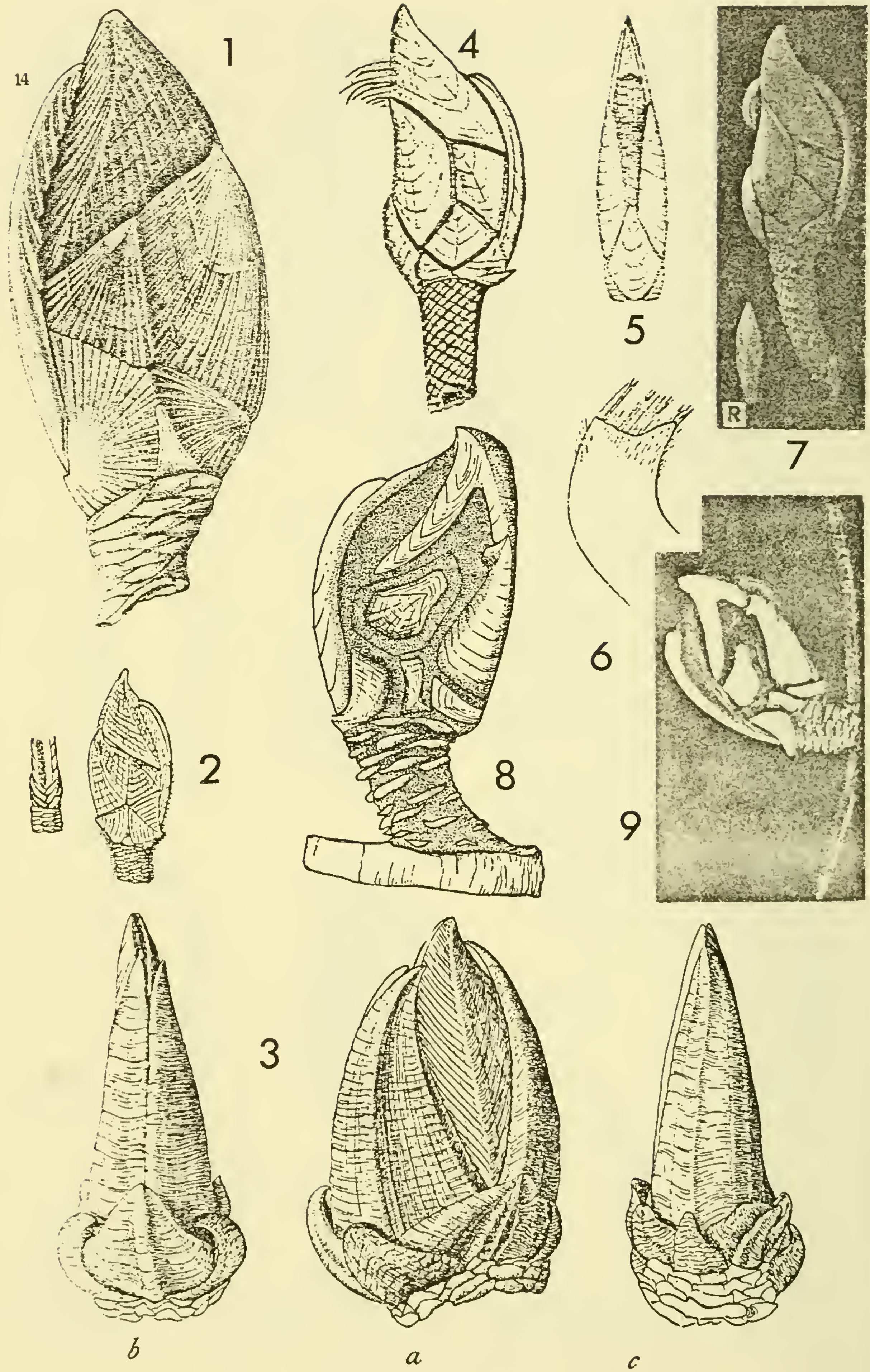
18a
19.
20
23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2
3
4
5
6
7
R
8
9
b
a
c

EXPLANATION OF PLATE 33

Figure		Page
1.	**Arcoscalpellum vitreum** (Hoek)	278
	Holotype × 6, lateral view. Dimensions: capitulum length 13.5 mm; peduncle length 3.5 mm.	
2.	**Arcoscalpellum talismani** Gruvel	278
	Holotype, redrawn by Gruvel (1905). Dimensions: capitulum 18 mm × 9 mm; peduncle length 3.5 mm, diameter 4.5 mm.	
3.	**Calantica superba** (Pilsbry)	280
	Holotype, natural size. 3a. Ventral view. 3b. Lateral view. 3c. Dorsal view. Dimensions: capitulum 46 mm × 34 mm; length of visible part of carina 38 mm, diameter 14 mm; peduncle short.	
4-7.	**Euscalpellum stratum** (Aurivillius)	281
	4. Lateral view of holotype. 5. Capitulum from below. 6. Anterior maxilla. 7. Specimen from Palm Beach, Florida (Pilsbry, 1953). 7R. Front view of rostrum.	
8, 9.	**Mesoscalpellum imperfectum** (Pilsbry)	283
	8. Holotype × 1.5, lateral view. Dimensions: capitulum 29 mm × 20 mm; peduncle length 14 mm; carina length 27 mm, diameter at base 5 mm. 9. Specimen from off Galapagos (MacDonald, 1929), lateral view, natural size.	

EXPLANATION OF PLATE 34

Figure		Page
1-3.	**Lithotrya dorsalis** (Ellis and Solander)	282

1.. Holotype. 2(1) - 2(1a′,1b′,1c′). Specimens figured by Darwin (1851) and described as follows: 2(1). Rock bored in two directions, × 2. 2(1a′). Animal with basal cup adherent, × 2. 2(1b′). Greatly enlarged, showing rostrum and rostral corners of the two scuta, together with a small portion of the subjacent membrane of the peduncle with its calcareous scales and inferior crenated edges. 2(1c′). Basal calcareous cup, × 1.5. 3. Specimen from Sambo Shoals, Florida, length 35 mm (Pilsbry, 1953).
Disregard figure 8.

4. **Neoscalpellum dicheloplax** (Pilsbry) 284

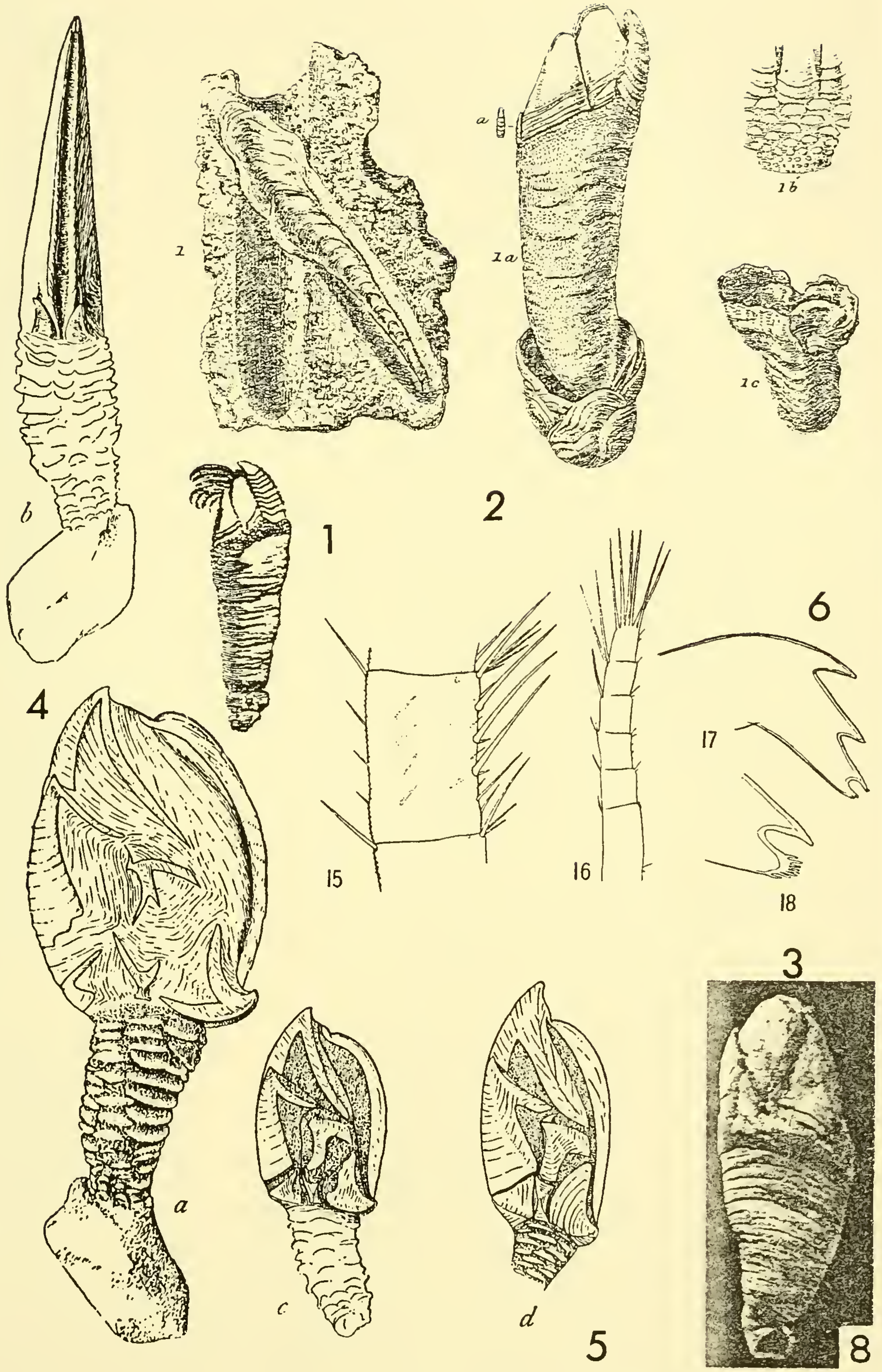
4a,b. Lateral and carinal views of holotype, natural size. Dimensions: capitulum 44 mm × 31 mm; peduncle length 24 mm; carina length 42 mm, diameter at base 4.5 mm; 4c, young individual, natural size.

5. **Neoscalpellum dicheloplax benthophila** (Pilsbry) 287

5d. Holotype × 2. Dimensions: capitulum 15 mm × 7.5 mm; peduncle length 4.5 mm.

6. **Mesoscalpellum imperfectum** (Pilsbry) 288

6(15). Intermediate segment from sixth cirrus. 6(16). Terminal appendage. 6(17). Mandible. 6(18). Lower tooth and lower point of same more enlarged.


1
2
3
4
5
6
8
a
b
c
d
1a
1b
1c
15
16
17
18

INDEX

NUMBER 299

Note: Light face type refers to page numbers. Bold face type refers to plate numbers.

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No. 300

PRIMARY TYPES IN THE STANFORD PALEONTOLOGICAL TYPE COLLECTION

By

JUDITH TERRY SMITH

Paleontological Research Institution
Ithaca, New York 14850, U.S.A.

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CONTENTS

PRIMARY TYPES IN THE STANFORD PALEONTOLOGICAL TYPE COLLECTION

Judith Terry Smith

INTRODUCTION

The Stanford University Paleontological Type Collection is part of an important national, as well as West Coast resource of Holocene and fossil, primarily invertebrate, specimens that are housed with an extensive library of systematic publications in the Department of Geology, Stanford University, Stanford, California.[1] The University acquired its first general collections between 1892 and 1895 at the instigation of James Perrin Smith, Assistant Professor of Mineralogy and Paleontology. Although the nearby California Academy of Sciences collections were severely damaged in the earthquake and fire of 1906, the Stanford collections remained unharmed and intact. Acquisitions increased steadily, and by the mid 1920's the collection included large suites of irreplaceable material from localities no longer accessible, such as many drawers of Pleistocene specimens collected from Deadman Island, off San Pedro, California, before it was destroyed in the mid 1900's. Several drawers of Paris Basin material was received from A. E. M. Cossmann in exchange for California specimens collected by Delos Arnold. Large population samples, primarily from the California Coast Ranges and Transverse Ranges, were contributed by Stanford Summer Geology classes from the late 1890's to the present.

THE TYPE COLLECTION

The Stanford University Department of Geology became a recognized repository for type specimens in 1924 when four graduate students, Eric Knight Jordan, Leo George Hertlein, Albert B. Reagan, and Colin H. Crickmay, set up a register and numbering system. Many holotypes and paratypes described before then remained in the general collections until 1940, when A. Myra Keen became the curator and undertook an exhaustive search to isolate unrecognized type material. Those who had some charge of the collections over the years included Carl H. Beal (1911-1915), Ida Shepard Oldroyd

---

[1]As of March 9, 1977, the type and general collections were transferred from Stanford University to the Department of Geology of the California Academy of Sciences, Golden Gate Park. San Francisco, California 94118. The types are now stored in the type collection room, and the general collection is to be integrated with the holdings of the Academy. No Stanford numbers are to be changed and type specimens should be cited as SUPTC numbers now in the collections of the California Academy of Sciences.

(1917-1940), and A. Myra Keen (1936 until retirement in 1970; curator emeritus 1970-).

ARRANGEMENT OF THE STANFORD UNIVERSITY PALEONTOLOGICAL TYPE COLLECTION

Type specimens are arranged in order of numerical accession in locked cases in the Department of Geology. They include 6,435 primary and secondary types as of June 30, 1976. Microfossils are numbered sequentially with the megafossils but housed separately. Type specimens bear numbers 1 to 1000 and 5000 to 10,345; numbers 1001-4999 were set aside for the general collections and never used for types.

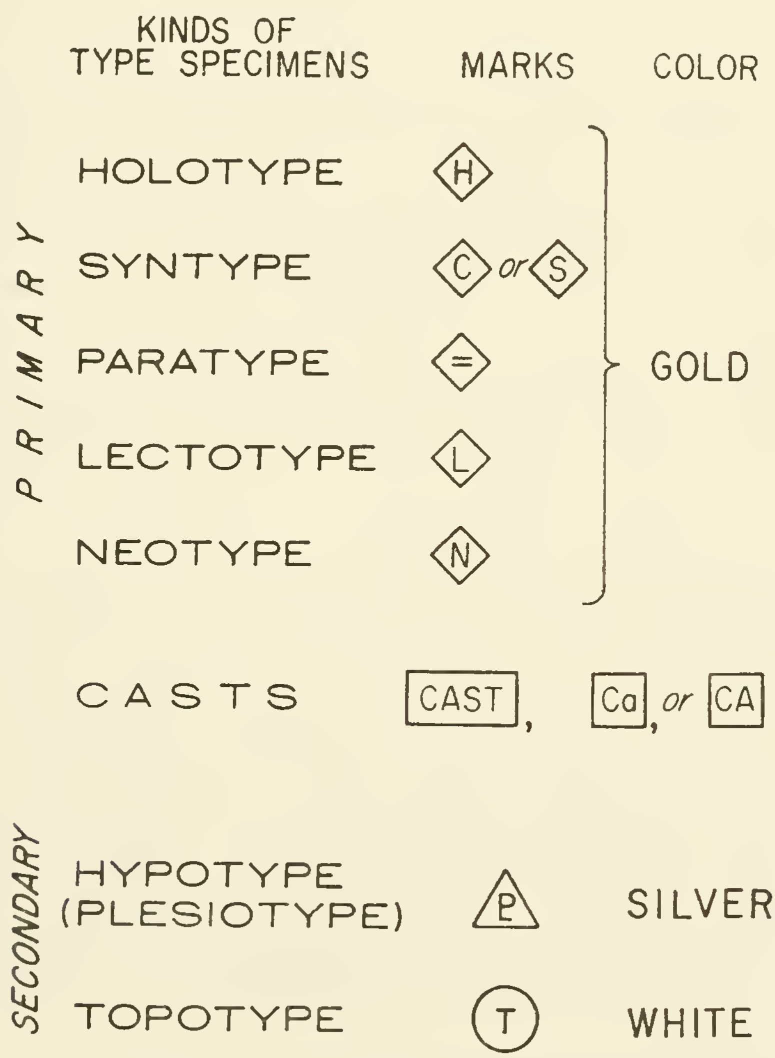
Type specimens are marked with the symbols shown in Text-fig. 1, which were recommended by Howell (1929, p. 7). They may also bear Stanford University locality numbers on a spot of white paint or a general collection accession number on yellow paint. Sometimes these numbers are written directly on the specimens. Numbers on turquoise paint identify specimens formerly in the collection of Hubert G. Schenck.

Published references to Stanford material should be to Stanford University Paleontological Type Collection (SUPTC) numbers. LSJU, sometimes abbreviated to SU, numbers refer to general collection accession numbers and in some cases to Stanford locality numbers.

TYPE COLLECTION RECORDS, CARD FILES AND LEDGERS

This publication lists only primary types: holotypes, paratypes, syntypes, lectotypes, plastoholotypes and plastosyntypes. Four complete listings of all holdings are kept with the type collection: three sets of file cards and a ledger in four volumes. Duplicate suites of 4 x 6 inch cards are arranged in two series, one systematically and one alphabetically by genus. Each card gives page and figure references for the type specimen, its locality, age, and formation data where applicable. For cross reference, specific names are indexed alphabetically on 3 x 5 inch cards. Complete bibliographic reference cards are arranged alphabetically by author and include annotations of which type numbers are described therein. Many of the original references are represented in the Conchological Library reprint collection, housed near the types; others are in the journals in the University's Branner Geology and Falconer Biology Libraries.

The ledger in four volumes, begun in 1924, records only type numbers and names of taxa. Locality data are detailed in two megafaunal ledgers and the Micropaleontology Locality Book of M-numbers. Megafaunal and microfossil localities were recorded together in the megafaunal ledger from 1923 to 1936. Type collection and locality ledgers and Harold Hannibal's handwritten "N.P. book" of North Pacific localities were microfilmed in January, 1969. Additional sources of locality data are the Stanford Summer Geology notebooks and a book of Ralph Arnold's California localities, the "C book," reconstructed from specimen labels by A. Myra Keen.



Text-figure 1. Type specimen marks and symbols.

SPECIAL STRENGTHS AND HISTORICAL PERSPECTIVE

Type holdings are greatest in Cenozoic mollusks, especially gastropods and pelecypods, and Foraminifera. The majority of specimens are from the North Pacific, tropical eastern Pacific, and the California marine Tertiary. From 1903 to the 1960's a number of large important monographs were published based on material in the Stanford Paleontological Type Collection. These included comprehensive systematic studies reflecting the research interests and course offerings of professors James Perrin Smith, Siemon W. Muller, and N. J. Silberling (Paleozoic and Mesozoic mollusks), Hubert G. Schenck (Foraminifera and Tertiary mollusks), Hans Thalmann, Joseph J. Graham and James C. Ingle (Foraminifera), A. Myra Keen (Tertiary and Quaternary mollusks), and W. R. Evitt (organic microfossils).

Many of the Stanford paleontologists, especially Siemon W. Muller and James Perrin Smith, acquired plaster casts of comparative material for their studies and placed these specimens in the type collection. The 483 plastoholotypes and plastosyntypes in the Stanford collection constitute an important resource for those taxa whose originals may be lost or are deposited in foreign repositories that do not lend primary specimens. Many of the plastoholotypes listed here are accompanied by plastoparatypes, although the latter are omitted from the catalogue. Table 1 lists authors, papers and numbers of plastoholotypes in the Stanford Paleontological Type Collection.

UNEXPECTED TYPES AND HOLDINGS

Students of Clark and Arnold's "Fauna of the Sooke Formation, Vancouver Island" (1923) will find all but four of the holotypes and most of the paratypes published with University of California (UCMP) numbers in the Stanford University Type Collection. The paper was in press before Arnold, who had financed the field work and intended the material for Stanford, had the specimens transferred from the University of California and renumbered. Many of the new species were described from SU loc. NP 129, sometimes cited as between Muir and Coal Creeks, elsewhere as between Muir and Kirby Creeks. Coal Creek is an older name for Kirby Creek, the current name.

Three holotypes, 1 syntype and 43 paratypes described by W. H. Dall were deposited in the Stanford University Type Collection in exchanges arranged by Ida Oldroyd. Many of these are Holocene species from the North Pacific and the Galápagos Islands, useful to West Coast workers and more readily available than the holotypes in the U.S. National Museum, Washington, D.C. The holotypes are *Sigaretus oldroydii* Dall, 1897c; *Drillia empyrosia* Dall, 1899a; and *Atrina oldroydii* Dall, 1901a. The syntype is *Venericardia hadra* Dall, 1903b, from Florida, and there is a neotype, *Lasaea subviridis* Dall, 1899b designated by Keen (1938).

TABLE 1.—PLASTOHOLOTYPES AND PLASTOSYNTYPES

Author	Subject	No. of Types
Burckhardt, 1903	Jurassic cephalopods, Chile and Argentina	7
Dickerson, 1914	Paleocene mollusks, California	7
Goldfuss, 1836	Cretaceous pelecypods, Germany	6
Hyatt and Smith, 1905	Triassic cephalopods, Inyo Mts.	45
Kittl, 1912	Triassic pelecypods, Austria	9
Merriam, 1941	Fossil Turritellas	21
Oppel, 1862	Jurassic mollusks, Tibet and Germany	9
Popenoe, 1937	Cretaceous mollusks, Santa Ana Mts.	30
Reeside, 1927b	Cephalopods, western U.S.	12
Smith, 1914	Triassic cephalopods, Humboldt Range	48
Smith, 1927	Triassic mollusks, northern California	34
Smith, 1932	Triassic cephalopods, Inyo Mts.	46
Waagen, 1895	Triassic cephalopods, Salt Range	15

Ninety-six other papers are represented by five or fewer plastoholotypes, of which perhaps the most unexpected are Diener (1895, 1903, 1907), Gabb (1864, 1866), Jimbo (1894), Mantell (1822), Matsumoto (1942, 1955a, 1955b, 1956), Noetling (1880), Pavlow (1891), Schluter (1867), Spath (1921), Steiger (1914), Uhlig (1910), Waagen (1867), Wachsmuth and Springer (1890).

Five or fewer plastoholotypes: Anderson, 1902; Arnold, 1903, 1906, 1908a; Billings, 1859, 1860, 1861, 1863, 1865; Clark, 1915, 1918, 1925, 1932, 1938; Clark and Anderson, 1928; Clark and Arnold, 1923; Clark and Woodford, 1927; Conrad, 1858; Diener, 1895, 1903, 1907; Durham, 1944, 1950, 1957; Fenton and Fenton, 1938; Gabb, 1864, 1866; Hanna, 1927; Heinz, 1928, 1934; Jenkins, 1913; Jimbo, 1894; Keen, 1954; Keen and Campbell, 1964; Loel and Corey, 1932; Mantell, 1822; Marwick, 1944; Matsumoto, 1942, 1955a, 1955b, 1956; McLearn, 1931, 1933b; Meek, 1864a, 1864b, 1876, 1877; Meek and Hayden, 1856, 1859, 1861, 1863, 1865; Nelson, 1925; Nicol, 1945; Noetling, 1880; Nomland, 1916b, 1917a, 1917b; Olsson, 1944; Owen, 1852; Parker, 1949; Pavlow, 1891; Pilsbry and Olsson, 1941; Reeside, 1927a; Reinhart, 1937a, 1937b; Rivers, 1913; Schenck, 1936; Schluter, 1867; Shattuck, 1903; Shimizu, 1930; Smith, 1904; Spath, 1921; Stanton, 1895, 1920; Steiger, 1914; Stephenson, 1923; Tilmann, 1917; Turner, 1936; Uhlig, 1910; Vincent, 1913; Vokes, 1935, 1939; Waagen, 1867; Wachsmuth and Springer, 1890; Wade, 1926; Wagner and Schilling, 1923; Walcott, 1884; Waterfall, 1929; Weaver, 1905; Wheeler, 1939; Whiteaves, 1884, 1893; Woodring, 1938; Yabe, 1904; Yabe and Shimizu, 1921.

Seven holotypes, three syntypes and one paratype described by Diener (1914, 1916) were purchased from the Palaeontologische Institut, Weiner Universität, by Professor James Perrin Smith. They were discovered in a Stanford attic in the 1930's along with 10 plastoholotypes, accounting for 21 of Diener's ammonite types from the Triassic of the New Siberian Islands, Madagascar, and the Himalayas. Two types of Quenstedt (1885) may have been acquired at the same time — the holotype of *Ammonites psilonotus plicatus* and a syntype of *Ammonites laqueus* from the Jurassic of Germany.

Although most of the California Cretaceous and Tertiary specimens described by Gabb (1864) are at the Philadelphia Academy of Natural Sciences, the Harvard Museum of Comparative Zoology, or the University of California Museum of Paleontology, two paratypes are in the Stanford University Paleontological Type Collection: *Aporrhais californica* Gabb, 1864, Cretaceous of the Siskiyou Mountains of California. Other types which are at Stanford, while all the other material described in the same papers is elsewhere, are the crinoid *Actinocrinus arnoldi* Wachsmuth and Springer, 1890 from Marshall Co., Iowa, and the upper Paleozoic pelecypod *Chaenomya maria* Worthen, 1882 from Shawnee Co., Kansas.

Most of the type specimens are marine taxa, although many fresh water and land mollusks are represented. They include taxa described by Hemphill (1876-1901, 119 types); Henderson (1913-1935, 22 types); Pilsbry, (1891-1940, 28 paratypes, 34 coauthored types); Hannibal (1912b, 36 types); Dall (1896, 1900a, 1917c); Berry (1930a, 1932, 1937, 1938b, 1940a); Fred Baker (1914); and Frank Baker (1939).

HYPOTYPES

Some of the most important holdings are the hypotypes or figured specimens, which are not treated here because of space limitations. These include large numbers of well-preserved specimens illustrated in the monographs of Grant and Gale (1931, 81 types), Miller (1947, 27 types of Tertiary nautiloids of the Americas) and Matsumoto (1959, 74 upper Cretaceous ammonites of California).

Specimens illustrated in two editions of "Sea Shells of Tropical West America" by A. Myra Keen (1958, 1971) remaian in the general collection. A silver dot identifies these shells.

OTHER STANFORD UNIVERSITY TYPE COLLECTIONS

Over the years workers at Stanford University in departments other than Geology described new species that were kept in separate collections at the Hopkins Marine Station, Pacific Grove, and in the Stanford Natural History Museum of Systematic Biology on the main campus. These taxa included new species of mollusks, mammals, Holocene and some fossil fish whose types might be expected in the paleontological type collection but which were never part of it.

The Stanford Natural History Museum type ledgers began in 1939 and were closed in 1963 when the material, including David Starr Jordan's fish collection, was moved to the California Academy of Sciences in San Francisco. Fossil fish went to the Department of Geology, insects to the Department of Entomology. In 1971 the types at Hopkins Marine station were transferred to the Academy's Department of Invertebrate Zoology. These included wet-preserved cephalopods described by S. S. Berry (1908-1910) and hundreds opisthobranch gastropod types described by MacFarland (1966) (James Carlton, personal communication, 1972). In 1976, the Dudley Herbarium also was moved to the Academy.

Some of the transferred types are described or listed, in some cases with other California Academy of Sciences holdings, in the following: MacFarland (1966, opisthobranchs); Mayer (1949, mammals in the type collection of Stanford Natural History Museum); Jordan (1896-1900, 4 volumes on "The Fishes of Middle and North America"); Böhlke, 1953 (type specimens of Recent fishes); Firby (1972, fossil fish).

ACKNOWLEDGMENTS

In assembling the information catalogued here, I was greatly assisted by A. Myra Keen, whose careful records and personal communications helped solve many problems of dates and references, and whose curatorial work over the past 36 years made the Stanford University Paleontological Type Collection the valuable resource it now is. My work was encouraged and helped by present and former members of the Paleontological Committee of the Department of Geology: W. R. Evitt, James C. Ingle, Warren O. Addicott, Norman J. Silberling, Carole S. Hickman, and A. Myra Keen.

Joseph H. Peck of the University of California Museum of Paleontology consulted on missing type specimens and LouElla R. Saul, University of California, provided information on some of the plastoholotypes. Text-fig. 1 was drafted by Natalie Miller, U.S. Geological Survey, Menlo Park, and the manuscript was read by Warren O. Addicott and A. Myra Keen. Publication funds were provided by the Pacific Section of the Society of Economic Paleontologists and Mineralogists and by the Department of Geology, Stanford University.

CATALOGUE ARRANGEMENT

Holocene and fossil taxa are listed alphabetically by species or subspecies under Phylum, or, in the cases of Mollusca and Crustacea, Class. The format is as follows:

SUPTC
no. species, Genus (Subgenus): Author — Kind of type
or subspecies, Genus (Subgenus) species: Author
Author, date, page, plate, figure[1]
Type locality[2] [supplementary data, *e.g.,* current quadrangle]
Age, Formation, if a fossil[3] [supplementary information][4]

1 Subsequent references are given only if the illustrations are much improved or if the original paper is not readily accessible.

2 Locality is for the particular specimen. Early workers occasionally designated paratypes from localities other than the holotype locality.

3 Age and formation are those given in the original description; many have been reassigned by later workers and should be verified with more recent publications. The formations "Chico" and "Horsetown" were used widely for Cretaceous rocks in California and are especially untrustworthy.

4 Supplementary information includes currently accepted age and formation assignments where these were readily available, data for missing specimens, and repositories of plastoholotypes represented in the Stanford type collection. Repositories are those from which the casts were received and may not reflect the present repositories of the types. Nomenclatural annotations are beyond the scope of this paper, but can be found in Keen and Bentson (1944), Keen (1971) and other systematic reviews.

PREPARATION OF THE CATALOGUE

About two thirds of the catalogue was compiled from systematic index cards, the remaining third directly from specimen labels and original references. The author checked megafaunal lists against the specimens in 1974-1976. Microfossil types were inspected by Elizabeth Watson in 1940-1941 and by Marjorie Korringa in 1965, since which time there have been few acquisitions of these groups. Most of the original references were consulted and publication dates verified.

DEPOSITORIES

ANSP Academy of Natural Sciences of Philadelphia
BM(NH) British Museum of Natural History
CAS California Academy of Sciences
CIT California Institute of Technology
Geol. Surv. Canada Geological Survey of Canada
LACMNH Los Angeles County Museum of Natural History
LSJU (or SU) Leland Stanford Junior University
N.Z. Geol. Surv. New Zealand Geological Survey
MCZ or Mus. Comp. Zool. Harvard Museum of Comparative Zoology
SUPTC Stanford University Paleontological Type Collections
UCLA University of California at Los Angeles
UCMP University of California at Berkeley
USGS or U.S. Geol. Surv. United States Geological Survey
USNM or U.S. Nat. Mus. United States National Museum
I.G.P.S. Institute Geology and Paleontology, Tohoku Univ., Sendai, Japan

CATALOGUE OF PRIMARY TYPES
PELECYPODA

7616 **acutiplicatus, Pecten:** Meek — Plastoholotype
Meek, 1864b, p. 46, pl. 8, fig. 3
Plumas Co., Calif.; Genessee Valley area
Jurassic [cast received from Museum of Comparative Zoology]

154 **aequilateralis, Spisula:** Waring — Holotype
Waring, 1917, p. 80, pl. 14, fig. 8
Ventura Co., Calif.; Martinez area, Simi Hills
Lower Eocene, Martinez Fm

5345 **africana, Fossularca:** Newton — Paratype
Newton, 1922, p. 68
Southern Nigeria, Africa; Ameki, Omobialla district
Upper Eocene, upper Lutetian

6061 **agulhasensis, Arca (Acar):** Thiele — Paratype
Thiele and Jaechel, 1931, p. 177
Cape Agulhas, near Cape of Good Hope, South Africa

7971 **alargada, Anadara (Anadara):** Marks — Paratypes
Marks, 1951, p. 56
SW Ecuador; Zacachún corehole, depth 710-720′
Miocene, Subibaja Fm

6062 **alaskana, Halobia:** Smith — Holotype
Smith, 1927, p. 113, pl. 100, fig. 5
SE Alaska; Gravina Island, Thompson Cove
Upper Triassic

5514 **alaskana, Monotis:** Smith — Plastoholotype
Smith, 1927, p. 119, pl. 101, fig. 1
Copper River region, Alaska; Mill Creek, near forks
Upper Triassic [holotype USNM 74193]

44 **aletes, Pecten (Pecten):** Hertlein — Holotype
Hertlein, 1925a, p. 8, pl. 2, fig. 4
Baja California, Mexico; Rancho Refugio, N of San Jose del Cabo
SU loc. 50
Upper Miocene or Lower Pliocene

45 **aletes, Pecten (Pecten):** Hertlein — Paratype
Hertlein, 1925a, p. 8, pl. 2, fig. 1
Baja California, Mexico; Rancho Refugio, SU loc. 50
Upper Miocene or Lower Pliocene

6943 **aleutica, Mysella:** Dall — Paratype
Dall, 1899b, p. 892
Aleutian Islands, Alaska; Kyska Harbor

5231 **alkiensis, Leda:** Clark — Holotype
Clark, 1925, p. 76, pl. 8, figs. 7, 10
Seattle, Wash.; R.R. cuts between Argo and Georgetown stations SU loc. NP 49
Oligocene, Blakeley Fm

9932 **americana, Daonella:** Smith — Plastoholotype
Smith, 1914, p. 145, pl. 49, figs. 4, 5
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74362]

8504 **americana, Leptomya:** Keen — Holotype
Keen, 1958a, p. 246, pl. 30, fig. 10; pl. 31, figs. 3, 6
Panama; San Miguel Bay, E side of Punta Alegre

8504a **americana, Leptomya:** Keen — Paratype
Keen, 1958a, p. 246, pl. 30, fig. 9; pl. 31, fig. 5
Panama; San Miguel Bay, E side of Punta Alegre

559 **anahuacensis, Immanitas:** Palmer — Paratype
Palmer, 1928a, p. 30, pl. 4, fig. 1
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

7560 **anahuacensis, Immanitas:** Palmer — Paratypes
7560a Palmer, 1928a, p. 30
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

134 **andersoni, Pecten (Plagioctenium):** Arnold — Paratypes
Arnold, 1906, p. 82, pl. 26, fig. 6
Santa Clara Co., Calif.; near Stanford University, Frenchmens Tower
Miocene, Temblor Fm

299 **andersonianum, Sphaerium (Amesoda):** Hannibal — Holotype
Hannibal, 1912b, p. 132, pl. 6, fig. 11. Also in Taylor and Smith, 1971, fig. 6
Badland Hill, Oregon; 1 mile E of Sand Hollow
Pliocene, Idaho Lake Beds [Grassy Mountain Fm, *fide* Taylor and Smith]

5137 **angermanni, Ostrea:** Hertlein and Jordan — Holotype
Hertlein and Jordan, 1927, p. 621, pl. 17, figs. 3, 6
Baja California, Mexico; trail from Arroyo Mesquital to La Purisima, in *Turritella* bed above San Gregorio Lagoon SU loc. 59
Miocene, Isidro Fm

8734 **annulatus, Inoceramus:** Goldfuss — Plastosyntypes
8735 Goldfuss, 1826, p. 114, pl. 110, figs. 7a, 7b
Westphalia, Germany
Cretaceous [casts of Goldfuss specimens 675b, 675c from BM(NH)]

8500 **anomioides, Plicatula:** Keen — Holotype
Keen, 1958a, p. 241, pl. 31, figs. 4, 7, 8. Also *in* Keen, 1971, p. 94, fig. 206
Sonora, Mexico; Guaymas

8501 **anomioides, Plicatula:** Keen — Paratype
Keen, 1958a, p. 241
Sonora, Mexico; Guaymas

619 **aragonia, Venericardia planicosta:** Arnold and Hannibal Neotype
Arnold and Hannibal, 1914, p. 907. Illustrated in Waring, 1915, pl. 1, fig. 22. Designated neotype of *Venericardia (Leuroactis) aragonia* by Stewart, 1930, p. 170
Umpqua Valley, Ore.
Upper Eocene, Umpqua Fm [= holotype of *Venericardia planicosta ionense* Waring, 1915]

7995 **argentea, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 25, pl. 1, figs. 10-14
Fresno, Co., Calif.; Tumey Hills Qd, Sec. 29, T 15 S, R 12 E SU loc. 2073
Paleocene, Lodo Fm

364 **arnoldi, Pecten (Lyropecten):** Aguerrevere Holotype
Aguerrevere, 1925, p. 51, pl. 5
Sucre, Venezuela; 1.75 miles E of Cumana Castle
Miocene?

526 **auburyi, Pecten (Pecten):** Arnold Paratypes
Arnold, 1906, p. 94
Los Angeles Co., Calif.; Puente Hills, 1 mile E of Chandler Wells
Pliocene

9736 **aurora, Semele:** Tursch and Pierret Holotype
Tursch and Pierret, 1964, p. 35, figs. 1, 2
Off Rio de Janeiro, Brazil, 30 fms, on sand

5908 **austini, Leda:** Oldroyd Holotype
Oldroyd, 1935, p. 14, fig. 2
British Columbia, Canada; near Nanaimo, off Neck Point

5908a **austini, Leda:** Oldroyd Paratype
Oldroyd, 1935, p. 14
British Columbia, Canada; near Nanaimo, off Neck Point

7273 **baileyi, Solen gravidus:** Loel and Corey Plastoholotype
Loel and Corey, 1932, p. 230, pl. 44, fig. 5
Ventura Co., Calif.; South Mountain UCMP loc. A-244
Miocene, Vaqueros Fm [holotype UCMP 31831]

5213 **bainbridgensis, Cochlodesma:** Clark Holotype
Clark, 1925, p. 86, pl. 13, fig. 3
Bainbridge Island, Wash.; beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Oligocene, Blakeley Fm

5214 **bainbridgensis, Cochlodesma:** Clark Paratype
Clark, 1925, p. 86, pl. 13, fig. 4
Bainbridge Island, Wash.; beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Oligocene, Blakeley Fm

6529 **balesi, Arca (Barbatia):** Pilsbry and McLean Paratype
Pilsbry and McLean, 1939, p. 1
Missouri Key, Fla.

7789 **balesi, Asthenothaerus:** Rehder Paratype
Rehder, 1943, p. 189
Missouri Key, Fla.

5444 **bardwelli, Macrocallista (Paradione):** Clench and McLean
Clench and McLean, 1936, p. 202 Paratype
Australia

8103 **baughmani, Anadara:** Hertlein Paratype
Hertlein, 1951b, p. 487
SE of Port Aransas, Texas; in 40 fms

507 **beali, Mactra:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 80. Illustrated in Wiedey, 1929b, pl. 1, fig. 3
Alameda Co., Calif.; Pleasanton Qd
Miocene, Monterey Fm

55 **beali, Pecten (Pecten):** Hertlein Holotype
Hertlein, 1925a, p. 10, pl. 2, fig. 3
Baja California, Mexico; Arroyo Fortuna, N of San Jose del Cabo SU loc. 44
Pliocene?

56 **beali, Pecten (Pecten):** Hertlein Paratype
Hertlein, 1925a, p. 10, pl. 5, fig. 8
Baja California, Mexico; 2 mi. NW of arroyo near La Palma, N of San Jose del Cabo SU loc. 64
Pliocene?

6947 **beckii, Liocyma:** Dall Paratype
Dall, 1870, p. 257
Eastern Siberia; Plover Bay, Bering Strait

10337 **bella, Cymbophora:** Saul Paratypes
Saul, 1974, p. 1089
Butte Co., Calif.; Cherokee Qd, near Pentz, conglomerate beds 1400'S, 600'W of NE cor. Sec. 36, T 21 N, R 3 E, UCLA loc. 4340
Cretaceous, early Campanian, Chico Fm

35 **bellilamellatus, Pecten (Chlamys):** Arnold Holotype
Arnold, 1906, p. 108, pl. 41, figs. 6, 6a, 7, 7a
San Diego Co., Calif.; Pacific Beach
Pliocene, San Diego Fm

9910 **beringiana, Myophoria:** Smith Plastoholotype
Smith, 1927, p. 109, pl. 101, fig. 3
SE Alaska; Gravina Island
Upper Triassic [holotype USNM 74194]

10323 **beta, Lima (Acesta):** Popenoe Plastoholotype
Popenoe, 1937, p. 382, pl. 45, fig. 5
Santa Ana Mts., Calif.; CIT loc. 1069
Cretaceous, Turonian [holotype UCLA 40619]

10327 **bifurcatus, Brachidontes:** Popenoe Plastoholotype
Popenoe, 1937, p. 383, pl. 46, fig. 2
Santa Ana Mts., Calif.; CIT loc. 974
Cretaceous, Campanian [holotype UCLA 40622]

6532 **binakayanensis, Arca:** Faustino Paratypes
Faustino, 1932, p. 545
Manila Bay, Philippines; Paranaque, Rizal

7527 **birchi, Nucula (Ennucula):** Keen Holotype
Keen, 1943, p. 41, pl. 3, fig. 12
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain

7527a **birchi, Nucula (Ennucula):** Keen Paratype
Keen, 1943, p. 41, pl. 3, figs. 9, 11
Kern Co., Calif.; Caliente Qd, SW 1/4 Sec. 6, T 29 S, R 30 E. SU loc. 2121
Miocene, Temblor Fm, Round Mountain

7527b **birchi, Nucula (Ennucula):** Keen Paratype
Keen, 1943, p. 41, pl. 3, fig. 10
Kern Co., Calif.; Caliente Qd, SW 1/4 Sec. 6, T 29 S, R 30 E. SU loc. 2121
Miocene, Temblor Fm, Round Mountain

6026 **bisenensis, Anadara (Anadara):** Schenck and Reinhart Holotype
Schenck and Reinhart, 1938, p. 44, pl. 4, figs. 2a, 2b, 2e; pl. 5, figs. 1a, 1c, 1d
Inland Sea, Japan; Bisen, Okayama Prefecture

6026a **bisenensis, Anadara (Anadara):** Schenck and Reinhart Paratype
Schenck and Reinhart, 1938, p. 44
Inland Sea, Japan; Bisen, Okayama Prefecture

9908 **blackburnei, Lima:** Smith Plastoholotype
Smith, 1927, p. 122, pl. 103, fig. 11
Alaska, Copeland Creek
Upper Triassic [holotype USNM 74216]

59 **blancoensis, Acila:** Howe Holotype
Howe, 1922, p. 95, pl. 9, fig. 3
Cape Blanco, Ore. SU loc. NP 26
Pliocene, Empire Fm

9739 **borealis, Aligena (Odontogena):** Cowan Holotype
Cowan, 1964, p. 108, pl. 20, figs. 1, 2
Georgia Strait, British Columbia, Canada; 190 fms

9740 **borealis, Aligena (Odontogena):** Cowan Paratypes
9741 Cowan, 1964, p. 108
Georgia Strait, British Columbia, Canada; 190 fms

220 **bosei, Pecten (Pecten):** Hanna and Hertlein Paratypes
Hanna and Hertlein, 1927, p. 154
Baja California, Mexico; canyon inland 1/2 mile from Santa Antonita Point CAS loc. 795
Upper Pliocene

432 **bowersi, Pecten (Lyropecten):** Arnold Paratype
Arnold, 1906, p. 70, pl. 12, fig. 2
Ventura Co., Calif.; Santa Monica Mts.
Lower Miocene

8334 **bramkampi, Aequipecten circularis:** Durham Plastoholotype
Durham, 1950, p. 63, pl. 9, figs. 4, 8
Imperial Co., Calif.; NW side Carrizo Mountain UCMP loc. A1268
Lower Pliocene, Imperial Fm [holotype UCMP 30035]

160 **branneri, Crassatellites:** Waring Holotype
Waring, 1914, p. 782. Illustrated in Waring, 1917, p. 74, pl. 14, fig. 17
Ventura Co., Calif.; Calabasas Qd, Simi Hills, Martinez area
"Lower Eocene," Martinez Fm [Paleocene]

7876 **branneri, Glycymeris:** Arnold Plastoholotype
Arnold, 1908a, p. 377, pl. 34, fig. 1
San Mateo Co., Calif.; Mindego Creek, 1 mile above Alpine Creek Arnold loc. 12
Upper Oligocene to lower Miocene

7781 **branneri, Mulinia:** Dall Paratype
Dall, 1901b, p. 145
Mamanguape, Brazil

358 **branneri, Pecten (Chlamys):** Arnold Holotype
Arnold, 1906, p. 55, pl. 3, fig. 9 (cast of external mold)
Santa Clara Co., Calif.; near Stanford University, Tuff Hill
Lower Miocene, Vaqueros Fm

356 **branneri, Pecten (Chlamys):** Arnold Paratypes
Arnold, 1906, p. 55, pl. 3, figs. 10, 11 (casts of fragments of molds)
Santa Clara Co., Calif.; near Stanford University, Tuff Hill
Lower Miocene, Vaqueros Fm

8696 **branneri, Trigonia:** Anderson Holotype
Anderson, 1958, p. 112, pl. 17, fig. 5
Siskiyou Co., Calif.; rocky gulch 2.5 miles SW of Hornbrook
Upper Cretaceous

9911 **brockensis, Myophoria:** Smith Plastoholotype
Smith, 1927, p. 110, pl. 96, figs. 25, 26
Shasta Co., Calif.; quarry SW end Brock Mt., between Squaw Creek and Pitt River
Upper Triassic, Hosselkus Ls [holotype USNM 74173]

9870 **brooksi, Halobia:** Smith Plastoholotype
Smith, 1927, p. 114, pl. 99, fig. 7
Chitina region, Alaska; W bank, Roadhouse Creek, 2 miles from Kuskulana River USGS loc. 8153
Upper Triassic [holotype USNM]

7864a **budaense, Cardium (Granocardium):** Shattuck Plastosyntype
Shattuck, 1903, p. 25, pl. 13, fig. 2
Near Austin, Texas
Cretaceous, Buda Ls

7864b **budaense, Cardium (Granocardium):** Shattuck Plastosyntype
Shattuck, 1903. p. 25, pl. 13, fig. 3
near Austin, Texas
Cretaceous, Buda Ls

7864c **budaense, Cardium (Granocardium):** Shattuck Plastosyntype
Shattuck, 1903, p. 25, pl. 13, fig. 4
near Austin, Texas
Cretaceous, Buda Ls

7248 **buwaldi, Petricola:** Clark Plastoholotype
Clark, 1915, p. 471, pl. 60, fig. 6
Contra Costa Co., Calif.; SE of Walnut Creek UCMP loc. 1942
Miocene, San Pablo Fm [holotype UCMP 11657]

5368 **cahillensis, Leda:** Arnold Holotype
Arnold, 1908a, p. 375, pl. 34, fig. 9
San Mateo Co., Calif.; 2 miles W of Woodside on road to Kings Mt. House
Lower Miocene, Vaqueros Fm [Arnold's specimen 1065]

8842 **calaverasensis, Pecten (Patinopecten) haywardensis:** Hall Holotype
Hall, 1958, p. 51, pl. 2, fig. 2
Alameda Co., Calif.; La Costa Valley Qd, NW 1/4 NW 1/4 Sec. 11, T 5 S, R 1 E SU loc. 3245
Middle Miocene, Oursan Fm

8843 **calaverasensis, Pecten (Patinopecten) haywardensis:** Hall Paratype
Hall, 1958, p. 51, pl. 3, fig. 4
Alameda Co., Calif.; La Costa Valley Qd. NW 1/4, NW 1/4 Sec. 11, T 5 S, R 1 E SU loc. 3245
Middle Miocene, Oursan Fm

8444 **calaverasensis, Pecten (Patinopecten) haywardensis:** Hall Paratype
Hall, 1958, p. 51, pl. 4, fig. 3
Alameda Co., Calif.; La Costa Valley Qd, NW 1/4 NW 1/4 Sec. 11, T 5 S, R 1 E SU loc. 3245
Middle Miocene, Oursan Fm

436 **calcarea, Arca (Arca) trilineata:** Grant and Gale Holotype
Grant and Gale, 1931, p. 140, pl. 2, figs. 6a, 6b
San Diego Co., Calif.; San Diego well
Middle Pliocene

6732 **calkinsi, Pecten (Chlamys):** Arnold Paratypes
Arnold, 1906, p. 51
Ventura Co., Calif.; N side of Sisar Valley
Eocene, "Tejon" Fm

68 **calli, Pecten (Plagioctenium):** Hertlein Holotype
Hertlein, 1925a, p. 17, pl. 4, fig. 6
Baja California, Mexico; first arroyo E of Santiago SU loc. 53
Miocene?

125 **calli, Pecten (Plagioctenium):** Hertlein Paratypes
127 Hertlein, 1925a, p. 17, pl. 4, **figs. 5, 7 (type 125)**
Baja California, Mexico; Scammon Lagoon Qd, W side Elephant Mesa SU loc. 60
Miocene? [paratype 125 = holotype of *Pecten (Plagioctenium) diminutivus* Hertlein and Jordan]

126 **calli, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 17
Baja California, Mexico; Arroyo Fortuna at Arroyo Refugio near San Jose del Cabo SU loc. 63
Miocene?

53 **callidus, Pecten (Plagioctenium):** Hertlein Holotype
Hertlein, 1925a, p. 22, pl. 5, figs. 1, 5
Baja California, Mexico; Cedros Island SU loc. 116
Pliocene, Salada Fm

54 **callidus, Pecten (Plagioctenium):** Hertlein Paratypes
54a Hertlein, 1925a, p. 22, pl. 5, **figs. 3 (type 54), 6 (type 54a)**
Baja California, Mexico; Cedros Island SU loc. 116
Pliocene, Salada Fm

131 **callidus, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 22
Baja California, Mexico; Scammon Lagoon Qd, mouth of big arroyo NW of Elephant Mesa SU loc. 48
Pliocene, Salada Fm

8042 **canoa, Glycymeris:** Pilsbry and Olsson Plastoholotype
Pilsbry and Olsson, 1941, p. 54, pl. 13, figs. 2, 2a
Punta Blanca, Ecuador
Pliocene, Canoa Fm [holotype ANSP 13669]

8733 **cardissoides, Inceramus:** Goldfuss Plastoholotype
Goldfuss, 1826, p. 112, pl. 110, figs. 2a, 2b
Westphalia, Germany
Cretaceous [holotype 672, from BM(NH)]

5249 **carmanahensis, Limopsis:** Clark Holotype
Clark, 1925, p. 80, pl. 22, fig. 8
Vancouver Island, British Columbia, Canada; in sea cliff ca. 3 miles W of Carmanah Point SU loc. NP 141
Oligocene

5177 **carmanahensis, Limopsis:** Clark Paratype
Clark, 1925, p. 80
Vancouver Island, British Columbia, Canada; in sea cliff ca. 3 miles W of Carmanah Point SU loc. NP 141
Oligocene

11 **carrizoensis, Pecten (Pecten):** Arnold Holotype
Arnold, 1906, p. 59, pl. 4, figs. 1, 1a, 1b
San Diego Co., Calif.; Alverson Canyon
"Miocene," Carrizo Fm

9714 **caryonautes, Transennella:** Berry Holotype
Berry, 1963, p. 141. Illustrated in Keen, 1971, p. 166, fig. 391
Sinaloa, Mexico; near Mazatlán

30 **catalinae, Pecten (Lyropecten) estrellanus:** Arnold Holotype
Arnold, 1906, p. 76, pl. 20, figs. 3, 3a
Los Angeles Co., Calif.; Santa Catalina Island, near isthmus
Upper Miocene

561 **catalinae, Pecten (Lyropecten) estrellanus:** Arnold Paratype
Arnold, 1906, p. 76, pl. 20, fig. 4
Los Angeles Co., Calif.; Santa Catalina Island, near isthmus
Upper Miocene

5816 **catherinae, Sphaerium?:** Hannibal Holotype
Hannibal, 1912b, p. 132, pl. 7, fig. 20. Also in Taylor and Smith, 1971, figs. 1, 5, 8 (as *Pisidium*)
Near Hawthorne, Nevada; hill on Belmont stage road
"Eocene" [Miocene, *fide* Taylor and Smith, 1971]

31 **cerritensis, Pecten (Chlamys) latiauritus:** Arnold Holotype
Arnold, 1906, p. 129, pl. 46, fig. 6
Los Angeles Co., Calif.; San Pedro
Pleistocene, upper San Pedro Fm

31a **cerritensis, Pecten (Chlamys) latiauritus:** Arnold Paratype
Arnold, 1906, p. 129, pl. 46, fig. 7
Los Angeles Co., Calif.; San Pedro
Pleistocene, upper San Pedro Fm

9903 **ceruleus, Pecten (Entolium):** Smith Plastoholotype
Smith, 1927, p. 121, pl. 95, fig. 13
Baker Co., Ore.; Martin Bridge, Eagle River
Upper Triassic [holotype USNM 74158]

5375 **chehalisensis, Malletia:** Arnold Paratype
Arnold, 1908a, p. 365. Ilustrated in Arnold, 1909, illust. 2, fig. 32
Santa Cruz Co., Calif.; Kings Creek, ½ mile above its confluence with San Lorenzo River
Oligocene, San Lorenzo Fm [Arnold's specimen 1062]

5394 **chehalisensis, Malletia:** Arnold Paratype
Arnold, 1908a, p. 365
Santa Cruz Co., Calif.; Kings Creek, ½ mile above its confluence with San Lorenzo River
Oligocene, San Lorenzo Fm

399 **chicoensis, Isocardia:** Waring Holotype
Waring, 1917, p. 62, pl. 8, fig. 3
Ventura Co., Calif.; Calabasas sheet, Bell's Canyon, N of Simi fault
Upper Cretaceous, Chico Fm

8722 **circularis, Venus?:** Meek and Hayden Plastoholotype
Meek and Hayden, 1856, p. 272. Illustrated in Meek, 1876, p. 190, pl. 17, fig. 8a (as *Thetis?*)
Valley Co., Montana; mouth of Milk River
Cretaceous, Bear Paw Fm

6048 **cistula, Lasaea:** Keen Holotype
Keen, 1938, pp. 25-26, pl. 2, figs. 7-9
San Mateo Co., Calif.; Half Moon Bay, Moss Beach

6050 **cistula, Lasaea:** Keen Paratype
Keen, 1938, pp. 25-26
San Mateo Co., Calif.; Half Moon Bay, Moss Beach

265 **clallamensis, Solen:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 152, pl. 20, fig. 4
Callam Bay, Wash.; sea cliffs 1.5 miles W of West Clallam SU loc. NP 88
Oligocene? Sooke Fm

8087 **clarionense, Cardium (Laevicardium):** Hertlein and Strong Paratype
Hertlein and Strong, 1947a, p. 144
Gulf of California; Santa Inez Bay

24 **clarkensis, Pecten:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 68. Illustrated in Wiedey, 1929b, pl. 2, fig. 3
San Jose Qd, Calif.; 2.5 miles NE of Milpitas
Middle Cretaceous, Horsetown Fm

5096 **clivi, Bayleoidea:** Palmer Paratype
Palmer, 1928a, p. 38
Vera Cruz, Mexico; Escamela Hill, Orizaba
Cretaceous

7 **coalingaensis, Pecten (Pecten):** Arnold Holotype
Arnold, 1906, p. 97, pl. 4, figs. 4, 4a
Fresno Co., Calif.; near Coalinga
Pliocene

10039 **coani, Tellina:** Keen Holotype
Keen, 1971, p. 211, fig. 512
Baja California, Mexico; Candelero Bay, near La Paz

6221 **cognata, Lutricola:** Pilsbry and Vanatta Syntype
Pilsbry and Vanatta, 1902, p. 556. Illustrated in Keen, 1971 p. 225, fig. 557 left (as *Florimetis*)
Galápagos Islands; Albemarle Island, Tagus Cove

29 **columbianum, Pecten:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 139, pl. 23, fig. 1
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, sea cliffs at mouth of Fossil Creek SU loc. NP 130
Upper Oligocene or Lower Miocene, Sooke Fm

15 **condoni, Pecten (Amusium):** Hertlein Holotype
Hertlein, 1925b, p. 41, pl. 4, figs. 8, 9
Ventura Co., Calif.; Piru Qd, E of Timber Canyon, Sec. 29, T 4 N, R 20 W SU loc. NP 244
Pleistocene, Saugus Fm

18 **condoni, Pecten (Amusium):** Hertlein Paratypes
18a Hertlein, 1925b, p. 41
18b West Wishkah, Wash.; at Dam 35 SU loc. 148
18c Miocene, Montesano Fm

8 **cooperi, Pecten (Plagioctenium):** Arnold Holotype
Arnold, 1906, p. 124, pl. 49, fig. 2
San Diego Co., Calif.; Pacific Beach
Pliocene, San Diego Fm [Renamed *Pecten invalidus* by Hanna, 1924, p. 177]

14 **cooperi, Pecten (Plagioctenium):** Arnold Paratype
Arnold, 1906, p. 124, pl. 49, fig. 3
San Diego Co., Calif.; Pacific Beach
Pliocene, San Diego Fm

210 **cooperi, Pecten (Plagioctenium):** Arnold Paratype
Arnold, 1906, p. 124, pl. 49, fig. 4
San Diego Co., Calif.; Pacific Beach
Pliocene, San Diego Fm

10315 **cor, Trinacria:** Popenoe Plastoholotype
Popenoe, 1937, p. 45, figs. 1, 3
Santa Ana Mts., Calif.; CIT loc. 974
Cretaceous, Campanian [holotype UCLA 40615]

10265 **Corbicula** n. sp.: Addicott Holotype
Addicott, 1976, p. 107, pl. 3, fig. 15
SW Wash.; SU loc. NP 220
Upper Miocene, Wishkahan stage

395 **cordata, Macrocallista:** Waring Holotype
Waring, 1917, p. 62, pl. 8, fig. 1
Ventura Co., Calif.; Bell's Canyon, N of Simi fault
Upper Cretaceous, Chico Fm

9872 **cordillerana, Halobia:** Smith Plastoholotype
Smith, 1927, p. 114, pl. 99, fig. 2
Alaska; S bank of Yukon River, 1 mile above Nation River USGS loc. 8897, bed 86
Upper Triassic [holotype USNM]

27 **cornwalli, Pecten (Chlamys):** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 140, pl. 25, fig. 1
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Kirby Creeks, W of Otter Point SU loc. NP 129
Upper Oligocene or Lower Miocene, Sooke Fm

28 **cornwalli, Pecten (Chlamys):** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 140
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Kirby Creeks, W of Otter Point SU loc. NP 129
Upper Oligocene or lower Miocene, Sooke Fm

8337 **coronadosensis, Protothaca?:** Durham Plastoholotype
Durham, 1950, p. 86, pl. 22, figs. 2, 9, 11
Coronado Island, Gulf of California UCMP loc. A3549
Upper Pliocene [holotype UCMP 32596]

7567 **corrugata, Tepeyacia:** Palmer Paratype
Palmer, 1928a, p. 46
Vera Cruz, Mexico; Orizaba
Cretaceous, Turonian

10320 **corrugatus, Clisocolus:** Popenoe Plastoholotype
Popenoe, 1937, p. 390-391, pl. 47, figs. 9, 10, 12
Santa Ana Mts., Calif.; CIT loc. 302
Upper Cretaceous, Turonian, Ladd Fm, Baker Mbr [holotype UCLA 40646]

826 **corteziana, Glycymeris:** Dall Paratype
Dall, 1916, p. 402
Cortez Bank, off southern Calif. US Bur. Fish. loc. 2518

7566 **costata, Caprinuloidea:** Palmer Paratype
Palmer, 1928a, p. 62, pl. 11, fig. 2
Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

550 **costata, Caprinuloidea:** Palmer Paratype
Palmer, 1928a, p. 62
Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

393 **cowperi, Pecten (Propeamusium):** Waring Syntype
Waring, 1917, p. 63, pl. 7, fig. 2
Ventura Co., Calif.; Calabasas sheet, Bell's Canyon. N of Simi fault
Upper Cretaceous, Chico Fm

394 **cowperi, Pecten (Propeamusium):** Waring Syntype
Waring, 1917, p. 63, pl. 7, fig. 1
Ventura Co., Calif.; Calabasas sheet, Bell's Canyon. N of Simi fault
Upper Cretaceous, Chico Fm

8056 **craneana, Semele:** Hertlein and Strong Paratype
Hertlein and Strong, 1949b, p. 241
S end of Gulf of California; Arena Bank, in 50 fms

8731 **crippsi, Inoceramus:** Mantell Plastoholotype
Mantell, 1822, p. 133, pl. 27, fig. 11
Sussex, England; Offham, near Lewes
Cretaceous, Cenomanian, Chalk Marl [holotype BM(NH) 5893]

36 **cristobalensis, Pecten (Plagioctenium)** Hertlein Holotype
Hertlein, 1925a, p. 19, pl. 3, figs. 2, 3
Baja California, Mexico; San Cristobal Bay Qd, 3 miles SE of Turtle Bay, SU loc. 49
Pliocene, Salada Fm, uppermost beds

37 **cristobalensis, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 19, pl. 3, fig. 1
Baja California, Mexico; San Cristobal Bay Qd, 3 miles SE of Turtle Bay SU loc. 49
Pliocene, Salada Fm, uppermost beds

37a **cristobalensis, Pecten (Plagioctenium):** Hertlein Paratypes
37b Hertlein, 1925a, p. 19
37c Baja California, Mexico; San Cristobal Bay Qd, 3 miles SE of Turtle
37d Bay SU loc. 49
Pliocene, Salada Fm, uppermost beds

94 **cristobalensis, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 19
Baja California, Mexico; Scammon Lagoon Qd, arroyo NW of Elephant Mesa SU loc. 48
Pliocene, Salada Fm

9712 **cristulata: Tellidorella:** Berry Holotype
Berry, 1963, p. 140. Illustrated in Keen, 1971, p. 106, fig. 236
Sonora, Mexico; off Puerto Libertad, in 40 fms

8808 **crockeri, Solen:** Hertlein and Strong Paratype
Hertlein and Strong, 1950, pp. 225-226
Gulf of Fonseca, Nicaragua; Monypenny Point, lat. 13° 03'N., long. 87° 30'W, in 5-16 fms

8338 **crooki, Pitar (Lamelliconcha)** Clark and Anderson Plastoholotype
Clark and Anderson, 1938, p. 946, pl. 1, figs. 4, 5
Yuba Co., Calif.; E of Marysville UCMP loc. A-1889
Upper Eocene, Wheatland Fm [holotype UCMP 11217]

7305 **crooki, Tellina:** Nelson Plastoholotype
Nelson, 1925, p. 415, pl. 53, fig. 4
Ventura Co., Calif.; S of Simi Valley UCMP loc. 3776
Eocene, "Martinez" Fm [holotype UCMP 30523]

10037 **cultrata, Amerycina:** Keen Holotype
Keen, 1971, p. 135, fig. 310
Near La Paz, Baja California, Mexico; off Isla Partida, Espiritu Santo Id., in 5-33 m

10037a **cultrata, Amerycina:** Keen Paratype
Keen, 1971, p. 135
Near La Paz, Baja California, Mexico; off Isla Partida, Espiritu Santo Id., in 5-33 m

5281 **cumshewensis, Parallelodon (Nanonavis):** Reinhart Plastolectotype
Reinhart, 1937a, p. 173. Lectotype illustrated by Whiteaves, 1884, p. 235, pl. 31, figs. 8a, 8b [as *Grammatodon inornatus* Meek and Hayden]
Queen Charlotte Islands, British Columbia, Canada; N shore of Cumshewa Inlet
Middle Cretaceous [lectotype, selected by Reinhart, 1937, is Geol. Surv. Canada specimen 4915]

7865 **cyclia, Adontorhina:** Berry Holotype
Berry, 1947b, p. 260, pl. 26, figs. 1, 2
San Pedro, Calif.; Hilltop Quarry
Pleistocene, Lomita Marl

7865a **cyclia, Adontorhina:** Berry Paratype
Berry, 1947b, p. 260
San Pedro, Calif.; Hilltop Quarry
Pleistocene, Lomita Marl

7295 **cylindrica, Psammobia** (?): Dickerson Plastosyntype
Dickerson, 1914, p. 139, pl. 12, fig. 2a
Lake Co.. Calif.; near Lower Lake UCMP loc. 780
Eocene, Martinez Fm [syntype UCMP 11678]

7296 **cylindrica, Psammobia** (?): Dickerson Plastosyntype
Dickerson, 1914, p. 139, pl. 12, fig. 2b
Lake Co., Calif.; near Lower Lake UCMP loc. 780
Eocene, Martinez Fm [syntype UCMP 11677]

8584 **cylista, Botula**: Berry Holotype
Berry, 1959, p. 107. Illustrated in Keen, 1971, p. 74, fig. 155 (lower)
Sinaloa, Mexico; Mazatlán, Las Gaviotas Beach

6946 **cymata, Psephidia**: Dall Paratype
Dall, 1913, p. 593
Baja California. Mexico; San Bartolomé [Turtle Bay]

100 **dallasi, Pecten (Plagioctenium)**: Jordan and Hertlein Paratypes
100a Jordan and Hertlein, 1926a, p. 213
100b Baja California, Mexico; canyons 1 or 2 miles from San Antonio Point CAS loc. 795
Upper Pliocene, Salada Fm?

225 **dalli, Myadesma**: Clark Holotype
Clark, 1922, p. 117, pl. 14, figs. 3a, 3b
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

227 **dalli, Myadesma**: Clark Paratype
Clark, 1922, p. 117, pl. 13, fig. 6
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

228 **dalli, Myadesma**: Clark Paratype
Clark, 1922, p. 117, pl. 13, fig. 2
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

229 **dalli, Myadesma**: Clark Paratype
Clark, 1922, p. 117, pl. 13, fig. 4
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

8328 **dalli, Nucula (Acila)**: Arnold Paratypes
Arnold, 1908a, p. 364
Santa Cruz Co., Calif.; Santa Cruz sheet, Big Basin, Blooms Creek, SW 1/4 Sec. 9, T 9 S, R 3 W Arnold loc. C-415
Oligocene, San Lorenzo Fm

5238 **dalli, Solemya**: Clark Holotype
Clark, 1925, p. 73, pl. 22, fig. 3
Twin, Wash.; sea cliffs W of West Twin River SU loc. NP 120
Oligocene, Blakeley Fm

9877 **dalliana, Halobia**: Smith Plastoholotype
Smith, 1927, p. 115, pl. 98, fig. 5
Keku Islet No. 1, Admiralty Island, Alaska; Herring Bay USGS loc. 10196
Upper Triassic, upper Karnic [holotype USNM]

7979 **dauleana, Chione (Chionopsis):** Marks Paratypes
Marks, 1951, p. 81
SW Ecuador; Daule Basin, near Pedro Carbo
Middle Miocene, Daule Fm

7970 **dauleana, Noetia:** Marks Paratypes
Marks, 1951, p. 52
SW Ecuador; Manabi Province, E of village of Calceta
Middle Miocene, Daule Fm

32 **delosi, Pecten (Chlamys) latiauritus:** Arnold Holotype
Arnold, 1906, p. 130, pl. 46, figs. 9, 9a
Los Angeles Co., Calif.; Deadman Island
Pleistocene, San Pedro Fm

32a **delosi, Pecten (Chlamys) latiauritus:** Arnold Paratype
Arnold, 1906, p. 130, pl. 46, figs. 10, 10a
Los Angeles Co., Calif.; Deadman Island
Pleistocene, San Pedro Fm

10322 **delta, Isocardia:** Popenoe Plastoholotype
Popenoe, 1937, p. 389, pl. 47, figs. 7, 8
Santa Ana Mts.. Calif.
Cretaceous, Turonian [holotype UCLA 40643]

7250 **diabloensis, Chione:** Clark Plastoholotype
Clark, 1915, p. 468, pl. 58, fig. 4
Contra Costa Co., Calif.; E of town of Walnut Creek UCMP loc. 1492
Miocene, San Pablo Fm [holotype UCMP 12325]

7246 **diabloensis, Tellina:** Clark Plastoholotype
Clark, 1915, p. 471, pl. 61, fig. 5
Contra Costa Co., Calif.; SE of Walnut Creek UCMP loc. 1478
Miocene, San Pablo Fm [holotype UCMP 11531]

411 **diabloensis, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 27, pl. 5, figs. 5-7
Contra Costa Co., Calif.; Brentwood, Marsh Creek
Eocene, Meganos Fm, D Mbr

9294 **dibbleei, Meretrix:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 203, pl. 34, figs. 8, 9
Santa Barbara Co., Calif.; Lompoc Qd, Nojoqui Creek SU loc. 2217
Eocene, Sacate-Gaviota Fm

9295 **dibbleei, Meretrix:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 203, pl. 35, figs. 1, 2
Santa Barbara Co., Calif.; Lompoc Qd, Nojoqui Creek SU loc. 2217
Eocene, Sacate-Gaviota Fm

9916 **digglesi, Cardiamorpha?:** Smith Plastoholotype
Smith, 1927, p. 111, pl. 94, fig. 8
Shasta Co., Calif.; old quarry SW end Brock Mt., between Squaw Creek and Pit River
Upper Triassic, Hosselkus Ls [holotype USNM 74141]

5480 **digona, Monotis:** Kittl Plastosyntypes
5481 Kittl, 1912, p. 174, pl. 10, figs. 16 (type 5480), 17 (type 5481), 18
5482 (type 5482)
Austria; Siriuskogel, Ischal
Upper Triassic, Noric

192 **dilatata, Corbula:** Waring Holotype
Waring, 1917, p. 92, pl. 15, fig. 2
Ventura Co., Calif.; McCray Wells
Eocene, Tejon Fm [Renamed *Corbula complicata* by Hanna, 1924, p. 163]

125 **diminutivus, Pecten (Plagioctenium):** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 623. Illustrated in Hertlein, 1925a, p. 16, pl. 4, figs. 5, 7 (as *Pecten (Plagioctenium) calli* Hertlein, 1925)
Baja California, Mexico; Scammon Lagoon Qd, W side Elephant Mesa
SU loc. 60
Miocene, Isidro Fm

127 **diminutivus, Pecten (Plagioctenium):** Hertlein and Jordan Paratype
Hertlein and Jordan, 1927, p. 623
Baja California, Mexico; Scammon Lagoon Qd, W side Elephant Mesa
SU loc. 60
Miocene, Isidro Fm

7309 **domenginensis, Tellina:** Vokes Plastoholotype
Vokes, 1939, p. 91, pl. 14, fig. 14
Fresno Co., Calif.; Domengine Creek UCMP loc. 3315
Eocene, Domengine Fm [holotype UCMP 15694]

8005 **durhami, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 23, pl. 7, figs. 1, 2
Ventura Co., Calif.; 1.5 miles W of Vickers Hot Spring
Lower Eocene, Juncal Fm

9285 **effingeri, Lucina (Here):** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 201, pl. 33, fig. 9
Santa Barbara Co., Calif.; Lompoc Qd, Nojoqui Creek
Eocene, Sacate-Gaviota Fm

9713 **electilis, Crenimargo:** Berry Holotype
Berry, 1963, p. 140. Illustrated in Keen, 1971, p. 133, fig. 304
Colima, Mexico; Playa las Hadas, 5 miles N of Manzanillo

322 **elegans, Septifer:** Waring Paratype
Waring, 1917, p. 79, pl. 14, fig. 2
Ventura Co., Calif.; McCray Wells
Upper Eocene, Tejon Fm

9960 **elimata, Macoma:** Dunnhill and Coan Paratype
Dunnhill and Coan, 1968, pp. 1-9
Near Victoria, British Columbia, Canada; N of Moresby Island, fine silty sd

7315 **eoundulata, Gari:** Vokes Plastoholotype
Vokes, 1939, p. 93, pl. 14, fig. 23
Fresno Co., Calif.; N of Domengine Creek UCMP loc. A-820
Eocene [holotype UCMP 15707]

6000a **equilateralis, Arca (Cucullaea):** Meek Plastosyntypes
6000b Meek, 1864a, pp. 39-40. Illustrated in Meek, 1876b, p. 357, pl. 2, figs. 6, 6a
Vancouver Island, British Columbia, Canada; Nanaimo?
Cretaceous [syntypes USNM 12386]

5994 **equilateralis, Mactra (Mactrotoma) californica:** Clark Plastoholotype
Clark, 1932, p. 819, pl. 14, fig. 8
Alaska; near Yakataga River, head of Oil Creek UCMP loc. 3870
Upper Oligocene, Poul Creek Fm [holotype UCMP 30390]

6514 **etheringtoni, Loxocardium:** Effinger Paratype
Effinger, 1938, p. 370
Lewis Co., Wash.; on Cowlitz River, Sec. 25, T 11 N, R 2 W
Lower Oligocene, Gries Ranch Fm

5198 **eugenensis, Mulinia:** Clark Plastoholotype
Clark, 1925, p. 104, pl. 14, fig. 2
Lane Co., Ore.; 3 miles S of Eugene
Oligocene [holotype UCMP 30372]

8505 **euterpes, Pecten (Leptopecten):** Berry Holotype
Berry, 1957, p. 75. Illustrated in Keen, 1971, p. 91, fig. 197
Off Acapulco, Mexico, 6-10 fms

8304 **ezoense, Nemocardium (Arctopratulum):** Takeda Paratypes
Takeda, 1953, p. 82
Hokkaido, Japan; Kushiro Province, along Koikatahbrokachoro River, upper course of Charo River, Shiranuka-gun
Upper Oligocene, Poronai Fm

7282 **fausta, Semele:** Nomland Plastoholotype
Nomland, 1917a, p. 233, pl. 9, figs. 3a, 3b
Fresno Co., Calif.; Zapato Creek UCMP loc. 2991
Pliocene, Etchegoin Fm [holotype UCMP 11102]

16 **fernandoensis, Pecten (Pseudamusium) vancouverensis:** Hertlein Holotype
Hertlein, 1925b, p. 43, pl. 4, fig. 7
Ventura Co., Calif.; 1.5 miles N of Ventura on Ventura River, 1/4 mile S of Taylor Well No. 1 SU loc. 155
Lower Pliocene, lower Fernando Fm

17 **fernandoensis, Pecten (Pseudamusium) vancouverensis:** Hertlein Paratype
Hertlein, 1925b, p. 43, pl. 4, fig. 6
Long Beach, Calif.; drill core, 2800′ deep, about 4500′ NW of Signal Hill, 500′ E of Orange Ave., 750′ N of Willow St.
Lower Pliocene

10059 **fitchi, Penitella:** Turner Paratype
Turner, 1955, p. 71-74
Baja California, Mexico; San Bartolomé [Turtle Bay]

8089 **fonsecana, Mactra (Micromactra):** Hertlein and Strong Paratype
Hertlein and Strong, 1950, p. 232
Gulf of Fonseca, Nicaragua; Potosi and Monypenny Point

6524 **forma, Chama sinuosa:** Pilsbry and McGinty Paratype
Pilsbry and McGinty, 1938, p. 76
Palm Beach Co., Fla.; rock reef S of Boynton Inlet

5138 **freudenbergi, Ostrea:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 622, pl. 17, fig. 9; pl. 18, fig. 4
Baja California, Mexico; above San Gregorio Lagoon, on trail from Arroyo Mesquital to La Purisima, in *Turritella* bed SU loc. 59
Miocene, Isidro Fm

8051 **frizzelli, Pitar (Lamelliconcha):** Hertlein and Strong Paratype
Hertlein and Strong, 1948, p. 176
Gulf of California, near Gorda Banks, 50 fms

794 **frustra, Spisula pittsburgensis:** Tegland Paratype
Tegland, 1933, p. 121, pl. 9, fig. 12
Puget Sound, Wash.; Bainbridge Island, beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Upper Oligocene, Blakeley Fm

10342 **gabbiana, Mactra:** Anderson Plastoholotype
Anderson, 1902, p. 74, pl. 7, fig. 156. Also in Saul, 1974, pp. 1084-1087, pl. 1, fig. 16; pl. 2, fig. 10; pl. 3, fig. 17 [as *Cymbophora gabbiana* (Anderson)]
Siskiyou Co., Calif.; Henley and Willow Creek
Cretaceous, Turonian, "lower Chico beds" Hornbrook Fm

6222 **galapagensis, Lima:** Pilsbry and Vanatta Syntype
Pilsbry and Vanatta, 1902, p. 556
Galápagos; Albemarle Island, Tagus Cove

10314 **gamma, Crassatella:** Popenoe Plastoholotype
Popenoe, 1937, p. 388, pl. 46, figs. 13, 14
Santa Ana Mts., Calif.; CIT loc. 1069
Cretaceous, Turonian, Ladd Fm [holotype UCLA 40636]

5907 **gardneri, Yoldia:** Oldroyd Holotype
Oldroyd, 1935, p. 14, fig. 1
Vancouver Island, British Columbia, Canada; Pender Harbor, Gardner Bay

5907a **gardneri, Yoldia:** Oldroyd Paratype
Oldroyd, 1935, p. 14
Vancouver Island, British Columbia, Canada; Pender Harbor, Gardner Bay

5223 **gastonensis, Tivela:** Clark Holotype
Clark, 1925, p. 93, pl. 19, fig. 1
Gaston, Ore.; county quarry, Scroggins Canyon SU loc. NP 295
Oligocene, lower Astoria Ss

5224 **gastonensis, Tivela:** Clark Paratype
Clark, 1925, p. 93, pl. 19, fig. 2
Gaston, Ore.; county quarry, Scroggins Canyon SU loc. NP 295
Oligocene, lower Astoria Ss

5225 **gastonensis, Tivela:** Clark Paratype
Clark, 1925, p. 93, pl. 19, fig. 3
Gaston, Ore.; county quarry, Scroggins Canyon SU loc. NP 295
Oligocene, lower Astoria Ss

5385 **gayi, Semele:** Arnold Paratype
Arnold, 1908a, p. 360
San Mateo Co., Calif.; between headwaters of San Lorenzo River and Pescadero Creek
Eocene

7573 **gherzii, Agria:** Palmer Syntype
Palmer, 1928a, p. 78, pl. 15, figs. 4, 5
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

556 **gherzii, Agria:** Palmer Paratype
Palmer, 1928a, p. 78
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

9882 **gigantea, Halobia:** Smith Plastoholotype
Smith, 1927, p. 116, pl. 93, fig. 6
Shasta Co., Calif.; E side Brock Mt., Bear Cove
Upper Triassic, *Juvavites* beds of Bear Cove [holotype USNM]

9917 **gleimi, Cardinia:** Smith Plastoholotype
Smith, 1927, p. 110, pl. 96, fig. 7
Shasta Co., Calif.; N fork Squaw Creek, 3 miles N of Kellys Ranch
Upper Triassic, Hosselkus Ls [holotype USNM 74165]

6135 **globula, Sphenia:** Dall Paratype
Dall, 1919b, p. 370. Illustrated in Schenck, 1945, p. 519, pl. 67, figs. 5-8
Bolinas Bay, Calif.

9834 **goesi, Kellyella:** Odhner Paratypes
Odhner, 1960, p. 397
Off St. Martin, West Indies, 300 fms

553 **gracilis, Caprinuloidea perfecta:** Palmer Paratypes
7568 Palmer, 1928a, p. 60
Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

6582 **granti, Pseudochama:** Strong Paratypes
Strong, 1934, p. 137
Orange Co., Calif.; dredged off Corona del Mar

6940 **granulata, Pandora:** Dall Paratype
Dall, 1915b, p. 449. Illustrated in Keen, 1971, p. 289, fig. 739 below
Off La Paz, Baja California, Mexico: Gulf of California
7260 **gravidus, Solen:** Clark Plastoholotype
Clark, 1918, p. 156, pl. 10, fig. 7
Contra Costa Co., Calif.; SW of Walnut Creek UCMP loc. 1131
Oligocene, San Ramon Fm [holotype UCMP 11138]
9914 **gravinaensis, Cassianella:** Smith Plastoholotype
Smith, 1927, p. 112, pl. 101, figs. 4, 5
Gravina Island, SE Alaska
Upper Triassic [holotype USNM 74195]
548 **gregaria, Horipleura:** Palmer Paratypes
549 Palmer, 1928a, p. 49
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian
501 **gregoryi, Avicula:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 69. Illustrated in Wiedey, 1929b, pl. 1, fig. 1
Alameda Co., Calif.; Tesla Qd, 1.5 miles S 10° W of Carnegie
Middle Cretaceous, Horsetown Fm
5578 **grewingki, Mya (Arenomya):** Makiyama Paratype
Makiyama, 1934, p. 156
Cape Maly, Matchgar coast, Russian Sachalin
"Oligocene," Asagaian Fm
6513 **griesensis, Ostrea:** Effinger Paratype
Effinger, 1938, p. 368
Lewis Co., Wash.; on Cowlitz River, Sec. 25, T 11 N, R 2 W
Oligocene, Gries Ranch Fm
8295 **griphus, Nemocardium (Arctopratulum):** Keen Holotype
Keen, 1954, p. 318, pl. 29, figs. 14, 17
Grays Harbor Co., Wash.; middle fork Wishkah River, 14 miles N of Aberdeen SU loc. NP 243
Middle Miocene, Astoria Fm
8296 **griphus, Nemocardium (Arctopratulum):** Keen Paratype
Keen, 1954, p. 318, pl. 29, fig. 12, text fig. 4
Grays Harbor Co., Wash.; middle fork Wishkah River, 14 miles N of Aberdeen SU loc. NP 243
Middle Miocene, Astoria Fm
8297 **griphus, Nemocardium (Arctopratulum):** Keen Paratype
Keen, 1954, p. 318, text fig. 3
Grays Harbor Co., Wash.; middle fork Wishkah River, 14 miles N of Aberdeen SU loc. NP 243
Middle Miocene, Astoria Fm
5443 **guadalupensis, Glycymeris:** Strong Paratype
Strong, 1938, p. 213
Off Guadalupe Island, Mexico; 9-15 fms
8052 **guatulcoensis, Chione:** Hertlein and Strong Paratypes
Hertlein and Strong, 1948, p. 182
Off Port Guatulco, Mexico; 15° 44′ 28″ N, 96° 07′ 51″ W, 7 fms
5338 **guineensis, Nucula:** Thiele Paratype
Thiele, 1931, p. 193
Gulf of Guinea; lat. 3° 10′ N, long. 5° 28′ W, 1139 fms
8359 **hadra, Venericardia:** Dall Syntypes
Dall, 1903b, p. 1429
Calhoun Co., Fla.; Chipola River, 1 mile below Bailey's Ferry
"Oligocene," in riverbank above white ls bed

40 **hakei, Pecten (Plagioctenium):** Hertlein Holotype
Hertlein, 1925a, p. 18, pl. 4, fig. 1
Baja California, Mexico; Turtle Bay SU loc. 47
Pliocene, Salada Fm

41 **hakei, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 18, pl. 4, fig. 3
Baja California, Mexico; Turtle Bay SU loc. 47
Pliocene, Salada Fm

95 **hakei, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 18
Baja California, Mexico; Ballenas Bay Qd, N edge of tilted mesa ca. 5 miles N of Abreojos Point SU loc. 46
Pliocene, Salada Fm

8516 **hancocki, Lithophaga (Leiosolenus):** Soot-Ryen Paratype
Soot-Ryen, 1955, p. 102. Illustrated in Keen, 1971, p. 68, fig. 141
Galápagos: Isla Onslow, N of Isla Floreana (Charles Island)

514 **hannai, Anomia:** Wiedey Holotype
Wiedey, 1929c, p. 280, pl. 21, fig. 1
Monterey Co., Calif.; Val Celico, W of Pleyto SU loc. 449
Lower Miocene, Vaqueros Fm

8302 **hannibali, Clinocardium:** Keen Holotype
Keen, 1954, p. 324, pl. 29, fig. 16
Aberdeen, Wash.; Chehalis and Summit Streets SU loc. NP 235
Mio-Pliocene, Montesano Fm

8303 **hannibali, Clinocardium:** Keen Paratype
Keen, 1954, p. 324, text fig. 9
Aberdeen, Wash.; Chehalis and Summit Streets SU loc. NP 235
Mio-Pliocene, Montesano Fm

234 **hannibali, Mytilus:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 142, pl. 16, fig. 3
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, sea cliffs at mouth of Fossil Creek SU loc. NP 130
Oligocene? Sooke Fm

5248 **hannibali, Nucula:** Clark Holotype
Clark, 1925, p. 73, pl. 8, fig. 2
W of Gettysburg, Wash.; sea cliffs at mouth of Duncan Creek SU loc. NP 90
Oligocene, Blakeley Fm

58 **hannibali, Paphia staleyi:** Howe Holotype
Howe, 1922, p. 98, pl. 10, figs. 1, 4
Scotia, Calif.; Eel River valley between Scotia and Nanning Switch SU loc. NP 82, Arnold loc. C-13
Pliocene, Wildcat Fm

5246 **hannibali, Phacoides (Lucinoma):** Clark Holotype
Clark, 1925, p. 89, pl. 22, figs. 2, 4
Wash.; bluff on Chehalis River below Porter SU loc. NP 53
Oligocene, Porter Fm

230 **hannibali, Spisula (Hemimactra):** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 153, pl. 19, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; W of Otter Point, sea cliffs between mouths of Muir and Coal Creeks SU loc. NP 129
Oligocene, Sooke Fm

231 **hannibali, Spisula (Hemimactra):** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 153, pl. 19, fig. 4
Vancouver Island, British Columbia, Canada; W of Otter Point, sea cliffs between mouths of Muir and Coal Creeks SU loc. NP 129
Oligocene, Sooke Fm

5253 **hannibali, Venericardia (Cyclocardia):** Clark Holotype
Clark, 1925, p. 88, pl. 19, figs. 6, 7
3/4 mile above Porter, Wash.; shaly ss bluffs along Porter Creek
SU loc. NP 54
Middle Oligocene, Sooke Fm

406 **harfordus, Pecten (Camptonectes):** Davis Syntype
Davis, 1913, p. 456, fig. 6
San Luis Obispo Co., Calif.; 6 miles N of Port Harford
Jurassic, San Luis Fm

408 **harfordus, Pecten (Camptonectes):** Davis Syntype
Davis, 1913, p. 456, figs. 3, 5
San Luis Obispo Co., Calif.; 6 miles N of Port Harford
Jurassic, San Luis Fm

5832 **haroldiana, Gonidea angulata:** Dall Paratype
Dall, 1908a, p. 500. Illustrated in Hannibal, 1912a, fig. 4 and Hannibal, 1912b, pl. 6, fig. 10
Coyote Creek, near San Jose, Calif.

505 **harrigani, Pholadomya:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 77. Illustrated in Wiedey, 1929b, pl. 1, fig. 5
Alameda Co., Calif.; Tesla Qd, Altamont, black shale in Western Pacific R.R. cut
Upper Cretaceous, Chico Fm

48 **hartmanni, Pecten (Pecten):** Hertlein Holotype
Hertlein, 1925a, p. 8, pl. 1, figs. 4, 6
Baja California, Mexico; Arroyo Mesquital SU loc. 54
Lower Pliocene?

5475 **haueri, Monotis:** Kittl Plastosyntypes
5476 Kittl, 1912, p. 171, pl. 10, figs. 7 (type 5475), 8 (type 5476), 9 (type
5477 5477)
Upper Austria; Rossmoos bei Goisern
Upper Triassic, Noric [syntypes at Geolog.-Paleont. Abtlg. Naturh. Staats.—Museum, Wien]

5343 **hawleyi, Arca (Arca):** Reinhart Holotype
Reinhart, 1943, p. 21, pl. 2, figs. 20, 22
Santa Barbara Co., Calif.; Lompoc Qd, E side of Nojoqui Creek, 3 miles N of Gaviota Pass SU loc. 834
Eocene, Gaviota Fm

5344 **hawleyi, Arca (Arca):** Reinhart Paratype
Reinhart, 1943, p. 21
Santa Barbara Co., Calif.; Lompoc Qd, E side of Nojoqui Creek, 3 miles N of Gaviota Pass SU loc. 834
Eocene, Gaviota Fm

19 **hawleyi, Pecten (Pecten):** Hertlein Holotype
Hertlein, 1925b, p. 40, pl. 4, fig. 5
Santa Barbara Co., Calif.; Santa Inez Mts.
Miocene, Vaqueros Fm

22 **hawleyi, Pecten (Pecten):** Hertlein Paratype
Hertlein, 1925b, p. 40, pl. 4, fig. 4
Santa Barbara Co., Calif.; Santa Inez Mts.
Miocene, Vaqueros Fm

522 **healeyi, Pecten (Patinopecten):** Arnold Paratype
Arnold, 1906, p. 103, pl. 37, fig. 2
San Mateo Co., Calif.; San Gregorio
Pliocene, Purisima Fm

46 **heimi, Pecten (Pecten):** Hertlein Holotype
Hertlein, 1925a, p. 9, pl. 1, fig. 3
Baja California, Mexico; S part of Arroyo San Gregorio SU loc. 65
Pliocene?

47 **heimi, Pecten (Pecten):** Hertlein Paratype
Hertlein, 1925a, p. 9, pl. 1, fig. 3
Baja California, Mexico; S part of Arroyo San Gregorio SU loc. 65
Pliocene?

8083 **helgolandicus, Mimoceramus:** Heinz Plastoholotype
Heinz, 1934, p. 728, pl. 61, fig. 2, text fig. 1
North Sea; Helgoland Island
Cretaceous, Campanian [holotype at Geologisches Staatinstut, Hamburg]

455 **hemphilli, Gonidea:** Hannibal Holotype
Hannibal, 1912b, p. 128, pl. 7, fig. 19. Also in Taylor and Smith, 1971, figs. 38, 39
Berkeley Hills, Calif.; Telegraph Canyon, water tunnel
Miocene [Pliocene, *fide* Taylor and Smith, 1971, p. 310]

6531 **hemphillii, Asthenothaerus:** Dall Paratypes
Dall, 1886, p. 308
Marco, Fla., 2 fms

452 **herrei, Margaritana:** Hannibal Holotype
Hannibal, 1912b, p. 121, pl. 7, fig. 17. Also in Taylor and Smith, 1971, figs. 12, 14 (as "*Margaritifera*")
Tesla, Calif.; 1/4 mile above Carnegie Pottery Plaint, in cut along Western Pacific R.R., Corral Hollow
Eocene

5160 **hertleini, Pteria:** Wiedey Holotype
Wiedey, 1928, p. 133, pl. 21, fig. 1
Monterey Co., Calif.; Los Vaqueros Valley SU loc. 200
Miocene, Vaqueros Fm [Wiedey's specimen 434]

8340 **hertleini, Semele:** Durham Plastoholotype
Durham, 1950, p. 90, pl. 24, fig. 6; pl. 25, fig. 7
Gulf of California; Coronado Island UCMP loc. A 3548
Pleistocene [holotype UCMP 30367]

9516 **hesperius, Pitar (Lamelliconcha):** Berry Holotype
Berry, 1960, p. 115. Illustrated in Keen, 1971, p. 174, fig. 415
Near Mazatlán, Mexico

7792 **hilli, Cardita:** Willett Paratype
Willett, 1944a, p. 19
Orange Co., Calif.; mesa at head of Newport Bay
Upper Pleistocene

20 **hodgei, Pecten (Chlamys):** Hertlein Holotype
Hertlein, 1925b, p. 42, pl. 4, fig. 2
Coalinga area, Calif.; Sec. 20, T 19 S, R 15 E
Miocene, Santa Margarita Fm

21 **hodgei, Pecten (Chlamys):** Hertlein Paratype
Hertlein, 1925b, p. 42, pl. 4, fig. 1
Coalinga area, Calif.; Sec. 20, T 19 S, R 15 E
Miocene, Santa Margarita Fm

22 **hodgei, Pecten (Chlamys):** Hertlein Paratype
Hertlein, 1925b, p. 42
Coalinga area, Calif.; Sec. 20, T 19 S, R 15 E
Miocene, Santa Margarita Fm

9912 **humboldtensis, Myophoria:** Smith Plastoholotype
Smith, 1927, p. 110, pl. 96, fig. 7
Humboldt Range, Nevada; Mulberry Canyon
Upper Triassic, Star Peak Fm [holotype USNM 74174]

10 **hydei, Pecten (Chlamys) sespeensis:** Arnold Holotype
Arnold, 1906, p. 69, pl. 5, figs. 3a-3c
Monterey Co., Calif.; Lynch's Mt.
Lower Miocene, Vaqueros Fm

8629 **hyphalopilema, Anadara (Scapharca):** Campbell Holotype
Campbell, 1962, p. 152, figs. 2, 4, 5, 7, 8
Guaymas, Mexico; near Cabo Haro, off Catalina Bay, 18-20 fms
5833 **idahoense, Pisidium:** Roper Paratypes
Roper, 1890, p. 85
Old Mission, Idaho
5162 **impavida, Arca:** Wiedey Holotype
Wiedey, 1928, p. 130, pl. 14, figs. 2, 3
Kern Co., Calif.; Barker's Ranch SU loc. 442
Middle Miocene, Temblor Fm [Wiedey's specimen 436]
7854 **impolita, Diplodonta:** Berry Holotype
Berry, 1953b, p. 409, pl. 28, figs. 3, 4
Forrester Island, Alaska; 15 fms
5168 **inequalis, Clementia:** Wiedey Paratype
Wiedey, 1928, p. 146, pl. 18, fig. 5
Ventura Co., Calif.; Santa Paula Qd, SW 1/4 NW 1/4 Sec. 22, T 3 N, R 21 W, from the abrupt terminus of South Mt.. along Santa Clara River SU loc. 406
Lower Miocene, Vaqueros Fm [Wiedey's specimen 426]
8339 **inezana, Plicatula:** Durham Plastoholotype
Durham, 1950, p. 68, pl. 13, fig. 6
Baja California, Mexico; Santa Inez Bay UCMP loc. A3584
Pleistocene [holotype UCMP 15532]
424 **inezana, Spondylus:** Wiedey Paratype
Wiedey, 1928, p. 139
Ventura Co., Calif.; Calabasas sheet, head of Wiley Canyon [Piru Qd]
Miocene, Vaqueros Fm
8253 **infelix, Hiata:** Zetek and McLean Paratypes
Zetek and McLean, 1936, p. 110
Balboa, Canal Zone
5101 **inflata, Radiolites:** Palmer Paratype
Palmer, 1928a, p. 83, pl. 17, fig. 4
Jalisco, Mexico; Huescalapa
Cretaceous, "Turonian"
5348 **inornatus, Grammatodon:** (Meek and Hayden) Plastosyntype
Meek and Hayden, 1865, p. 90, pl. 3, figs. 9a, 9c
Wyoming; SW base of Black Hills
Jurassic, Sundance Fm [syntype USNM 201 = *Arca (Cucullaea) inornata* Meek and Hayden, 1858, type species of *Grammatodon* Meek and Hayden, 1860]
5349 **inornatus, Grammatodon:** (Meek and Hayden) Plastosyntype
Meek and Hayden, 1865, p. 90, pl. 3, fig. 9b
Wyoming: SW base of Black Hills
Jurassic, Sundance Fm [syntype USNM 201 = *Arca (Cucullaea) inornata* Meek and Hayden, 1858, type species of *Grammatodon* Meek and Hayden, 1860]
814 **insignis, Schizodus:** Drake Holotype
Drake, 1898, p. 406, pl. 9, fig. 7
McDermitt, Okla.; 5 miles E of town
Permian
8 **invalidus, Pecten:** Hanna
Hanna, 1924, p. 177. [Renaming of *Pecten (Plagioctenium) cooperi* Arnold, 1906]
San Diego, Calif.; Pacific Beach
Pliocene, San Diego Fm

619 **ionense, Venericardia planicosta:** Waring Holotype
Waring, 1914, p. 785. Illustrated in Waring, 1917, p. 96, pl. 11, fig. 1
Umpqua Valley, Oregon
Eocene, Umpqua Fm [= neotype of *Venericardia (Leuroactis) aragonia* Arnold and Hannibal, 1914, designated by Stewart, 1930, p. 170]

5825 **irisans, Anodontites:** Marshall Paratypes
Marshall, 1926, p. 10
Venezuela

10056 **jamesi, Nuttallia:** Roth and Guruswami-Naidu Paratype
Roth and Guruswami-Naidu, 1974, p. 143
Sonoma Co., Calif.; Sebastopol Qd, road cut N side of River Rd., .02 miles N of Trenton CAS loc. 54164
Pliocene, Merced Fm

9919 **jenkinsi, Cardita:** Smith Plastoholotype
Smith, 1927, p. 111, pl. 96, fig. 2
Shasta Co., Calif.; N fork Squaw Creek, 3 miles N of Kellys Ranch
Upper Triassic, Hosselkus Ls [holotype USNM 74160]

421 **jordani, Pteria:** Wiedey Paratype
Wiedey, 1928, p. 134, pl. 15, fig. 3
Los Angeles Co., Calif.; Dry Canyon, 2 miles S of Calabasas
Middle Miocene, Temblor Fm

5218 **kamakawaensis, Tellina:** Clark Holotype
Clark, 1925, p. 95, pl. 12, fig. 13
Skamokawa, Wash.; along Skamokawa River, above big bend, 1 mile E of junction of main and middle forks SU loc. NP 272
Oligocene, Lincoln Fm, ss bluffs

7992 **keenae, Venericardia (Glyptoactis):** Verastegui Holotype
Verastegui, 1953, p. 41, pl. 1, figs. 1-5
Fresno Co., Calif.; Panoche Qd, Sec. 29, T 15 S, R 12 E [Tumey Hills Qd] opposite jct. of Panoche and Silver Creeks SU loc. 2073
Paleocene, Lodo Fm

5 **keepi, Pecten (Pecten):** Arnold Holotype
Arnold, 1906, p. 60, pl. 5, fig. 1; pl. 6, figs. 1, 1a
San Diego Co., Calif.; Carrizo Creek area
Miocene

9301 **kelleyi, Pitar:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 204, pl. 35, fig. 11
Santa Barbara Co., Calif.; Goleta Qd, near Las Yegas Canyon UCMP loc. B6983
Eocene, Gaviota Fm

9302 **kelleyi, Pitar:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 204, pl. 35, fig. 10
Santa Barbara Co., Calif.; Goleta Qd, near Las Yegas Canyon UCMP loc. B6979
Eocene, Gaviota Fm

9303 **kelleyi, Pitar:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 204, pl. 36, fig. 1
Santa Barbara Co., Calif.; Goleta Qd, near Las Yegas Canyon UCMP loc. B6933
Eocene, Gaviota Fm

5819 **kelseyi, Diplodon:** Baker Paratype
Baker, 1914, p. 665
Rio Jamauchim, Brazil

128 **kernensis, Pecten (Patinopecten):** Hertlein Holotype
Hertlein, 1925b, p. 40, pl. 4, fig. 3
Kern Co., Calif.; Pyramid Hill, 3 miles NW of mouth of Kern River Canyon SU loc. 150 [Rio Bravo Ranch Qd, T 28 S, R 29 E]
Miocene, Monterey Fm

5166 **kernensis, Pholadomya:** Wiedey Holotype
Wiedey, 1928, p. 141, pl. 17, figs. 1, 2
Kern Co., Calif.; N of Poso Creek, SW 1/4 SE 1/4 Sec. 12, T 27 S, R 28 E SU loc. 438
Middle Miocene, Temblor Fm [Wiedey's specimen 437]

515 **kewi, Mytilus:** Wiedey Holotype
Wiedey, 1929c, p. 281, pl. 31, fig. 2 [renamed *Mytilus loeli* by Grant, 1930, p. 419]
Monterey Co., Calif.; Los Vaqueros Valley SU loc. 100
Lower Miocene, Vaqueros Fm

5159 **kewi, Mytilus:** Wiedey Paratype
Wiedey, 1929c, p. 281 [renamed *Mytilus loeli* by Grant, 1930, p. 419]
Monterey Co., Calif.; Los Vaqueros Valley
Lower Miocene, Vaqueros Fm

5998 **kewi, Tellina:** Dickerson Plastoholotype
Dickerson, 1914, p. 138, pl. 12, fig. 1
Lake Co., Calif.; near Lower Lake UCMP loc. 784
Lower Eocene, Martinez Fm [holotype UCMP 11718]

6311 **kincaidi, Pecten hindsii:** Oldroyd Holotype
Oldroyd, 1920, p. 135, pl. 4, figs. 3, 4
Puget Sound, Wash.

5548 **kiyonoi, Arca:** Makiyama Paratype
Makiyama, 1931a, p. 269, 273
Kyushu, Japan; Hakata Bay, in mud [cited as specimen VI]

8426 **landanensis, Venericardia:** Vincent Plastosyntypes
8426a Vincent, 1913, p. 29, pl. 3, figs. 5 (type 8426), 6 (type 8426a)
Portuguese West Africa; Falaise de Landana, Cabinda
"Paleocene" [syntypes RG 174, RG 110, at Mus. R. Congo Belge?]

9304 **lascrucensis, Pitar:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 204, pl. 36, fig. 2
Santa Barbara Co., Calif.; Lompoc Qd, San Julian Ranch UCMP loc. A 940
Eocene-Oligocene, upper Gaviota Fm

9305 **lascrucensis, Pitar:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 204, pl. 36, fig. 5
Santa Barbara Co., Calif.; Lompoc Qd, San Julian Ranch UCMP loc. A 940
Eocene-Oligocene, upper Gaviota Fm

9306 **lascrucensis, Pitar:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 204, pl. 36, fig. 3
Santa Barbara Co., Calif.; Lompoc Qd, El Jaro at Yridisis Creek loc. 2906b
Eocene, Middle Gaviota Fm

5412 **leana, Trigonia:** Gabb Plastosyntype
Gabb, 1877, p. 312, pl. 31, fig. 362. Also *in* Gabb, 1864, p. 190, pl. 25, fig. 178 (as *T. gibboniana* Lea?) [See Stewart, 1930, pp. 92-93]
Near Martinez, California (fig. 178); Jacksonville, Ore.
Cretaceous

4 **lecontei, Pecten (Pecten):** Arnold Holotype
Arnold, 1906, p. 98, pl. 33, figs. 4, 4a, 4b
Off Baja California, Mexico; Cedros Island
Pliocene, Salada Fm?

5194 **lewisi, Pinna:** Waring Holotype
Waring, 1917, p. 94, pl. 15, fig. 24
Ventura Co., Calif.; McCray Wells
Upper Eocene, Tejon Fm

6938 **limata, Leda hamata:** Dall Paratype
Dall, 1916, p. 397
Off Santa Rosa Island, California; 53 fms

8023 **lisa, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 39, pl. 21, figs. 1, 2
Lewis Co., Wash.; bluffs along Olequa Creek at Old Ainslee Mill, T 11 N, R 2 W
Upper Eocene, Cowlitz Fm

8741 **lobatus, Inoceramus:** Munster in Goldfuss Plastoholotype
Goldfuss, 1836, p. 113, pl. 110, fig. 3
Westphalia, Germany
Cretaceous [holotype 673 BM (NH)]

519 **loeli, Amiantis (?):** Wiedey Holotype
Wiedey, 1929c, p. 288, pl. 32, fig. 2; pl. 33, fig. 3
San Mateo Co., Calif.; Searsville Road roadcut near Stanford University SU loc. 450
Middle Miocene, Monterey Fm

515 **loeli, Mytilus:** Grant Holotype
Grant, 1930, p. 419. [new name for *Mytilus kewi* Wiedey, 1929c]
Monterey Co., Calif.; Los Vaqueros Valley SU loc. 100
Lower Miocene, Vaqueros Fm

5425 **lorenzanum, Cardium cooperi:** Arnold Paratype
Arnold, 1908a, p. 366
Santa Cruz Co., Calif.; E branch, N Fork, Waddell Creek, Big Basin
Oligocene, San Lorenzo Fm

407 **lucianus, Inoceramus:** Davis Holotype
Davis, 1913, p. 455, fig. 2
Monterey Co., Calif.; 4 miles N of Slate's Springs
Jurassic, Franciscan Fm

9711 **lunaris, Pecten:** Berry Holotype
Berry, 1963, p. 139. Illustrated in Keen, 1971, p. 85, fig. 176
Sonora, Mexico; off Morro Colorado, 30-45 fms

167 **maccrayi, Glycimeris** [sic]): Waring Holotype
Waring, 1917, p. 93, pl. 15, fig. 1
Ventura Co., Calif.; McCray Wells
Upper Eocene, Tejon Fm

9906 **madisonensis, Posidonia:** Smith Plastoholotype
Smith, 1927, p. 112, pl. 94, fig. 12
Shasta Co., Calif.; NW end Brock Mt. between Squaw Creek and Pit River
Upper Triassic, Hosselkus Ls [holotype USNM 74144]

5167 **margaritana, Dosinia:** Wiedey Paratype
Wiedey, 1928, p. 145, pl. 18, fig. 2
San Luis Obispo Co., Calif.; 4 miles E of La Panza, S side of low ridge forming N wall of canyon through which McKittrick-La Panza road passes SU loc. 436
Lower Miocene, Vaqueros Fm [Wiedey's specimen 425]

5583 **maria, Chaenomya:** Worthen Holotype
Worthen, 1882, p. 39. Illustrated in Worthen, 1883, p. 319, figs. 1a, 1b
Shawnee Co., Kansas; Plowboy
Pennsylvanian, Upper Coal Measures

7258 **markleyensis, Mactra (Spisula):** Clark Plastoholotype
Clark, 1938, p. 699, pl. 2, fig. 6
Solano Co., Calif.; Napa Qd, S of Putah Creek UCMP loc. A 1297
Eocene, Markley Fm [holotype UCMP 30852]

8021 **marksi, Venericardia (Glyptoactis):** Verastegui Holotype
Verastegui, 1953, p. 44, pl. 19, figs. 2-4
Kern Co., Calif.; E side Live Oak Canyon SU loc. 183
Upper Eocene, Tejon Fm

7303 **martinezensis, Tellina:** Weaver Plastoholotype
Weaver, 1905, p. 115, pl. 12, fig. 3
Contra Costa Co., Calif.; S of Martinez UCMP loc. 337
"Eocene," Martinez Fm [Paleocene] [holotype UCMP 11816]

9915 **martini, Lima:** Smith Plastoholotype
Smith, 1927, p. 122, pl. 101, fig. 11
Alaska; S bank of Yukon River opposite Nation River
Upper Triassic [holotype USNM 74200]

8011 **mcmastersi, Venericardia (Glyptoactis):** Verastegui Holotype
Verastegui, 1953, p. 42, pl. 13, figs. 2, 3
San Diego Co., Calif.; San Clemente Canyon
Middle Eocene, La Jolla Fm

450 **meeki, Corneocyclas:** Hannibal Holotype & Paratypes
Hannibal, 1912b, p. 135, pl. 6, fig. 12. Also in Taylor and Smith, 1971, fig. 2 (as *Sphaerium*)
Near Hawthorne, Nevada; hill on Belmont Stage road
Eocene [Miocene, Esmeralda Fm, *fide* Taylor and Smith, 1971, p. 310]

7526 **menuda, Lucinisca:** Keen Holotype
Keen, 1943, p. 40, pl. 3, figs. 15, 16
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

6560 **meridionalis, Chione:** Oldroyd Paratype
Oldroyd, 1921, p. 93, pl. 4, fig. 4
Peru

6941 **meridionalis, Miodontiscus:** Dall Paratype
Dall, 1916, p. 408
San Diego Co., Calif.; off Point Loma 67-78 fms

7787 **meropsis, Tellina (Moerella):** Dall Paratypes
Dall, 1900b, p. 317
San Diego, Calif.

433 **merriami, Pecten (Pecten):** Arnold Neotype
Arnold, 1906, p. 99. Holotype presumed destroyed in San Francisco fire, 1906, in California State Mining Bureau collections. Neotype selected by Grant and Gale, 1931, p. 195
Ventura Co., Calif.; San Felician Creek, near Piru
Pliocene

8586 **mexicanum, Galeomma (Lepirodes?):** Berry Holotype
Berry, 1959, p. 108. Illustrated in Keen, 1971, p. 135, fig. 308 (as *Tryphomyax*)
Gulf of California, San Luis Gonzaga Bay, 3-4 fms

7850 **microsperma, Nucula (Ennucula):** Berry Holotype
Berry, 1947b, p. 258, pl. 26, fig. 2
San Pedro, Calif.; near Second and Pacific Streets
Pleistocene, Lomita Fm

398 **milthoidea, Dosinia:** Waring Holotype
Waring, 1917, p. 60, pl. 8, fig. 5
Ventura Co., Calif.; Calabasas sheet, Bell's Canyon, N. of Simi fault
Upper Cretaceous, Chico Fm

39 **modulatus, Pecten (Lyropecten):** Hertlein Holotype
Hertlein, 1925a, p. 11, pl. 3, fig. 6
Baja California, Mexico; Scammon Lagoon Qd, mesa W of Mesa de las Auras SU loc. 43
Pliocene, Salada Fm

8029 **montereyensis, Cardita (Cyclocardia) ventricosa:** Smith and Gordon Paratypes
Smith and Gordon, 1948, p. 213
Off Monterey, Calif., 70 fms

10319a **moorei, Cyprimeria:** Popenoe Plastosyntypes
10319b Popenoe, 1937, p. 391, pl. 48, fig. 1 (type 10319), fig. 2 (type 10319a)
10319c Santa Ana Mts., Calif.; CIT loc. 92
Cretaceous, Turonian [syntypes UCLA 40648, 40649, 40650]

166 **morani, Cucullaea:** Waring Holotype
Waring, 1914, p. 784. Ilustrated in Waring, 1917, pl. 14, figs. 12, 13
Ventura Co., Calif.; 1.5 miles E of McCray Wells
Eocene, Tejon Fm

516 **morani, Dosinia:** Wiedey Holotype
Wiedey, 1929c, p. 281, pl. 31, fig. 3
San Luis Obispo Co., Calif.; Canyon de Piedra, 4 miles E of San Luis Obispo
Lower Miocene, Vaqueros Fm

9308 **mulinoidus, Pitar:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 205. pl. 36, fig. 7
Santa Barbara Co., Calif.; El Jaro at Yridisis Creek loc. 2907
Eocene, middle Gaviota Fm

9309 **mulinoidus, Pitar:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p 205, pl. 36, figs. 6, 10
Santa Barbara Co., Calif.; El Jaro at Yridisis Creek loc. 2907
Eocene, middle Gaviota Fm

7994 **mulleri, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 20, pl. 1, figs. 6-9
Fresno Co., Calif.; Panoche Qd [Tumey Hills Qd], Sec. 29, T 15 S, R 12 E SU loc. 2073
Paleocene, Lodo Fm

971 **multirugosus, Pecten (Chlamys):** Gale Paratype
Gale, 1928, p. 92. Illustrated *in* Grant and Gale, 1931, p. 159, pl. 11, figs. 5a, 5b
San Pedro, Calif.

5100 **multitubifera, Caprinuloidea:** Palmer Paratype
Palmer, 1928a, p. 61
Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

7852 **myrae, Ensis:** Berry Holotype
Berry, 1953a, p. 398, pl. 29, figs. 5, 6, text fig. 4
San Pedro Bay, Calif.; near Terminal Island

7851 **myrae, Ensis:** Berry Paratype
Berry, 1953a, p. 398, text fig. 3
San Pedro Bay, Calif.; near Terminal Island

9499 **myrae, Periploma (Halistrepta):** Rogers Holotype
Rogers, 1962, p. 235, figs. 1, 2. Illustrated in Keen, 1971, p. 295, fig. 257
Gulf of California; off Loreto, near Carmen Island, 15-25 fms

10189 **Mytilus,** n. sp. aff. **M. tichanovitchi** Makiyama: Addicott Holotype
Addicott, 1976, p. 101, pl. 1, fig. 6
Clallam Co., Wash.; Clallam Bay, seacliffs eastward from Slip Point for 1/2 mile. SU loc. NP 89
Lower Miocene, Clallam Fm, Pillarian stage

8059 **nakamurai, Katelysia (Nipponomarcia):** Ikebe Paratypes
Ikebe, 1941, p. 50
Shiga Prefecture, Japan; Sendani, Yamanouchi-mura, Koga-gun
Middle Miocene, Ayugawa group

5914 **nana, Cuspidaria:** Oldroyd Holotype
Oldroyd, 1918b, p. 28. Illustrated in Oldroyd, 1925, p. 99, pl. 13, figs. 8, 9
Monterey, Calif.

9909 **nana, Myoconcha:** Smith Plastoholotype
Smith, 1927, p. 111, pl. 94, figs. 10, 11
Shasta Co., Calif.; old quarry SW end Brock Mt. between Squaw Creek and Pit River
Upper Triassic, Hosselkus Ls [holotype USNM 74141]

118 **nanaimensis, Pholadomya:** Reagan Holotype
Reagan, 1924, p. 185, pl. 20, fig. 7
Vancouver Island, British Columbia, Canada; near Nanaimo
Upper Cretaceous

5203 **nelsoni, Nucula (Acila):** Clark Holotype
Clark, 1925, p. 74, pl. 8, fig. 1
Wash.; 3/4 mile W of Gettysburg in shaly ss sea cliffs at mouth of Duncan Creek SU loc. NP 90
Oligocene, Blakeley Fm

431 **nevadanus, Pecten** Conrad: Grant and Gale Neotype
Conrad, 1856, p. 329, pl. 8, fig. 7. Neotype designated by Grant and Gale, 1931, p. 189, pl. 7, figs. 2a-2c, as type of *Vertipecten* Grant and Gale. [Specimen is *Pecten bowersi* Arnold, not *Pecten nevadanus* Conrad]
McKittrick district? Santa Monica Mts. ?
Middle Miocene

65 **newcombei, Mulinia:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 153, pl. 16, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene? Sooke Fm

66 **newcombei, Mulinia:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 153, pl. 15, fig. 2
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene? Sooke Fm

87 **newcombei, Mulinia:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 153, pl. 15, fig. 3
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene? Sooke Fm

88 **newcombei, Mulinia:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 153, pl. 15, figs. 4a, 4b
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene? Sooke Fm

72 **newcombei, Pododesmus:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 141, pl. 21, fig. 4
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, sea cliffs at mouth of Fossil Creek SU loc. NP 130
Oligocene? Sooke Fm

73 **newcombei, Pododesmus:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 141, pl. 21, fig. 6
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, sea cliffs at mouth of Fossil Creek SU loc. NP 130
Oligocene? Sooke Fm

92 **newcombei, Pododesmus:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 141, pl. 21, fig. 3
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, sea cliffs at mouth of Fossil Creek SU loc. NP 130
Oligocene? Sooke Fm

8054 **nicoyana, Tellina (Scissula):** Hertlein and Strong Paratype
Hertlein and Strong, 1949a, p. 85
Gulf of Nicoya, Costa Rica; off Ballenas Bay, 35 fms

6049 **nipponica, Lasaea:** Keen Holotype
Keen, 1938, pp. 26-27, figs. 1a, 1b
NE Matsusima, Japan; Watanoha, Rikuzen

6051 **nipponica, Lasaea:** Keen Paratype
Keen, 1938, pp. 26-27
NE Matsusima, Japan; Watanoha, Rikuzen

5950 **nodosus, Vermetus:** Oldroyd Holotype
Oldroyd, T. S., 1921a, p. 116, pl. 5, fig. 10
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm [=a burrow lining of a Holocene teredid pelecypod, *teste* Keen, 1976]

6570 **nuculiformis, Crassinella:** Berry Holotype
Berry, 1940b, p. 149, pl. 17, fig. 1
San Pedro, Calif.; W side of Gaffey Street cut
Pleistocene

6570a **nuculiformis, Crassinella:** Berry Paratype
Berry, 1940b, p. 149
San Pedro, Calif.; W side of Gaffey Street cut
Pleistocene

6 **nutteri, Pecten (Chlamys):** Arnold Holotype
Arnold, 1906, p. 67, pl. 11, fig. 3
San Mateo Co., Calif.; S of mouth of San Gregorio Creek
Pliocene, Purisima Fm

5220 **oakvillensis, Lima (Radula):** Clark Holotype
Clark, 1925, p. 84, pl. 15, fig. 1
Wash.; 1 mile W of Oakville, in lower tuffaceous conglomerate beds immediately overlying basalt at quarry on N.P. R.R. SU loc. NP 109
Oligocene, Lincoln Fm

5346 **obliqua, Protarca:** Stephenson Plastoholotype
Stephenson, 1923, p. 104, pl. 19, fig. 3
Greene Co., N.C.; Snow Hill
Cretaceous, Black Creek Fm, Snow Hill Mbr

6533 **okawensis, Nuculopsis (Palaeonucula?):** Schenck Paratype
Schenck, 1939, p. 23
Illinois; 1.4 miles NE of Ruma
Mississippian, lower Okaw Ls

6508 **oldroydi, Corbicula:** Clark Paratype
Clark, 1938, p. 698
Napa Qd, Calif.; Brink Ranch, 2 miles S of Putah Creek
Upper Eocene, Markley Fm

5913 **oldroydii, Atrina:** Dall Holotype
Dall, 1901a, p. 143. Illustrated in Dall, 1921, pl. 2, figs. 4-6
Los Angeles Co., Calif.; San Pedro Bay, 25 fms

121 **oldroydii, Avicula:** Reagan Holotype
Reagan, 1924, p. 186, pl. 20, fig. 1
Vancouver Island, British Columbia, Canada; near Nanaimo SU loc. 117
Upper Cretaceous

7978 **olssoni, Megapitaria:** Marks Paratype
Marks, 1951, p. 79
SW Ecuador; NE of Progreso
Middle Miocene, Progreso Fm

5251 **olympiana, Yoldia:** Clark Holotype
Clark, 1925, p. 77, pl. 9. fig. 9
Twin, Wash.; sea cliffs W of Twin River SU loc. NP 120
Oligocene, Blakeley Fm

7773 **onestae, Integricardium (Onestia):** McLearn Plastoholotype
McLearn, 1933b, p. 152, pl. 2, fig. 10
Alberta, Canada; E bank Athabasca River, 3 miles below Brule rapids
Cretaceous, Clearwater Fm [holotype at Natl. Mus. Canada]

5991 **ooides, Tellina:** Gabb Plastoholotype or Plastosyntype
Gabb, 1864, p. 157, pl. 22, fig. 135a
Butte Co.. Calif.; Pence's Ranch
Cretaceous [holotype UCMP 31437]

6590 **operculiformis, Pecten:** Gabb Plastoholotype
Gabb, 1864, p. 201, pl. 26, fig. 188. Cited as lectotype by Stewart, 1930, p. 120
Shasta Co., Calif.; possibly from Huling Creek
Cretaceous [holotype UCMP 31446]

6052 **oregonensis, Crassinella:** Keen Holotype
Keen, 1938, p. 31, pl. 2, figs. 11, 12
Coos Bay, Ore.; South Slough at highway bridge, 1-2 fms

9888 **oregonensis, Halobia:** Smith Plastoholotype
Smith, 1927, p. 117, pl. 95, fig. 1
Baker Co., Ore.; Martins Bridge
Upper Triassic, upper Karnic, Eagle River Fm [holotype USNM]

25 **oregonensis, Pecten:** Howe Holotype
Howe, 1922, p. 98, pl. 11, fig. 1
Coos Bay, Ore.; SU loc. NP 44
Pliocene, Empire Fm

201 **oregonensis, Pecten:** Howe Paratype
Howe, 1922, p. 98, pl. 12, fig. 2
Coos Bay, Ore.; SU loc. NP 44
Pliocene, Empire Fm

191 **oregonensis, Pecten:** Howe Paratype
Howe, 1922, p. 98, pl. 11, fig. 2
Grays Harbor Co., Wash.; N of mouth of Raft River, Taholah SU loc. NP 82
Pliocene, Quillayute Fm

8009 **oregonensis, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 25, pl. 9, figs. 7-9
Douglas Co., Ore.; Roseburg Qd, Little River bluffs at jct. with North Umpqua River near Glide
Lower Eocene, Umpqua Fm

9890 **ornatissima, Halobia:** Smith Plastoholotype
Smith, 1927, p. 117, pl. 94, fig. 4
Shasta Co., Calif.; W side Brock Mt. between Squaw Creek and Pit River
Upper Triassic, Hosselkus Ls, upper horizon, *Juvavites* subzone of *Tropites subbullatus* zone

5468 **ovalis, Posidonia:** Kittl Plastoholotype
Kittl, 1912, p. 29, pl. 1, fig. 15
Pelponnes or Dalmatia; Kurkuli
Middle Jurassic, *Humphresianum* zone [holotype in Naturh. Staatsmus. Wien]

9913 **overbecki, Pleurophorus:** Smith Plastoholotype
Smith, 1927, p. 111, pl. 101, fig. 15
Alaska; S bank of Yukon River opposite Nation River
Upper Triassic [holotype USNM 74203]

6937 **pacifica, Malletia:** Dall Paratype
Dall, 1897a, p. 11
Off Pt. Conception, Calif.; 278 fms, USBF Sta. 3198

513 **pacifica, Mesodesma:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 79. Illustrated *in* Clark, 1922, p. 118, pl. 13, fig. 5 (as *Myadesma*)
Alameda Co., Calif.; Pleasanton Qd, Alameda Creek, 1.5 miles S of Welch Creek, 1/5 mile S of Calaveras fault
Miocene, Monterey Fm

7293 **packardi, Tellina:** Dickerson Plastoholotype
Dickerson, 1914, p. 137, pl. 11, fig. 11
Lake Co., Calif.; Lower Lake UCMP loc. 784
Eocene, Martinez Fm [holotype UCMP 11739]

6944 **panamensis, Protocardia:** Dall Paratype
Dall, 1908b, p. 415
Panama Bay, 182 fms

150 **parsonsi, Miltha:** Waring Holotype
Waring, 1917, p. 78, pl. 12, fig. 13
Ventura Co., Calif.; Martinez area in the Simi Hills
Lower Eocene, Martinez Fm

8335 **peabodyi, Chione (Chione) californiensis:** Parker Plastoholotype
Parker, 1949, p. 581, pl. 90, fig. 1
Ventura Co., Calif.; N of Springville
Pleistocene [holotype UCMP]

7793 **pectunculoides, Peruarca:** Olsson Plastoholotype
Olsson, 1944, p. 33, pl. 3, figs. 6, 7
Paita region, Peru; near La Tortuga
Cretaceous, Maestrichtian, Radiolite Ss *Baculites* zone [holotype PRI No. 4817]

6518 **pembertoni, Inoceramus:** Waring Holotype
Waring, 1917, p. 61, pl. 7, figs. 7, 8
Los Angeles Co., Calif.; S of Santa Monica Mts.
Upper Cretaceous, Chico Fm

6939 **penderi, Leda:** Dall and Bartsch Paratype
Dall and Bartsch, 1910, p. 9
Vancouver Island, British Columbia, Canada; Barkley Sound

8060 **pentodon, Limopsis:** Aguayo and Borro Paratype
Aguayo and Borro, 1946b, p. 48
Matanzas, Cuba; Barranco E of Rio Canimar
Upper Miocene, Yumuri Fm

5820 **peraltum, Pisidium:** Sterki Paratypes
Sterki, 1900, p. 5
Benzie Co., Mich.; Crystal Lake

6945 **perambilis, Cardium (Fulvia):** Dall Paratype
Dall, 1881, p. 132
Off Barbados, 100 fms

42 **percarus, Pecten (Aequipecten):** Hertlein Holotype
Hertlein, 1925a, p. 13, pl. 2, figs. 2, 5
Baja California, Mexico; Scammon Lagoon Qd, mouth of large arroyo NW of Elephant Mesa SU loc. 48
Pliocene, Salada Fm

43
43a
43b **percarus, Pecten (Aequipecten):** Hertlein Paratypes
Hertlein, 1925a, p. 13
Baja California, Mexico; Scammon Lagoon Qd, mouth of large arroyo NW of Elephant Mesa SU loc. 48
Pliocene, Salada Fm

199 **percarus, Pecten (Aequipecten):** Hertlein Paratype
Hertlein, 1925a, p. 13
Baja California, Mexico; Turtle Bay CAS loc. 930
Pliocene, Salada Fm

8582 **percrassa, Nucula:** Conrad Plastoholotype
Conrad, 1858, p. 327, pl. 35, fig. 4
Mississippi; Owl Creek, 3 miles N of Ripley
Upper Cretaceous, Ripley Fm [types at ANSP No. 16710]

5163 **perdisparis, Arca:** Wiedey Paratype
Wiedey, 1928, p. 131, pl. 14, fig. 1. Also *in* Reinhart, 1943, p. 72, pl. 10, fig. 8
Monterey Co., Calif.; 3/4 mile SW of Zayante Station, Santa Cruz Mts. SU loc. 443
Middle Miocene, Monterey Fm [Wiedey's specimen 433]

552 **perfecta, Caprinuloidea:** Palmer Paratypes
7571 Palmer, 1928a, p. 59
5529 Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

5098 **perforata, Radiolites:** Palmer Paratype
Palmer, 1928a, p. 81, pl. 16, fig. 11
Jalisco, Mexico; Huescalapa
Cretaceous, Turonian

7564 **perforata, Radiolites:** Palmer Paratype
Palmer, 1928a, p. 81, pl. 14, figs. 6, 7
Jalisco, Mexico; Huescalapa
Cretaceous, Turonian

7569 **perforata, Radiolites:** Palmer Paratypes
551 Palmer, 1928a, p. 81, pl. 16, fig. 9 (type 7569)
Jalisco, Mexico; Huescalapa
Cretaceous, Turonian

8732 **pernoides, Inoceramus:** Goldfuss Plastoholotype
Goldfuss, 1836, p. 109, pl. 109, fig. 3
Westphalia, Germany
Cretaceous [cast of Goldfuss specimen 665 BM(NH)]

303 **perrini, Lima:** Waring Holotype
Waring, 1914, p. 782. Illustrated *in* Waring, 1917, p. 76, pl. 10, figs. 1, 2
Ventura Co., Calif.; Simi Hills, Martinez area, Calabasas sheet
Lower Eocene, Martinez Fm

502 **perrini, Ostrea titan:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 80. Illustrated in Wiedey, 1929b, pl. 3, fig. 1
Alameda Co., Calif.; Pleasanton Qd
Middle Miocene, Briones Fm

13 **perrini, Pecten (Lyropecten):** Arnold Holotype
Arnold, 1906, p. 80, pl. 14, figs. 1, 1a; pl. 15, fig. 1
San Luis Obispo Co., Calif.; [Cayucos Qd] between Morro and Toro Creeks
Miocene, Vaqueros Fm

423 **perrini, Spondylus:** Wiedey Paratype
Wiedey, 1928, p. 138
Ventura Co., Calif.; Calabasas sheet, Wiley Canyon [Piru Qd]
Miocene, Vaqueros Fm

7292 **perrini, Tellina:** Dickerson Plastoholotype
Dickerson, 1914, p. 137, pl. 11, fig. 8
Lake Co., Calif.; Lower Lake UCMP loc. 784
Eocene, Martinez Fm [holotype UCMP 11716]

8697 **perrinsmithi, Trigonia:** Anderson Holotype
Anderson, 1958, p. 110, pl. 2, fig. 7
Shasta Co., Calif.; Horsetown
Upper Cretaceous, Horsetown Fm

5485 **peruanus, Pecten:** Tilmann Plastoholotype
Tilmann, 1917, pp. 673-674, pl. 24, fig. 5
Peru; Chilingote, El Tingo, Utcubamba-Tal
Lower Jurassic, Arietenzone, *Psiloceras beds* [holotype probably at der Sammlung des Geologisch-paläontologischen Instituts der Universität Bonn]

6138 **phenax, Musculus:** Dall Paratype
Dall, 1915a, p. 138. Illustrated *in* Schenck, 1945, p. 519, pl. 67, figs. 27-30
Bering Sea; Pribiloff Islands, St. George

9515 **phoebe, Pegmapex:** Berry Holotype
Berry, 1960, p. 115. Illustrated *in* Keen, 1971, p. 131, fig. 300
Sinaloa, Mexico; Las Gaviotas Beach, Mazatlán

521 **piedraensis, Platyodon:** Wiedey Holotype
Wiedey, 1929c, p. 289, pl. 33, fig. 2
San Luis Obispo Co., Calif.; head of Canyon de Piedra, ca. 5 miles E of San Luis Obispo SU loc. 441
Lower Miocene, Vaqueros Fm

9904 **pittensis, Pecten (Entolium):** Smith Plastoholotype
Smith, 1927, p. 121, pl. 7, fig. 5
Shasta Co., Calif.; Brock Mt
Upper Triassic, Hosselkus Ls [holotype USNM 73947]

5202 **pittsburgensis, Spisula:** Clark Holotype
Clark, 1925, p. 101, pl. 17, figs. 2, 4
Ore.; bluffs along Nehalem River near old Pittsburg mill below Vernonia
Oligocene, Pittsburg Bluff Fm [specimen published as LSJU No. 53]

5239 **pittsburgensis, Tellina:** Clark Holotype
Clark, 1925, p. 95, pl. 12, fig. 8
Ore.; ss bluffs along Nehalem River near old Pittsburg mill below Vernonia SU loc. NP 5
Oligocene, Pittsburg Bluff Fm

977 **planiuscula, Macoma:** Grant and Gale Holotype
Grant and Gale, 1931, p. 372, pl. 14, figs. 11a, 11b; pl. 20, figs. 8a, 8b
Bering Sea, off Alaska; Nunivak Island

8066 **planiuscula, Macoma:** Grant and Gale Paratype
Grant and Gale, 1931, p. 372
Bering Sea, off Alaska; Nunivak Island

8287 **pomeyroli, Granocardium (Ethmocardium):** Keen Holotype
Keen, 1954, p. 314, pl. 29, fig. 4
New Caledonia, area of Momea tribe
Upper Cretaceous

8288 **pomeyroli, Granocardium (Ethmocardium):** Keen Paratype
Keen, 1954, p. 314, pl. 29, fig. 3
New Caledonia; area of Momea tribe
Upper Cretaceous

8289 **pomeyroli, Granocardium (Ethmocardium):** Keen Paratype
Keen, 1954, p. 314, pl. 29, fig. 2
New Caledonia; area of Momea tribe
Upper Cretaceous

8290 **pomeyroli, Granocardium (Ethmocardium):** Keen Paratype
Keen, 1954, p. 314, text figs. 1, 2
New Caledonia; area of Momea tribe
Upper Cretaceous

8291 **pomeyroli, Granocardium (Ethmocardium):** Keen Paratypes
8292 Keen, 1954, p. 314
8293 New Caledonia; area of Momea tribe
8294 Upper Cretaceous

10336 **popenoei, Cymbophora:** Saul Paratypes
Saul, 1974, p. 1087
Santa Ana Mts., Calif.; Corona sheet, SW slope of ridge between Aliso and Santiago Creek, 1650′ N 38° E of Pankratz Ranch house, 4800′ S 18° W of dam 1/4 mile above mouth of Harding Canyon CIT loc. 974
Cretaceous, late Campanian, Williams Fm, Pleasants Ss Mbr

5222 **porterensis, Modiolus:** Clark Holotype
Clark, 1925, p. 85, pl. 9, fig. 11
Wash.; marly tuffs at old log dam on Porter Creek, 1.5 miles above Porter SU loc. NP 51
Oligocene, Lincoln Fm

7808 **portusregii, Pecten (Plagioctenium) gibbus:** Grau Paratype
Grau, 1952a, p. 17. Grau, 1952b, p. 69 (new name for *P.g. carolinensis*, preoccupied)
Off South Carolina; 2 miles off Port Royal, 80′

8298 **praeblandum, Clinocardium:** Keen Plastoholotype
Keen, 1954, p. 321, pl. 29, fig. 6
Contra Costa Co., Calif.; W end of Las Trampas Ridge
Upper Miocene, Briones Fm [holotype UCMP 14836]

7262 **praecuta, Tellina:** Clark Plastoholotype
Clark, 1918, p. 153, pl. 12, fig. 13
Contra Costa Co., Calif.; Sobrante Ridge UCMP loc. 14
Oligocene, San Ramon Fm [holotype UCMP 11166]

38 **pretiosus, Pecten (Lyropecten):** Hertlein Holotype
Hertlein, 1925a, p. 12, pl. 3, fig. 4
Baja California, Mexico; *Turritella* bed above San Gregorio Lagoon, on the trail from Arroyo Mesquital to La Purisima SU loc. 59
Miocene, Isidro Fm

89 **pretiosus, Pecten (Lyropecten):** Hertlein Paratype
Hertlein, 1925a, p. 12, pl. 2, fig. 6
Baja California, Mexico; La Purisima cliffs on San Ramon River SU loc. 57
Miocene, Isidro Fm

6960 **princeps, Acila (Truncacila):** Schenck Holotype
Schenck, 1943, p. 63, pl. 8, figs. 4, 6, 7, 8
Merced Co., Calif.; Sec. 12, T 12 S, R 10 E SU loc. 2372
Upper Cretaceous, Moreno Fm

6961 **princeps, Acila (Truncacila):** Schenck Paratype
Schenck, 1943, p. 63, pl. 8, fig. 2
Merced Co., Calif.; Sec. 12, T 12 S, R 10 E SU loc. 2372
Upper Cretaceous, Moreno Fm

6962 **princeps, Acila (Truncacila):** Schenck Paratype
Schenck, 1943, p. 63, pl. 8, figs. 1, 3
Merced Co., Calif.; Sec. 12, T 12 S, R 10 E SU loc. 2372
Upper Cretaceous, Moreno Fm

6963 **princeps, Acila (Truncacila):** Schenck Paratype
Schenck, 1943, p. 63
Merced Co., Calif.; Sec. 12, T 12 S, R 10 E SU loc. 2372
Upper Cretaceous, Moreno Fm

8301 **pristinum, Clinocardium:** Keen Plastoholotype
Keen, 1954, p. 322, pl. 29, fig. 15
Contra Costa Co., Calif.; Concord Qd, Shell Ridge
Upper Miocene, Neroly Fm? [holotype UCMP]

420 **procumbens, Arca:** Wiedey Holotype
Wiedey, 1928, p. 132, pl. 13, fig. 11. Also *in* Reinhart, 1943, p. 54, pl. 5, fig. 2 (as *Anadara*)
Lincoln Co., Ore.; 5 miles N of Yaquina Head SU loc. 444
Miocene

7972 **progresoensis, Pecten (Aequipecten):** Marks Paratypes
Marks, 1951, p. 60
SW Ecuador; about 6 miles NE of Progreso
Middle Miocene, Progreso Fm

8086 **prosperi, Glibertia:** Van der Meulen Paratype
Van der Meulen, 1951, pp. 49, 53
The Netherlands; beach sand near Rittham, Zeeland Province
Pliocene, reworked [cited as paratype II]

7379 **pseudoillota, Barbatia (Fugleria):** Reinhart Plastoholotype
Reinhart, 1937b, p. 184, pl. 28, figs. 6, 9, 10
Santa Barbara Co., Calif.; Fugler Point
Pliocene [holotype CIT 1383 = now LACMNH 4075]

6235 **pugetensis, Lyonsia:** Dall Paratype
Dall, 1913, p. 595
Wash.; coast N of Queets River

5114 **pugetensis, Nucula (Acila):** Clark Holotype
Clark, 1925, p. 75, pl. 8, fig. 4
Bainbridge Island, Wash.; Bean Point SU loc. NP 205
Oligocene, Blakeley Fm [Clark's specimen No. 5]

6312 **pugetensis, Pecten islandicus:** Oldroyd Holotype
Oldroyd, I. S., 1920, p. 136, pl. 4, figs. 5, 6. Also *in* Oldroyd, I. S., 1925, p. 55, pl. 12, figs. 4, 5
Puget Sound, Wash.; off San Juan Island

6231 **puntarenensis, Mytilus (Hormomya):** Pilsbry and Lowe Paratypes
Pilsbry and Lowe, 1932a, p. 104, Illustrated *in* Keen, 1971, p. 61, fig. 121, lower left (as *Brachidontes*)
Puntarenas, Costa Rica

3 **purisimaensis, Pecten (Patinopecten):** Arnold Holotype
Arnold, 1906, p. 105, pl. 34, fig. 3
San Mateo Co., Calif.; N of mouth of Pescadero Creek
Pliocene, Purisima Fm

9747 **pygmaeus, Musculus:** Glynn Holotype
Glynn, 1964, pp. 121-128, pl. 23, figs. 1a, 1b
Pacific Grove, Calif.; near Hopkins Marine Station

9748 **pygmaeus, Musculus:** Glynn Paratype
Glynn, 1964, pp. 121-128
Pacific Grove, Calif.; near Hopkins Marine Station

8050 **quadrata, Palaeocardita:** Trechmann Paratypes
Trechmann, 1918, p. 212
New Zealand; Nugget Point, Otago
Triassic, Carnic

6924 **redondoensis, Aligena:** Burch Paratypes
Burch, T., 1941, p. 50
Los Angeles Co., Calif.; off Redondo Beach, 75 fms

7872 **redondoensis, Cardita:** Burch Paratype
Burch, J. Q., 1945, p. 32
Los Angeles Co., Calif.; off Redondo Beach, 100 fms, mud bottom

7871 **redondoensis, Nuculana penderi:** Burch Paratypes
Burch, J. Q., 1945, p. 10
Los Angeles Co., Calif.; off Redondo Beach, 25 fms, gravel bottom

49 **refugioensis, Pecten (Pecten):** Hertlein Holotype
Hertlein, 1925a, p. 7, pl. 1, fig. 2
Baja California, Mexico; Rancho Refugio, N of San Jose del Cabo SU loc. 50
Upper Miocene or lower Pliocene

50 **refugioensis, Pecten (Pecten):** Hertlein Paratype
Hertlein, 1925a, p. 7, pl. 5, fig. 9
Baja California, Mexico; Rancho Refugio, N of San Jose del Cabo SU loc. 50
Upper Miocene or lower Pliocene

93 **refugioensis, Pecten (Pecten):** Hertlein Paratype
Hertlein, 1925a, p. 7
Baja California, Mexico; Arroyo Fortuna, N of San Jose del Cabo SU loc. 44
Upper Miocene or lower Pliocene

10328 **regina, Calva:** Popenoe Plastosyntype
Popenoe, 1937, p. 395, pl. 48, figs. 6, 13
Santa Ana Mts., Calif.; CIT loc. 1164
Cretaceous, Turonian, Ladd Fm, Baker Mbr [syntype UCLA 40660]

10329 **regina, Calva:** Popenoe Plastosyntype
Popenoe, 1937, p. 395, pl. 48, figs. 7, 14
Santa Ana Mts., Calif.; CIT loc. 1164
Cretaceous, Turonian, Ladd Fm, Baker Mbr [syntype UCLA 40661]

7306 **remondii, Tellina:** Gabb Plastoholotype
Gabb, 1864, p. 156, pl. 22, fig. 132
Contra Costa Co., Calif.; Cochran's, E of Mt. Diablo UCMP loc. 138
"Cretaceous." [Eocene, Meganos Fm] [holotype UCMP 314511]

6232 **rhypis, Pandora (Kennerlia):** Pilsbry and Lowe Paratypes
Pilsbry and Lowe, 1932a, p. 105
Gulf of Fonseca, El Salvador; La Union

5143 **richthofeni, Chione:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 619, pl. 17, figs. 7, 8
Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

5144 **richthofeni, Chione:** Hertlein and Jordan Paratype
Hertlein and Jordan, 1927, p. 619, pl. 17, fig. 4
Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

33 **riversi, Pecten (Propeamusium):** Arnold Holotype
Arnold, 1906, p. 126, pl. 44, fig. 8
Los Angeles Co., Calif.; Santa Monica Canyon
"Pliocene"

34 **riversi, Pecten (Propeamusium):** Arnold Paratype
Arnold, 1906, p. 126, pl. 44, fig. 9
Los Angeles Co., Calif.; Santa Monica Canyon
"Pliocene"

5483 **robusta, Posidonia wengensis:** Kittl Plastoholotype
Kittl, 1912, p. 18, pl. 1, fig. 12
Austria; Pederoa, Abteital
Middle Triassic, Wengener Schichten [holotype in Naturh. Staatsmus. Wien]

557 **robusta, Radiolites:** Palmer Paratypes
7563 Palmer, 1928a, p. 80
7563a Jalisco, Mexico; Huescalapa
Cretaceous, Turonian

8506 **rogersi, Lithophaga (Labis) attenuata:** Berry Holotype
Berry, 1957, p. 76. Illustrated *in* Keen, 1971, p. 68, fig. 140
Sonora, Mexico; Cholla Cove, Bahia de Adair

457 **rogersi, Sphaerium:** Hannibal Holotype
Hannibal, 1912b, p. 131, pl. 7, fig. 21. Also *in* Taylor and Smith, 1971, figs. 9, 11, 13, 15
Tesla Qd, Calif.; 1/4 mile above Carnegie Pottery, Corral Hollow
Eocene

7856 **rostae, Barbatia (Acar):** Berry Holotype
Berry, 1954a, p. 67. Illustrated *in* Keen, 1971, p. 40, fig. 72
Sinaloa, Mexico; Mazatlán

8740 **rostratus, Inoceramus:** Goldfuss Plastoholotype
Goldfuss, 1836, p. 110, pl. 115, fig. 3
Westphalia, Germany
Cretaceous [Goldfuss holotype 667 BM(NH)]

7562
7562a **rotunda, Immanitas:** Palmer Paratypes
Palmer, 1928a, p. 32
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

6250 **rugosa, Nucula:** Odhner Paratypes
Odhner, 1919, p. 23
Tamatave, Madagascar

7853 **sacculifer, Volsella:** Berry Holotype
Berry, 1953b, p. 407, pl. 28, figs. 1, 2
San Pedro Harbor, California

7968 **saibana, Nuculana (Saccella):** Marks Paratype
Marks, 1951, p. 48
SW Ecuador; Zacachún corehole, 890-900′ depth
Miocene, Subibaja Fm

410 **salazari, Monopleura:** Palmer Paratype
Palmer, 1928a, p. 45, pl. 7, figs. 2, 3
Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

9930 **sanctaeanae, Daonella:** Smith Plastoholotype
Smith, 1914, p. 145, pl. 50, fig. 12, as *sanctae-anae*
Orange Co., Calif.; Santa Ana Mts., Silverado Canyon
Middle Triassic [holotype USNM 74365]

5377 **sanctaecrucis, Periploma:** Arnold Holotype
Arnold, 1908a, p. 382, pl. 35, fig. 8. Also *in* Arnold, 1909, Illus. 2, fig. 53
Santa Clara Co., Calif.; 2.5 miles SSW of Mayfield, E side Madera Creek
Upper Miocene [Arnold's specimen No. 1074]

223 **sanjuanensis, Pecten (Pseudamusium) vancouverensis:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 140, pl. 16, fig. 5
Vancouver Island, British Columbia, Canada; Port San Juan, sea cliffs 1/4 mile E of Providence Cove SU loc. NP 133
Oligocene? Sooke Fm

224 **sanjuanensis, Pecten (Pseudamusium) vancouverensis:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 140, pl. 16, fig. 6
Vancouver Island, British Columbia, Canada; Port San Juan, sea cliffs 1/4 mile E of Providence Cove SU loc. NP 133
Oligocene? Sooke Fm

7367 **santaclarana, Arca (Anadara):** Loel and Corey Paratype
Ventura Co., Calif.; ridge W of mouth of Wiley Canyon UCMP loc. A-252
Lower Miocene, Vaqueros Fm

360 **santaecruzensis, Pecten (Pecten):** Arnold Holotype
Arnold, 1906, p. 54, pl. 3, fig. 13
Santa Cruz Co., Calif.; Twobar Creek
Oligocene, San Lorenzo Fm

361 **santaecruzensis, Pecten (Pecten):** Arnold Paratype
Arnold, 1906, p. 54, pl. 3, fig. 12
Santa Cruz Co., Calif.; Bear Creek
Oligocene, San Lorenzo Fm

7377 **santamariensis, Arca (Arca):** Reinhart Plastoholotype
Reinhart, 1937b, p. 183, pl. 28, figs. 4, 5, 7, 8, 11
Santa Barbara Co., Calif.; Fugler Point
Pliocene [holotype CIT 1381, now LACMNH 4072]

6571 **scarificata, Tivela:** Berry Holotype
Berry, 1940b, p. 151, pl. 17, fig. 5
San Pedro, Calif.; NW corner of Beacon and Second Streets
Pleistocene

6571a **scarificata, Tivela:** Berry Paratypes
Berry, 1940b, p. 151
San Pedro, Calif.; NW corner of Beacon and Second Streets
Pleistocene

5165 **schencki, Cardium:** Wiedey Paratype
Wiedey, 1928, p. 143, pl. 17, fig. 4
Los Angeles Co., Calif.; Santa Monica Mts., Dry Canyon, 2 miles S of Calabasas SU loc. 425
Middle Miocene, Temblor Fm [Wiedeys' No. 431]

616 **schencki, Chione:** Loel and Corey Holotype
Loel and Corey, 1932, p. 224, pl. 42, fig. 5
San Luis Obispo Co., Calif.; Corral del Piedra Creek
Lower Miocene, Vaqueros Fm

7880 **schencki, Glycymeris:** Nicol Holotype
Nicol, 1947, p. 349, pl. 50, figs. 5, 6
Panama Canal Zone; 9° 18′ N, 79° 55′ + 200′ W SU loc. 2654
Miocene, Gatun Fm

7881 **schencki, Glycymeris:** Nicol Paratype
Nicol, 1947, p. 349
Panama Canal Zone; 9° 16′ + 4700′ N, 79° 54′ + 5800′ W SU loc. 2653
Miocene, Gatun Fm

7882 **schencki, Glycymeris:** Nicol Paratype
Nicol, 1947, p. 349
Colon Province, Republic of Panama; 9° 21′ + 5000′ N, 79° 50′ + 1000′ W SU loc. 2656
Miocene, Gatun Fm

7883 **schencki, Glycymeris:** Nicol Paratype
Nicol, 1947, p. 349, pl. 50, fig. 3
Panama Canal Zone; 9° 18′ N, 79° 55′ + 200′ W SU loc. 2654
Miocene, Gatun Fm

7884 **schencki, Glycymeris:** Nicol Paratypes
7885 Nicol, 1947, p. 349
7887 Panama Canal Zone; 9° 18′ N, 79° 55′ + 200′ W SU loc. 2654
Miocene, Gatun Fm

7886 **schencki, Glycymeris:** Nicol Paratype
Nicol, 1947, p. 349, pl. 50, figs. 2, 4
Panama Canal Zone; 9° 18′ N, 79° 55′ + 200′ W SU loc. 2654
Miocene, Gatun Fm

7888 **schencki, Glycymeris:** Nicol Paratype
Nicol, 1947, p. 349, pl. 50, fig. 1
Panama Canal Zone; 9° 18′ N, 79° 55′ + 200′ W SU loc. 2654
Miocene, Gatun Fm

789 **schencki, Thracia:** Clark ex Tegland Ms Paratype
Clark, 1932, p. 808. Illustrated *in* Tegland, 1933, p. 112, pl. 6, fig. 8
Puget Sound, Wash.; beach between S side of entrance to Blakeley Harbor and Restoration Point, Bainbridge Island SU loc. NP 103
Upper Oligocene, Blakeley Fm

790 **schencki, Thracia:** Clark ex Tegland Ms Paratype
Clark, 1932, p. 808. Illustrated *in* Tegland, 1933, pp. 112-113, pl. 6, fig. 9
Puget Sound, Wash.; beach between S side entrance to Blakeley Harbor and Restoration Point, Bainbridge Island SU loc. NP 103
Upper Oligocene, Blakeley Fm

8003 **schencki, Venericardia (Leuroactis):** Verastegui Holotype
Verastegui, 1953, p. 50, pl. 4, figs. 6-8
Ventura Co., Calif.; Camulos Qd, Simi Hills, 2 miles NE of Simi Peak
Lower Eocene, Santa Susana Shale

7279 **scrippsensis, Donax:** Hanna Plastoholotype
Hanna, 1927, p. 293, pl. 40, figs. 1, 12
San Diego Co., Calif.; Scripps Institution UCMP loc. 5089
Eocene, La Jolla Fm [holotype UCMP 30992]

7955 **secticostata, Glycymeris:** Nicol Plastoholotype
Nicol, 1945, p. 623, pl. 85, fig. 3
Costa Rica; E Grape Point Creek
Miocene, Gatun Fm

7284 **semiplicata, Chione:** Nomland Plastoholotype
Nomland, 1917b, p. 305, pl. 15, figs. 2a, 2b
Fresno Co., Calif.; near Coalinga UCMP loc. 2283
Miocene, Santa Margarita Fm [holotype UCMP 11318]

7559 **septata, Caprinuloidea:** Palmer Paratype
Palmer, 1928a, p. 62, pl. 11, fig. 1
Jalisco, Mexico; Soyatlan de Adentro
Cretaceous, Cenomanian

9895 **septentrionalis, Halobia:** Smith Plastoholotype
Smith, 1927, p. 118, pl. 98, fig. 1
Alaska; Keku Islet No. 1, Admiralty Island, Herring Bay USGS loc. 10196
Upper Triassic, lower Noric or upper Karnic [holotype USNM]

215 **sespeensis, Pecten (Chlamys):** Arnold Plastoholotype
Arnold, 1906, p. 69. pl. 8, fig. 3
Ventura Co., Calif.; Sespe Canyon
Miocene [holotype USNM]

7314 **sheridani, Macoma:** Vokes Plastoholotype
Vokes, 1939, p. 92, pl. 14, fig. 21
San Benito Co., Calif.; Vallecitos UCMP loc. A-1154
Eocene, Domengine [holotype UCMP 15703]

8001 **simiana, Venericardia (Venericor):** Verastegui Holotype
Verastegui, 1953, p. 47, pl. 4, figs. 2-4
Ventura Co., Calif.; Calabasas Qd, 1/2 mile NE of Hill 2150, Simi Hills
Paleocene

8002 **simiana, Venericardia (Venericor):** Verastegui Paratype
Verastegui, 1953, p. 47, pl. 4, fig. 1
Ventura Co., Calif.; Calabasas Qd, 1/2 mile NE of Hill 2150, Simi Hills
Paleocene

9518 **singularis, Orobitella (Isorobitella):** Keen Holotype
Keen, 1962, p. 323, figs. 4a-4c, 5a, 5b
Baja California del Norte, Mexico; Bahia de San Quintin, on mud flats

7378 **sisquocensis, Arca (Arca):** Reinhart Plastoholotype
Reinhart, 1937b, p. 182, pl. 28, figs. 1-3
Santa Barbara Co., Calif.; Fugler Point
Pliocene [holotype CIT 1382 now LACMNH 4073]

9829 **sloati, Siliqua:** Hertlein Paratype
Hertlein, 1961, p. 14
Point Bonita, Calif.

508 **smithii, Panopea:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 79. Illustrated *in* Wiedey, 1929b, pl. 2, fig. 1
Alameda Co., Calif.; Tesla Qd, cut opposite R.R. crossing, Corral Hollow. Arnold loc. C-141
Upper Eocene, "Tejon" Fm

8071 **smithii, Panopea:** Hall and Ambrose Paratype
Hall and Ambrose, 1916, p. 79
Alameda Co., Calif.; Tesla Qd, cut opposite RR crossing, Corral Hollow
Upper Eocene, "Tejon" Fm

5205 **snohomishensis, Panope:** Clark Holotype
Clark, 1925, p. 105, pl. 10, fig. 1
Opposite Snohomish, Wash.; ss on Fiddlers Bluffs, along Snohomish River SU loc. NP 146
Oligocene, Lincoln Fm

5206 **snohomishensis, Panope:** Clark Paratype
Clark, 1925, p. 105, pl. 11, fig. 2
Opposite Snohomish, Wash.; ss on Fiddlers Bluffs, along Snohomish River SU loc. NP 146
Oligocene, Lincoln Fm

7281 **soledadensis, Tellina:** Hanna Plastosyntype
Hanna, 1927, p. 291, pl. 42, fig. 2
San Diego Co., Calif.; Tecolote Creek UCMP loc. 5091
Eocene, La Jolla Fm [syntype UCMP 31369]

64 **sookensis, Cardium:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 145, pl. 22, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

212 **sookensis, Cardium:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 145, pl. 22, fig. 2
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

70 **sookensis, Macoma:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 151, pl. 25, fig. 3
Vancouver Island, British Columbia, Canada; Sooke, ss and cgl on sea cliffs between mouths of Muir and Kirby Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

235 **sookensis, Modiolus:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 143, pl. 26, fig. 2
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouth of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

236 **sookensis, Modiolus:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 143, pl. 26, fig. 4
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

290 **sookensis, Ostrea:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 138, pl. 17, fig. 2
Vancouver Island, British Columbia, Canada; Jordan River, sea cliffs at mouth of Fossil Creek, 2 miles W of Sherringham Point SU loc. NP 130
Oligocene, Sooke Fm

9907 **soperi, Avicula:** Smith Plastoholotype
Smith, 1927, p. 112, pl. 96, fig. 9
Shasta Co., Calif.; N fork Squaw Creek, 3 miles N of Kellys Ranch
Upper Triassic, Hosselkus Ls [holotype USNM 74166]

8065 **spectri, Macoma (Psammacoma) panamensis:** Hertlein and Strong Paratype
Hertlein and Strong, 1949a, p. 91
Gulf of California, Mexico; Arena Bank, 45 fms

7974 **stainforthi, Anodontia:** Marks Paratype
Marks, 1951, p. 69
SW Ecuador; S of Progreso
Middle Miocene, upper Progresso Fm

12 **stanfordensis, Pecten (Propeamusium):** Arnold Holotype
Arnold, 1906, p. 91, pl. 23, fig. 4
Santa Clara Co., Calif.; Burke Ranch, 3 miles S of Stanford University
Miocene, Vaqueros Fm

8454 **stanfordia, Tivela:** Hall Holotype
Hall, 1958, p. 53, pl. 6, figs. 3-5
Alameda Co., Calif.; La Costa Valley Qd, NE 1/4 Sec. 11, T 5 S, R 1 E SU loc. 3244
Upper Miocene, Briones Fm

8453 **stanfordia, Tivela:** Hall Paratype
Hall, 1958, p. 53, pl. 6, figs. 1, 2
Alameda Co., Calif.; La Costa Valley Qd, NE 1/4 Sec. 11, T 5 S, R 1 E
Upper Miocene, Briones Fm

8455 **stanfordia, Tivela:** Hall Paratype
Hall, 1958, p. 53, pl. 6, figs. 6, 7
Alameda Co., Calif.; La Costa Valley Qd, NE 1/4 Sec. 11, T 5 S, R 1 E
Upper Miocene, Briones Fm

5178 **stantoni, Macrocallista:** Waring Holotype
Waring, 1917, p. 77, pl. 14, fig. 6
Ventura Co., Calif.; Martinez area, Simi Hills SU loc. 2695
Lower Eocene, Martinez Fm

5179 **stantoni, Macrocallista:** Waring Paratype
Waring, 1917, p. 77
Ventura Co., Calif.; Martinez area, Simi Hills SU loc. 2695
Lower Eocene, Martinez Fm

5180 **stantoni, Macrocallista:** Waring Paratype
Waring, 1917, p. 77, pl. 14, fig. 1
Ventura Co., Calif.; Martinez area, Simi Hills SU loc. 2695
Lower Eocene, Martinez Fm

5316 **strongi, Arca (Barbatia):** Loel and Corey Syntype
Loel and Corey, 1932, p. 183
Orange Co., Calif.; San Joaquin Hills, 2.5 miles N of Laguna Beach UCMP loc. A-527
Lower Miocene, Vaqueros Fm

51 **Subdolus, Pecten (Plagioctenium):** Hertlein Holotype
Hertlein, 1925a, p. 20, pl. 5, figs. 4, 7
San Diego Co., Calif.; Pacific Beach SU loc. 115
Pliocene, San Diego Fm

52 **subdolus, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 20, pl. 5, fig. 2
San Diego Co., Calif.; Pacific Beach SU loc. 115
Pliocene, San Diego Fm

198 **subdolus, Pecten (Plagioctenium):** Hertlein Paratype
Hertlein, 1925a, p. 20
Off Baja California, Mexico; Cedros Island SU loc. 116
Pliocene

7969 **subibajana, Nuculana (Saccella):** Marks Paratypes
Marks, 1951, p. 50
SW Ecuador; Zacachún corehole, 500-510′ depth
Miocene, Subibaja Fm

61 **subimpressa, Leda:** Howe Holotype
Howe, 1922, p. 97, pl. 10, fig. 3
Coos Bay, Ore. SU loc. NP 36
Pliocene, Empire Fm

6053 **subviridis, Lasaea rubra:** Dall ex Carpenter Ms Neotype
Dall, 1899b, p. 881. Neotype selected by Keen, 1938, p. 29, pl. 2, figs. 1-3
Baja California, Mexico; San Martin Island

9265 **subyneziana, Pecten (Vertipecten) yneziana:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 198, pl. 31, fig. 3
Santa Barbara Co., Calif.; Camino Cielo, UCMP loc. B-6940
Eocene, "Coldwater" Ss

9266 **subyneziana, Pecten (Vertipecten) yneziana:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 198, pl. 31, fig. 5
Santa Barbara Co., Calif.; Camino Cielo UCMP loc. B-6940
Eocene, "Coldwater" Ss

9267 **subyneziana, Pecten (Vertipecten) yneziana:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 198, pl. 31, fig. 7
Santa Barbara Co., Calif.; Camino Cielo UCMP loc. B-6940
Eocene, "Coldwater" Ss

9268 **subyneziana, Pecten (Vertipecten) yneziana:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 198, pl. 31, fig. 2
Santa Barbara Co., Calif.; Lompoc Qd, Nojoqui Creek UCMP loc. B-6963
Eocene, Sacate-Gaviota Fm

120 **suciensis, Thracia:** Reagan Syntype
Reagan, 1924, p. 183, pl. 20, fig. 3
Puget Sound, Wash.; Sucia Islands
Upper Cretaceous, upper Chico Fm

120a **suciensis, Thracia:** Reagan Snytype
Reagan, 1924, p. 183, pl. 20, fig. 4
Puget Sound, Wash.; Sucia Islands
Upper Cretaceous, upper Chico Fm

120b **suciensis, Thracia:** Reagan Syntype
Reagan, 1924, p. 183, pl. 20, fig. 5
Puget Sound, Wash.; Sucia Islands
Upper Cretaceous, upper Chico Fm

143 **superioris, Cardita:** Waring Holotype
Waring, 1917, p. 91
Ventura Co., Calif.; McCray Wells SU loc. 8
Eocene, Tejon Fm [= *Schedocardia brewerii* (Gabb), *teste* Keen, 1949]

5362 **supramontereyensis, Yoldia:** Arnold Holotype
Arnold, 1908a, p. 382, pl. 35, fig. 9. Also *in* Arnold, 1909, Illus. 2, fig. 56
Santa Clara Co., Calif.; 2.5 miles S of Mayfield, "Tusk Gully" near road
Upper Miocene [Arnold's No. 1067]

8004 **susanaensis, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 22, pl. 5, figs. 1-4
Ventura Co., Calif.; Camulos Qd, McCray Wells, Oil Canyon
Lower Eocene, Santa Susana Shale

5132 **swartsi, Glycimeris** [sic.]: Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 620, pl. 17, fig. 2
Baja California, Mexico; Scammon Lagoon Qd, W side of Elephant Mesa SU loc. 60
Miocene, Isidro Fm

9899 **symmetrica, Halobia:** Smith Plastoholotype
Smith, 1927, p. 119, pl. 98, fig. 7
Alaska; Keku Islet No. 1, Admiralty Island, Herring Bay
Upper Triassic [holotype USNM 74182]

8336 **taberi, Chione (Chione) undatella:** Parker Plastoholotype
Parker, 1949, p. 582, pl. 90, figs. 2, 4, 9
Gulf of California; loc. 2897 [holotype UCMP]

7996 **taliaferroi, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 38, pl. 1, fig. 15
San Luis Obispo Co., Calif.; Adelaida Qd. NW 1/4 NE 1/4 Sec. 30, T 25 S, R 10 E, S of Williams Ranch on the Nacimiento River
Paleocene, Dip Creek Fm

7997 **taliaferroi, Venericardia (Pacificor):** Verastegui Paratype
Verastegui, 1953, p. 38, pl. 1, fig. 16
San Luis Obispo Co., Calif.; Adelaida Qd. NW 1/4 NE 1/4 Sec. 30, T 25 S, R 10 E, S of Williams Ranch on the Nacimiento River
Paleocene, Dip Creek Fm

7918 **tayloriana, Ostrea:** Gabb Plastoholotype
Gabb, 1866, p. 34, pl. 12, figs. 60, 60a
San Marcos Pass, near Santa Barbara, Calif.
"Miocene" [holotype UCMP 12005]

5999 **tehamaensis, Arca:** Stanton Plastoholotype
Stanton, 1895, p. 18, pl. 6, fig. 8. Also *in* Reinhart, 1937, p. 174 [as *Parallelodon? (Gilbertwhitea?) tehamaensis* (Stanton)]
Tehama Co., Calif.; 5 miles N of Paskenta, Shelton's Ranch
Cretaceous? upper Knoxville Fm [holotype USNM 23044]

189 **tejonensis, Isocardia:** Waring Holotype
Waring, 1914, p. 784. Illustrated *in* Waring, 1917, p. 93, pl. 15, fig. 14
Ventura Co., Calif.; Camulos Qd, 1.5 miles E of McCray Wells SU loc. 2696
Upper Eocene, Tejon Fm [Llajas Fm, *fide* Keen and Bentson, 1944, p. 54]

5188 **tejonensis, Isocardia:** Waring Paratypes
5189 Waring, 1914, p. 784
5190 Ventura Co., Calif.; Camulos Qd. 1.5 miles E of McCray Wells SU loc. 2696
Upper Eocene, Tejon Fm [Llajas Fm, *fide* Keen and Bentson, 1944, p. 54]

5484 **teltschenensis, Daonella:** Kittl Plastoholotype
Kittl, 1912, p. 33, pl. 1, fig. 18
Austria; Feuerkogel (Teltschen) Aussia
Upper Triassic, Karnic [holotype at Naturh. Staatsmus. Wien]

6001 **textrina, Arca:** Stanton Plastosyntype
Stanton, 1895, p. 14, pl. 6, fig. 7. Also *in* Reinhart, 1937a, p. 175 [as *Nemodon? textrina* (Stanton)]
Tehama Co., Calif.; Cottonwood Creek, Cold Fork, near Stephenson's
Cretaceous, "upper Knoxville Fm" [syntype USNM 23045]

6002 **textrina, Arca:** Stanton Plastosyntype
Stanton, 1895, p. 14, pl. 6, fig. 6. Also *in* Reinhart, 1937a, p. 175
Tehama Co., Calif.; Cottonwood Creek, Cold Fork, near Stephenson's
Cretaceous, "upper Knoxville Fm" [syntype USNM 23045]

7973 **thalmanni, Cavilucina (Pegophysema):** Marks Paratype
Marks, 1951, p. 68
SW Ecuador; N of Pajan, Daule Basin
Middle Miocene, Daule Fm

7975 **thompsoni, Pitar (Lamelliconcha):** Marks Holotype
Marks, 1951, p. 74, pl. 4, fig. 7
Republic of Panama; 6 miles E of Colon, on Roosevelt-Boyd Transisthmian Highway SU loc. 2611
Miocene, lower Gatun Fm

7976 **thompsoni, Pitar (Lamelliconcha):** Marks Paratype
Marks, 1951, p. 74, pl. 4, fig. 6
Republic of Panama; 6 miles E of Colon, on Roosevelt-Boyd Transisthmian Highway SU loc. 2611
Miocene, lower Gatun Fm

7977 **thompsoni, Pitar (Lamelliconcha):** Marks Paratype
Marks, 1951, p. 74
Republic of Panama; 6 miles E of Colon, on Roosevelt-Boyd Transisthmian Highway SU loc. 2611
Miocene, lower Gatun Fm

23 **tolmani, Pecten:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 82. Illustrated *in* Wiedey, 1929b, p. 23, pl. 1, fig. 2
Alameda Co., Calif.; Pleasanton Qd, Sunol, mouth of Welch Creek
Middle Miocene? Briones Fm?

5341 **topangaensis, Anadara (Anadara):** Reinhart Paratypes
5342 Reinhart, 1943, p. 53
Los Angeles Co., Calif.; Santa Monica Mts., Sec. 36, T 1 N, R 15 W
Miocene, Topanga Fm

5099 **totiseptata, Sabinia:** Palmer Paratype
Palmer, 1928a, p. 73
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

5134 **toulai, Sanguinolaria:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 625, pl. 20, fig. 2
Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

5209 **townsendensis, Sanguinolaria (Nuttalina):** Clark Holotype
Clark, 1925, p. 97, pl. 18, fig. 7
Townsend Bay, Wash.; ss sea cliffs between Classens Wharf and ship canal estuary SU loc. NP 125
Oligocene, Lincoln Fm

5200 **townsendensis, Solen (Plectosolen):** Clark Holotype
Clark, 1925, p. 97, pl. 22, fig. 10
Skamokawa, Wash.; ss bluffs along Skamokawa River above big bend, 1 mile E of jct. of main and middle forks SU loc. NP 272
Oligocene, Lincoln Fm

5201 **townsendensis, Solen (Plectosolen):** Clark Paratype
Clark, 1925, p. 97, pl. 22, fig. 7
Skamokawa, Wash.; ss bluffs along Skamokawa River above big bend, 1 mile E of jct. of main and middle forks SU loc. NP 272
Oligocene, Lincoln Fm

5208 **townsendensis, Tellina:** Clark Holotype
Clark, 1925, p. 94, pl. 12, fig. 12
Oregon; Grays River, in tuffaceous ss in R.R. cut on logging road up Fossil Creek, 3 miles above jct. with Grays River SU loc. NP 278
Oligocene, Lincoln Fm

5207 **townsendensis, Tellina:** Clark Paratype
Clark, 1925, p. 94, pl. 12, fig. 11
Townsend Bay, Wash.; from sea cliffs between Classens Wharf and ship canal estuary SU loc. NP 125
Oligocene, Lincoln Fm

454 **transpacifica, Unio:** Hannibal Holotype
Hannibal, 1912b, p. 123, pl. 7, fig. 18a. Also *in* Taylor and Smith, 1971, figs. 3, 4 (as *Plesielliptio*)
Wash.; Olequa Creek, at shoals, 1.5 miles above Little Falls
Eocene [late Eocene, Cowlitz Fm, *fide* Taylor and Smith, 1971, p. 309]

453 **transpacifica, Unio:** Hannibal Paratype
Hannibal, 1912b, p. 123, pl. 7, fig. 18b. Also *in* Taylor and Smith, 1971, figs. 7, 10 (as *Plesielliptio*)
Wash.; Olequa Creek, at shoals, 1.5 miles above Little Falls
Eocene [late Eocene, Cowlitz Fm, *fide* Taylor and Smith, 1971, p. 309]

5805 **tremperi, Corneocyclas:** Hannibal Holotype
Hannibal, 1912b, p. 137, pl. 7, fig. 22. Also *in* Taylor and Herrington, 1962, pl. 28, figs. 1, 2 (as *Pisidium*)
San Bernardino Mts., Calif.; Bluff Lake Cienaga

5815a **tremperi, Corneocyclas:** Hannibal Paratype
Hannibal, 1912b, p. 137
San Bernardino Mts., Calif.; Bluff Lake Cienaga

397 **triangulatus, Crassatellites:** Waring Holotype
Waring, 1917, p. 59, pl. 9, fig. 1
Los Angeles Co., Calif.; Calabasas sheet, S of Santa Monica Mts.
Cretaceous, Chico Fm

7307 **truncata, Tapes:** Gabb Plastoholotype
Gabb, 1866, p. 25, pl. 7, fig. 44
San Benito Co., Calif.; Griswold's "Monterey"
Miocene, Temblor Fm [holotype UCMP 12335]

430 **turneri, Pecten (Patinopecten):** Arnold Holotype
Arnold, 1906, p. 106, pl. 35, fig. 2
Marin Co., Calif.; near Tomales Bay in Arroyo San Antonio
Pliocene

430a **turneri, Pecten (Patinopecten):** Arnold Paratype
Arnold, 1906, p. 106, pl. 35, fig. 3
Marin Co., Calif.; near Tomales Bay in Arroyo San Antonio
Pliocene

363 **turneri, Pecten (Patinopecten):** Arnold Paratype
Arnold, 1906, p. 106, pl. 34, fig. 4
Marin Co., Calif.; near Tomales Bay in Arroyo San Antonio
Pliocene

5236 **twinensis, Kellia ?:** Clark Holotype
Clark, 1925, p. 90, pl. 18, fig. 8
Twin, Wash.; sea cliffs W of West Twin River for a distance of 3/4 mile SU loc. NP 120
Oligocene, Blakeley Fm

5235 **twinensis, Macoma:** Clark Holotype
Clark, 1925, p. 96, pl. 12, fig. 7
Townsend Bay, Wash.; Port Hadlock, Help-Me-Jack Rock SU loc. NP 127
Oligocene

5243 **twinensis, Spisula:** Clark Holotype
Clark, 1925, p. 103, pl. 16, fig. 6
Twin, Wash.; sea cliffs W of West Twin River for a distance of 3/4 mile SU loc. NP 120
Oligocene, Blakeley Fm

5446 **umnaka, Cardita:** Willett Paratype
Willett, 1932, p. 87
Umnak Island, Alaska

7298 **umpquaensis, Gari hornii:** Turner Plastoholotype
Turner, 1938, p. 62, pl. 7, fig. 11
Douglas Co., Ore.; Little River UCMP loc. A-662
Eocene, Umpqua Fm [holotype UCMP 33149]

831 **undulata, Pleuromya (?):** Davis Holotype
Davis, 1913, p. 454, text fig. 4
Monterey Co., Calif.; Slates Hot Springs
"Jurassic," "Franciscan" Fm

8585 **ursipes, Spondylus:** Berry Holotype
Berry, 1959, p. 107. Illustrated *in* Keen, 1971, p. 98, fig. 213
Baja California, Mexico; Isla Angel de la Guarda, Puerto Refugio

517 **valentinei, Chione:** Wiedey Holotype
Wiedey, 1929c, p. 284, pl. 31, fig. 4
Santa Clara Co., Calif.; 2 miles S of Mayfield SU loc. 448
Miocene, Temblor Fm?

6003 **vancouverensis, Arca:** Meek Plastoholotype
Meek, 1864a, p. 40. Illustrated *in* Meek, 1876, p. 356, pl. 3, figs. 5, 5a. Also *in* Reinhart, 1937a, p. 171, pl. 27, fig. 4 [as *Parallelodon (Nanonavis) vancouverensis* (Meek)]
Vancouver Island, British Columbia, Canada; Comox
Cretaceous [holotype USNM 12398]

246 **vancouverensis, Chione:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 147, pl. 20, figs. 2a, 2b
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

63 **vancouverensis, Glycimeris** [sic.]: Clark and Arnold Holotype
Clark and Arnold, 1923, p. 137, pl. 27, figs. 2a, 2b
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

211 **vancouverensis, Glycimeris** [sic.]: Clark and Arnold Paratype
Clark and Arnold, 1923, p. 137, pl. 27, fig. 5
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

262 **vancouverensis, Metis:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 150, pl. 22, fig. 3
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

289 **vancouverensis, Semele:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 151, pl. 27, fig. 4
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

264 **vancouverensis, Tellina:** Clark and Arnold Plastoholotype
Clark and Arnold, 1923, p. 149
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouth of Muir and Coal Creeks, W of Otter Point SU loc. NP 129 (= CAS loc. 231)
Oligocene, Sooke Fm [holotype CAS 599]

263 **vancouverensis, Tellina:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 149, pl. 22, fig. 5
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

5226 **vanwinkleae, Pecten:** Clark Holotype
Clark, 1925, p. 82, pl. 15, fig. 2
Wash.; ss bluffs along Porter Creek, 3/4 mile above Porter SU loc. NP 54
Lower Oligocene, Lincoln Fm

5405 **vaquerosensis, Cardium (Trachycardium):** Arnold Paratype
Arnold, 1908a, p. 378
San Mateo Co.. Calif.; Mindego Creek, 1 mile above Alpine Creek
Lower Miocene, Vaqueros Fm

520 **vaquerosensis, Tivela (?):** Wiedey Holotype
Wiedey, 1929c, p. 288, pl. 33, fig. 1
Monterey Co., Calif.; Los Vaqueros Valley, type section of Vaqueros Fm SU loc. 200
Lower Miocene, Vaqueros Fm

9 **vaughani, Pecten (Lyropecten):** Arnold Holotype
Arnold, 1906, p. 81, pl. 23, figs. 3, 3a, 3b
Ventura Co., Calif.; Ojai Valley
Lower Miocene

5215 **veneriformis, Spisula:** Clark Holotype
Clark, 1925, p. 103, pl. 16, fig. 3
Oregon coast W of Coos Bay; sea cliffs at Tunnel Point SU loc. NP 42
Oligocene, Lincoln Fm

5216 **veneriformis, Spisula:** Clark Paratype
Clark, 1925, p. 103, pl. 16, fig. 1
Wash.; bluffs along Porter Creek, 1/4 to 1 mile above old log dam at Porter SU loc. NP 56
Oligocene, Lincoln Fm

5217 **veneriformis, Spisula:** Clark Paratype
Clark, 1925, p. 103, pl. 16, fig. 2
Porter, Wash.; ss cut on Lytle logging R.R. near top of ridge 1 mile above switch SU loc. NP 55
Oligocene, Lincoln Fm

8333 **venturaensis, Pecten (Chlamys):** Waterfall Plastoholotype
Waterfall, 1929, p. 84, pl. 6, fig. 4
Ventura Co., Calif.; E center Sec. 21, T 3 N, R 21 W
Pliocene, Pico Fm [holotype UCMP 31416]

159 **venturensis, Venericardia planicosta:** Waring Holotype
Waring, 1915, map folio fig. 12. Also *in* Waring, 1917, p. 80, pl. 11, figs. 6, 7
Ventura Co., Calif.; Calabasas sheet, 3 miles NE of Simi Peak SU loc. 2697
Lower Eocene, Martinez Fm

6942 **vernicosa, Astarte:** Dall Paratype
Dall, 1903a, p. 948
Icy Cape, Alaska; 15 fms

8601 **vespertina, Ostrea:** Conrad Plastolectotype
Conrad, 1854, p. 300. Lectotype selected by Woodring, 1938, p. 43, pl. 8, figs. 3, 8
Calif.; "near San Diego" [probably Carrizo Creek *fide* Woodring, 1938]
"Miocene" [probably Pliocene] [lectotype ANSP 13366]

518 **vickeryi, Chione:** Wiedey Holotype
Wiedey, 1929c, p. 286, pl. 32, fig. 4
Santa Clara Co., Calif.; E of San Jose, Alum Rock Canyon, 500 yds upstream from the falls. SU loc. 451
Middle Miocene, upper Monterey Fm

26 **vickeryi, Pecten (Lyropecten):** Trask Holotype
Trask, 1922, p. 148, pl. 4, fig. 1
Alameda Co., Calif.; Pleasanton Qd, vicinity of McGuire Peaks
Miocene, Briones Fm

5581 **vigilia, Acila (Acila) divaricata:** Schenck Plastoholotype
Schenck, 1936, p. 101, pl. 17, figs. 1-6
Japan; off S coast of Yesso [Hokkaido], 175 fms *Albatross* Sta. 5038 [holotype USNM 406502]

164 **virginalis, Opis:** Waring Holotype
Waring, 1917. p. 78, pl. 14, fig. 4
Venture Co., Calif.; Martinez area, Simi Hills
Lower Eocene, Martinez Fm

7561 **vivari, Sabinia:** Palmer Paratype
Palmer, 1928a, p. 74, pl. 14, fig. 4
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

7565 **vivari, Sabinia:** Palmer Paratype
Palmer, 1928a, p. 74, pl. 13, fig. 4
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

5094 **vivari, Sabinia:** Palmer Paratypes
5095 Palmer, 1928a, p. 74
Colima, Mexico; Paso del Rio
Cretaceous, Cenomanian

1 **vogdesi, Pecten (Pecten):** Arnold Holotype
Arnold, 1906, p. 100, pl. 33, fig. 1
Los Angeles Co., Calif.; San Pedro
Pleistocene, San Pedro Fm

8016 **vokesi, Venericardia (Leuroactis):** Verastegui Paratype
Verastegui, 1953, p. 61, pl. 14, fig. 3
Kings Co., Calif.; Cholame Qd, Reef Ridge sheet, SW cor. Sec. 17, T 23 S, R 17 E, 1/2 mile E of Big Tar Canyon
Eocene, Avenal Fm

7280 **vorbei, Tellina:** Hanna Plastoholotype
Hanna, 1927, p. 292, pl. 40, fig. 16
San Diego Co., Calif.; Soledad Canyon UCMP loc. 5074
Eocene, La Jolla Fm [holotype UCMP 30984]

816 **wairarapaensis, Glycimeris** [sic.] **(Grandaxinea):** Powell
Powell, 1938, p. 158 Paratype
New Zealand; Castle Point, SE coast of North Island
Pliocene, Nukumaruan stage

5230 **washingtonensis, Mytilus:** Clark Holotype
Clark, 1925, p. 85, pl. 9, fig. 3
Freshwater Bay, Wash.; point E of old shingle warehouse SU loc. NP 155
Oligocene

5232 **washingtoniana, Corbis:** Clark Holotype
Clark, 1925, p. 90, pl. 20, figs. 2, 3
Port Townsend, Wash.; sandy shales in sea cliffs, S shore of Mystery Inlet, Scow Bay SU loc. NP 126
Oligocene, Keasey Fm

5233 **washingtoniana, Corbis:** Clark Paratype
Clark, 1925, p. 90, pl. 20, fig. 1
Port Townsend, Wash.; sea cliffs on S shore of Mystery Inlet, Scow Bay
Oligocene, Keasey Fm

5234 **washingtoniana, Corbis:** Clark Paratype
Clark, 1925, p. 90, pl. 20, fig. 4
Port Townsend, Wash.; sea cliffs on S shore of Mystery Inlet, Scow Bay
Oligocene, Keasey Fm

5340 **waylandi, Anadara:** Cox Paratype
Cox, 1927, p. 34
East Africa; Ras Tungwe, Pemba Island
Lower Miocene

8024 **weaveri, Venericardia (Pacificor):** Verastegui Holotype
Verastegui, 1953, p. 31, pl. 21, figs. 3, 4
Wash.; 1.25 miles NW of Vader on SE bank of Stillwater Creek
Upper Eocene, Cowlitz Fm

8460 **welchensis, Ventricolaria:** Hall Holotype
Hall, 1958, p. 54, pl. 7, figs. 3, 4
Contra Costa Co., Calif.; 1 mile NE of Hercules SU loc. 3255
Upper Miocene, Cierbo Fm

8461 **welchensis, Ventricolaria:** Hall Paratype
Hall, 1958, p. 54, pl. 7, fig. 5
Alameda Co., Calif.; La Costa Valley Qd. NE 1/4 Sec. 1, T 5 S, R 1 E SU loc. 3239
Upper Miocene, Briones Fm

7877 **whaleyi, Glycimeris** [sic.]: Nicol Paratype
Nicol, 1947, p. 347, pl. 50, fig. 7
Fresno Co., Calif.; near Arroyo Ciervo, Sec. 36, T 16 S, R 13 E, 2000′ N, 400′ W of SE corner of section, 800′ S of point where the first Temblor "reef" crosses Arroyo Ciervo
Miocene, Temblor Fm?

7878 **whaleyi, Glycimeris** [sic.]: Nicol Paratypes
7879 Nicol, 1947, p. 347
Fresno Co., Calif.; near Arroyo Ciervo, 2000′ N, 400′ W of SE cor. Sec. 36, T 16 S, R 13 E
Miocene, Temblor Fm?

5280 **whiteavesi, Parallelodon (Nanonavis):** Reinhart Plastosyntypes
5280a Reinhart, 1937a, p. 172. Illustrated *in* Whiteaves, 1879, pl. 19, figs. 1, 1a (as *Nemodon vancouverensis* Meek)
Vancouver Island, British Columbia, Canada; Blunden Point
Cretaceous [syntypes Geol. Surv. Canada 5684, 5684a]

6234 **willetti, Astarte:** Dall Paratypes
Dall, 1903a, p. 948
Forrester Island, Alaska; 50 fms

9517 **williamsi, Mactra (Mactra):** Berry Holotype
Berry, 1960, p. 116. Illustrated *in* Keen, 1971, p. 202, fig. 486
Off La Libertad, Ecuador; 10 fms

5228 **willipaensis, Trinacria:** Clark Holotype
Clark, 1925, p. 81, pl. 9, figs. 5, 10
N of Holcomb, Wash.; ss bluffs along Willipa River SU loc. NP 253
Oligocene, Keasey Fm

5252 **willipaensis, Trinacria:** Clark Paratype
Clark, 1925, p. 81, pl. 9, fig. 8
N of Holcomb, Wash.; ss bluffs along Willipa River SU loc. NP 253
Oligocene, Keasey Fm

7810 (T) **woodsi, Ethmocardium:** Marwick Plastoholotype
Marwick, 1944, p. 259, pl. 36, fig. 21
New Zealand; Selwyn Rapids, Canterbury
Upper Cretaceous, Piripauan stage, upper Senonian [holotype at N.Z. Geol. Surv.]

5204 **yaquinensis, Mulinia (?):** Clark Holotype
Clark, 1925, p. 105, pl. 17, fig. 1
Yaquina, Ore.; ss in sea cliffs along Yaquina Bay SU loc. NP 306
Oligocene

386 **youngi, Cucullaea:** Waring Holotype
Waring, 1917, p. 59, pl. 8, fig. 12
Ventura Co., Calif.; Calabasas sheet, Bell's Canyon, N of Simi fault
Upper Cretaceous, Chico Fm

386a **youngi, Cucullaea:** Waring Paratypes
386b Waring, 1917, p. 59
Ventura Co., Calif.; Calabasas sheet, Bell's Canyon, N of Simi fault
Upper Cretaceous, Chico Fm

9905 **yukonensis, Pecten (Entolium):** Smith Plastoholotype
Smith, 1927, p. 122, pl. 101, fig. 9
Alaska; S bank Yukon River opposite Nation River
Upper Triassic [holotype USNM 74199]

8053 **zacae, Tellina (Tellinella):** Hertlein and Strong Paratype
Hertlein and Strong, 1949a, p. 65
Gulf of California; Arena Bank, 35 fms

10302 **zeta, Flaventia:** Popenoe Plastoholotype
Popenoe, 1937, p. 393, pl. 48, fig. 9
Santa Ana Mts., Calif.; CIT loc. 1068
Cretaceous, Turonian [holotype UCLA 40654]

8084 **zeltbergensis, Inoceramus humboldti:** Heinz Plastoholotype
Heinz, 1928, p. 35, pl. 3, fig. 1
Hanover, Germany; Zeltberg bei Lüneberg
Upper Cretaceous, u. l. Emscher Fm [holotype at Geologisches Staatinstitut, Hamburg]

8057 **zeteki, Mytilopsis:** Hertlein and Hanna Paratypes
Hertlein and Hanna, 1949, p. 15
Panama Canal Zone; Miraflores Locks

CEPHALOPODA

8900 **acutus, Aspenites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 96, pl. 3, figs. 1, 2
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75249]

7620 **adicrus, Ammonites:** Waagen Plastoholotype
Waagen, 1867, p. 591, pl. 25, figs. 1a, 1b
Schwaben, Germany; Gingen, Vilsthale
Jurassic, Dogger [cast from Pal. Mus. Wien]

5429 **alexandrae, Gymnites:** Smith Paratype
Smith, 1914, p. 52, pl. 25, fig. 1
West Humboldt Range, Nevada; Fossil Hill, S American Canyon SU loc. 1780
Middle Triassic, Star Peak Fm

9028 **alexandrae, Gymnites:** Smith Plastoholotype
Smith, 1914, p. 53, pl. 26, figs. 1, 2
West Humboldt Range, Nevada; Fossil Hill, between Troy Canyon and S fork of American Canyon
Middle Triassic, Star Peak Fm [holotype USNM 74300]

8684 **allani, Gastroplites:** McLearn Plastoholotype
McLearn, 1931, p. 5, pl. 1, fig. 10
Alberta, Canada; Peace River, 20 miles below Cadotte River
Lower Cretaceous, Peace River Ss [holotype Geol. Surv. Canada 6337]

9006 **alternans, Acrochordiceras:** Smith Plastoholotype
Smith, 1914, p. 38, pl. 32, figs. 15-17
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74326]

6503 **alternecostatus, Perisphinctes:** Steiger Plastoholotype
Steiger, 1914, p. 483, pl. 104, figs. 1a, 1b
Himalaya Mts.
Upper Jurassic, upper Malm, Spiti Shale

9091 **altilis, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 83, pl. 67, figs. 19-21
West Humboldt Range, Nevada; Fossil Hill, S fork of American Canyon
Middle Triassic [holotype USNM 74394]

6471 **ambiensis, Paranorites:** Waagen Plastoholotype
Waagen, 1895, p. 158, pl. 22, fig. 1
Punjab, India; Salt Range, Amb (Stachella beds)
Triassic, Ceratite [holotype Palaeont. Inst. Wiener Univ. 4041]

6469 **ammonoides, Proptychites:** Waagen Plastosyntype
Waagen, 1895, p. 171, pl. 17, fig. 1
Punjab, India; Salt Range, W of Khoora
Triassic, Ceratite [syntype Palaeont. Inst. Wiener Univ. 4236]

5436 **andersoni, Arcestes:** Hyatt and Smith Holotype
Hyatt and Smith, 1905, p. 74, pl. 56, figs. 1-3
West Humboldt Range, Nevada; Muttleberry Canyon, 8 miles SE of Lovelock
Upper Triassic

5435 **andersoni, Arcestes:** Hyatt and Smith Paratype
Hyatt and Smith, 1905, p. 74, pl. 56, figs. 4-6
West Humboldt Range, Nevada; Muttleberry Canyon, 8 miles SE of Lovelock
Upper Triassic

5497 **andinus, Macrocephalites:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 33, pl. 3, figs. 10-12
Chile; Comisaria Lonquimay, Rio Colorado
Jurassic, lower Callovian

8685 **anguinus, Gastroplites:** McLearn Plastoholotype
McLearn, 1931, p. 5, pl. 1, fig. 11
Alberta, Canada; Peace River, 8 miles below Cadotte River
Lower Cretaceous, Peace River Ss [holotype Geol. Sur. Canada 6338]

8928 **angulatus, Cordillerites:** Hyatt and Smith Plastosyntypes
8929 Hyatt and Smith, 1905, p. 110, pl. 2, figs. 1-3 (type 8928), 4, 5 (type
8930 8929), 6 (type 8930); pl. 68, figs. 1-3 (type 8931a), 4-7 (type 8931)
8931 Aspen Ridge, Idaho; Wood Canyon, 9 miles NE of Soda Springs
8931a Lower Triassic, *Meekoceras* zone [syntypes USNM 75247, 75347, 75300]

8945 **apostolicus, Celtites:** Smith Plastoholotype
Smith, 1932, p. 104, pl. 48, figs. 1, 2
Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74989]

9083 **applanatus, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 80, pl. 53, figs. 9-11
West Humboldt Range, Nevada; Fossil Hill, S fork of American Canyon
Middle Triassic [holotype USNM 74372]

7597 **aquilaensis, Scaphites:** Reeside Plastoholotype
Reeside, 1927b, p. 25, pl. 19, figs. 1-5
Fergus Co., Montana; Willow Creek, 6 miles above Ft. Maginnis-Junction City road
Upper Cretaceous, Eagle Ss [holotype USNM 73348]

5494 **araucanus, Macrocephalites:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 30, pl. 3, figs. 1-3
Chile; Comisaria Lonquimay, Rio Colorado
Jurassic, lower Callovian

5488 **argentina, Witchellia:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 17, pl. 1, figs. 15-17
Argentina: Mendoza Province, Cerro Puchén
Jurassic, lower Dogger

8757 **arnoldi, Paralecanites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 136, pl. 64, figs. 1-4
Idaho; Aspen Ridge, Wood Canyon
Lower Triassic, *Meekoceras* zone [holotype USNM 75295]

8804 **arthaberi, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 56, pl. 32, figs. 26-28
Bear Lake Co., Idaho; NE end of Bear Lake, 1 mile NE of Hot Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74973]

8795 **aspenensis, Flemingites:** Smith Plastoholotype
Smith, 1932, p. 52, pl. 23, figs. 6-8
SE Idaho; 5 miles E of Grays Lake
Lower Triassic, *Meekoceras* zone [holotype USNM 74919]

8890 **attenuatus, Dalmatites:** Smith Plastoholotype
Smith, 1932, p. 81, pl. 57, figs. 11-13
Idaho; Paris Canyon, 1.5 miles W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75023]

8932 **austini, Prosphingites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 72, pl. 7, figs. 1-4
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75256]

618 **Baculites** sp., of **Baculites anceps** group: Nomland and Schenck "Holotype"
Nomland and Schenck, 1932, fig. 4
Monterey Co., Calif.; Slate's Hot Springs, on sea coast NE 1/4 Sec. 9, T 21 S, R 3 E SU loc. 929
Cretaceous

8796 **bannockensis, Flemingites:** Smith Plastoholotype
Smith, 1932, p. 52, pl. 23, figs. 18-20
SE Idaho; Aspen Mts., Slug Creek, 14 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74922]

7591 **bassleri, Desmoscaphites:** Reeside Plastoholotype
Reeside, 1927b, p. 16, pl. 21, fig. 17
San Juan Co., New Mexico; just W of Hogback Mt. and 1 mile N of Shiprock-Farmington Rd.
Upper Cretaceous, Mancos Shale (280′ below top) [holotype USNM 73358]

9105 **beecheri, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 94, pl. 43, figs. 15-17
West Humboldt Range, Nevada; Fossil Hill, S fork of American Canyon
Middle Triassic [holotype USNM 74349]

8918 **bicarinatus, Lanceolites:** Smith Plastoholotype
Smith, 1932, p. 90, pl. 55, figs. 1-3
Elko Co., Nevada; 70 miles S of Wells
Lower Triassic, *Meekoceras* zone [holotype USNM 75013]

8730 **bispinosum, Trachyceras (Trachyceras):** Johnston Paratype
Johnston, 1941, p. 487 (cited as No. 3)
New Pass Range, Nevada
Upper Triassic, Star Peak Fm

9035 **bittneri, Xenodiscus:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 123, pl. 20, figs. 5-7
Inyo Co., Calif.; Inyo Range, Union Wash
Middle Triassic [holotype USNM 74460]

9082 **bonaevistae, Dinarites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 162, pl. 60, figs. 1-4, as *bonae-vistae*
West Humboldt Range, Nevada; Buena Vista Canyon
Middle Triassic [holotype USNM 74383]

8866 **bonnevillense, Dagnoceras:** Smith Plastoholotype
Smith, 1932, p. 65, pl. 29, figs. 9-11
Idaho; Wood Canyon, 9 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74949]

7607 **brevis, Scaphites nodosus:** Meek Plastoholotype
Meek, 1876, p. 426, pl. 25, figs. 1a-1c
Montana; Yellowstone River near Miles City
Upper Cretaceous, Pierre Shale [holotype USNM 367]

9045 **breweri, Eutomoceras:** Smith Plastoholotype
Smith, 1914, p. 61, pl. 28, figs. 1-4
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74312]

8867 **bridgesi, Dagnoceras:** Smith Plastoholotype
Smith, 1932, p. 65, pl. 31, figs. 1-3
Idaho; Slug Creek, 14 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74956]

6497 **broilii, Perisphinctes (Virgatosphinctes):** Uhlig Plastoholotype
Uhlig, 1910, p. 336, pl. 91, fig. 1 (reversed)
Himalaya Mts., India; Shangra Laptel, Gnari-Khorsum
Upper Jurassic, Spiti Shale, Chidamu beds

9617 **californicum, Delepinoceras:** Gordon Paratypes
9617a Gordon, 1964, p. A19, pl. 2, figs. 10 (type 9167a), 15-17 (type 9167)
9617b Inyo Co., Calif.; Panamint Range, Cottonwood Mts., near Rest Spring
Upper Mississippian, Perdido Fm

9032 **calli, Gymnites:** Smith Plastoholotype
Smith, 1914, p. 53, pl. 26, fig. 1
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74306]

8688 **canadensis, Hoplites:** Whiteaves Plastoholotype
Whiteaves, 1893, p. 118, pl. 11, figs. 3-5
Alberta, Canada; Peace River, 20 miles below Cadotte River
Lower Cretaceous, Peace River Ss [holotype Geol. Surv. Canada 7430]

5610 **carbonarius, Bactrites:** Smith Holotype
Smith, 1903, p. 31, pl. 6, fig. 9
Independence Co., Arkansas; near Moorfield, on O. P. Goodwin farm
Carboniferous, Fayetteville Fm, St. Louis-Chester stage

5611 **carbonarius, Bactrites:** Smith Paratype
Smith, 1903, p. 31, pl. 6, figs. 10, 11
Independence Co., Arkansas; near Moorfield, on O. P. Goodwin farm
Carboniferous, Fayetteville Fm, St. Louis-Chester stage

8935 **carpenteri, Owenites:** Smith Plastoholotype
Smith, 1932, p. 100, pl. 54, figs. 31-32
Inyo Co., Calif.; Inyo Range, Union Wash, 15 miles SE of Independence
Lower Triassic, *Owenites* subzone [holotype USNM 75012]

6485 **cautleyi, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 279, pl. 78, fig. 1 (fig. inverted)
Tibet; Laptel, Gnari-Khorsum
Jurassic, upper Malm, Spiti Shale

8537 **chicoensis, Baculites:** Trask Neotype
Matsumoto, 1959a, p. 145, pl. 36, fig. 2, text fig. 60
Butte Co., Calif.; E bank of Chico Creek SU loc. 2609
Upper Cretaceous, Chico Fm

8933 **columbianus, Paranannites:** Smith Plastoholotype
Smith, 1932, p. 99, pl. 32, figs. 11-13
Idaho; Wood Canyon, 9 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74968]

8915 **compactus, Lanceolites:** Hyatt and Smith Plastosyntypes
8916 Hyatt and Smith, 1905, p. 113, pl. 5, figs. 7, 8 (type 8916); pl. 78,
8917 figs. 9-11 (type 8917)
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [syntypes USNM 75252, 75254, 75281]

8925 **compressa, Ussuria:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 89, pl. 3, figs. 6, 7
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75250]

6468 **compressus, Flemingites:** Waagen Plastoholotype
Waagen, 1895, p. 202, pl. 15, fig. 1; pl. 16, fig. 1
Punjab, India; Koofri, Salt Range [cast from Paleont. Inst. Wiener Univ.]
Triassic, Ceratite

8749 **compressus, Marshallites:** Matsumoto Plastoholotype
Matsumoto, 1955a, pp. 123-124, pl. VIII, figs. 1a, 1b
Hokkaido, Japan; Teshio Province, Abishinai Valley, loc. T608, bed IIb
Cretaceous, Paleogyliakian [cast from Dept. of Geology, Kyushu Univ., specimen GK-H-2751 = GT-I-3231]

8948 **consanguineus, Columbites:** Smith Plastoholotype
Smith, 1932, p. 106, pl. 46, figs. 1, 2
Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74983]

8761 **cordilleranus, Xenodiscus:** Smith Plastoholotype
Smith, 1932, p. 43, pl. 24, figs. 21-23
Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74926]

9115 **cornatus, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 98, pl. 62, figs. 1-4
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74387]

8856 **corrugata, Meekoceras mushbachanum:** Smith Plastoholotype
Smith, 1932, p. 61, pl. 38, fig. 1
Idaho; NE end of Bear Lake, 1 mile NE of Hot Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74980]

7598 **costatus, Scaphites aquilaensis:** Reeside Plastoholotype
Reeside, 1927b, p. 25, pl. 19, figs. 10-13
Park Co., Wyoming; Sec. 25, T 58 N, R 100 W
Upper Cretaceous, Telegraph Creek Fm, Elk Basin Ss mbr [holotype USNM 73351]

10015 **costula, Fontannesia:** Imlay Paratype
Imlay, 1973, p. 57, pl. 4, figs. 22-24
Grant Co., Ore.; SW 1/4, NE 1/4 Sec. 29, T 18 S, R 26 E, 600′ S of head of gully draining SSW from North Ammonite Hill
Middle Jurassic, Snowshoe Fm, near top of lower 1/3 of Weberg Mbr, Bajocian stage

10016 **costula, Fontannesia:** Imlay Paratype
Imlay, 1973, p. 57, pl. 4, figs. 18-20
Crook Co., Ore.; near Wade Butte, a little W of center of Sec. 24, T 18 S, R 24 E
Middle Jurassic, Bajocian stage Snowshoe Fm, Weberg mbr

9108 **crassicornu, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 95, pl. 43, figs. 11, 12
West Humboldt Range, Nevada; Fossil Hill, S fork of American Canyon
Middle Triassic [holotype USNM 74348]

6492 **crassicostatus, Ceratites (Hollandites) japonicus:** Shimizu Plastoholotype
Shimizu, 1930, p. 66, pl. 24, fig. 2
Oshika-gun, Japan; Inai, Inai-mura
Triassic

9067 **crassus, Lecanites:** Smith Plastoholotype
Smith, 1914, p. 66, pl. 89, figs. 1, 2
West Humboldt Range, Nevada; S fork American Canyon
Middle Triassic (holotype USNM 74424]

7594 **crassus, Scaphites hippocrepis:** Reeside Plastoholotype
Reeside, 1927b, p. 23, pl. 17, figs. 8-13
Sheridan Co., Wyoming; 2 miles W of Parkman, SW 1/4 Sec. 33, T 58 N, R 87 W
Upper Cretaceous, Steele Shale [holotype USNM 73336]

8805 **cristatum, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 56, pl. 34, figs. 1-3
Caribou Co., Idaho; 5 miles E of Grays Lake
Lower Triassic, *Meekoceras* zone [holotype USNM 74974]

8562 **cumshewaense, Haploceras:** Whiteaves Plastoholotype
Whiteaves, 1884, p. 208, pl. 24, fig. 1
Queen Charlotte Islands, Canada; N shore Cumshewa Inlet
Cretaceous, Haida Fm [holotype Geol. Surv. Canada 4973]

8808 **curticostatum, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 56, pl. 48, figs. 21-22.
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74990]

9048 **dalli, Eutomoceras (Halilucites):** Smith Plastoholotype
Smith, 1914, p. 65, pl. 29, figs. 1-4
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74314]

8488 **damesi, Desmoceras:** Jimbo Plastolectotype
Jimbo, 1894, p. 26, pl. 1, fig. 2. Specimen selected as lectotype of *Damesites* by Matsumoto, 1954a, p. 267
Hokkaido, Japan; Chiptaushibets, Tumbets River, Kitami Province, about 68 km from river mouth
Cretaceous [lectotype Kyushu Univ. GT-I-91]

6464 **damesii, Ammonites (Acrochordiceras):** Noetling Plastoholotype
Noetling, 1880, p. 334, pl. 15, figs. 1a-1c
Silesia, Germany; Gross-Hartmannsdorf (Schlesien)
Triassic, Wellenkalk [holotype in Geol.-Palaont. Mus., Berlin]

6476 **declivis, Kingites:** Waagen Plastoholotype
Waagen, 1895, p. 233, pl. 26, fig. 2
Punjab, India; Virgal, Salt Range
Triassic, Ceratite Marl [holotype at Paleont. Inst. Wiener Univ.]

10007 **delicatum, Asthenoceras:** Imlay Paratypes
10012 Imlay, 1973, pp. 55-56, pl. 3, figs. 12 (type 10012), 13 (type 10013),
10013 32 (type 10007)
Grant Co., Ore.; Delintment Lake 15′ Qd, NE 1/4, SW 1/4 SW 1/4 Sec. 29, T 18 S, R 26 E
Middle Jurassic, Bajocian stage, Snowshoe Fm, Warm Springs Mbr

10009 **delicatum, Asthenoceras:** Imlay Paratypes
10010 Imlay, 1973, pp. 55-56, pl. 3, figs. 15 (type 10010); pl. 4, figs. 4 (type
10011 10009), 3 (type 10011)
Grant Co., Ore.; SE cor. NE 1/4, NE 1/4 Sec. 19, T 18 S, R 26 E, from spur projecting into SE end of small valley ESE of Weberg Ranch house
Middle Jurassic, Bajocian stage, Snowshoe Fm, Weberg Mbr (near top)

10014 **delicatum, Asthenoceras:** Imlay Paratype
Imlay, 1973, pp. 55-56, pl. 3, fig. 14
Grant Co., Ore.; Delintment Lake 15′ Qd, NW 1/4, SE 1/4 NE 1/4 Sec. 30, T 18 S, R 26 E, from calcareous ss on W slope of hill 1000′ E of old Washburn place
Middle Jurassic, Bajocian stage, Snowshoe Fm, Warm Springs Mbr, basal bed

10008 **delicatum, Asthenoceras:** Imlay Paratype
Imlay, 1973, pp. 55-56, pl. 3, fig. 21
Grant Co., Ore.; Delintment Lake 15′ Qd, SE 1/4, NW 1/4 Sec. 29, T 18 S, R 26 E. Bulldozer cut on divide SW of jct between road to Boundary Spring and Suplee-Izee Road
Middle Jurassic, Bajocian, Snowshoe Fm, Warm Springs Mbr, near base

8490 **denseplicatum, Lytoceras:** Jimbo Plastoholotype
Jimbo, 1894, p. 36, pl. 7, fig. 1
Hokkaido, Japan; Bache Ekimomaanoro
Cretaceous [holotype Kyushu Univ. GT-I-118]

8871 **desertorum, Anasibirites:** Smith Plastoholotype
Smith, 1932, p. 71, pl. 51, figs. 7, 8
Inyo Co., Calif.; Union Wash, Inyo Range, 15 miles SE of Independence
Lower Triassic, *Meekoceras* zone [holotype USNM 74998]

9079 **desertorum, Dinarites:** Smith Plastoholotype
Smith, 1914, p. 69, pl. 89, figs. 3, 4
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74425]

8726 **desertorum, Metahedenstroemia?:** Johnston Paratype
Johnston, 1941, p. 460 (cited as no. 3)
New Pass Range, Nevada; South Canyon
Upper Triassic, Star Peak Fm

5413 **devasena, Ceratites:** Diener Plastoholotype
Diener, 1907, p. 55, pl. 4, fig. 4
Himalaya Mts.; NNW of Kaga, Spiti
Triassic, Muschelkalk [holotype Paleont. Inst. Wiener Univ. 4077]

9853 **dickinsoni, Leptaleoceras:** Imlay Holotype
Imlay, 1968, p. C 32, pl. 6, figs. 7, 9-11
Grant Co., Ore.; Izee Qd, in concretions on E slope Pole Canyon, NW 1/4, SW 1/4 Sec. 35, T 17 S, R 27 E about 75′ above andesite flow
Upper Lower Jurassic, Nicely Shale

9852 **dickinsoni, Leptaleoceras:** Imlay Paratype
Imlay, 1968, p. C 32, pl. 6, fig. 8
Grant Co., Ore.; Izee Qd, NW 1/4, SW 1/4 Sec. 35, T 17 S, R 27 E
Upper Lower Jurassic, Nicely Shale

8963 **dieneri, Nannites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 79, pl. 7, figs. 10-13
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75257]

8781 **dieneri, Ophiceras:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 118, pl. 8, figs. 16-18
SE Idaho; Aspen Mts., Wood Canyon
Lower Triassic, *Meekoceras* zone [holotype USNM 75260]

6475 **discus, Ambites:** Waagen Plastosyntype
Waagen, 1895, p. 152, pl. 21, fig. 5
Punjab, India; Salt Range, Amb
Triassic, Ceratite Marls [syntype at Palaeont. Inst. Wiener Univ.]

6500 **divergens, Aulacosphinctes:** Steiger Plastoholotype
Steiger, 1914, p. 464, pl. 101, figs. 3a-3c
Himalaya Mts.; Shangra, Gnari-Khorsum
Upper Jurassic, upper Malm, Spiti Shale

5872 **douvillei, Xenodiscus:** Diener Holotype
Diener, 1914, p. 918, pl. 1, fig. 1. Also *in* Tozer, 1969, p. 361, pl. 16, figs. a-d (as *Paratirolites*)
Madagascar
Lower Triassic

9050 **dunni, Eutomoceras:** Smith Plastoholotype
Smith, 1904, p. 381, pl. 43, fig. 11; pl. 44, fig. 4
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74310]

8811 **elkoense, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 56, pl. 55, figs. 14-16
Elko Co., Nevada; Ruby Range, Cottonwood Canyon, 70 miles S of Wells
Lower Triassic, *Meekoceras* zone [holotype USNM 75015]

9119 **emmonsi, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 98, pl. 60, figs. 13-15
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74382]

8838 **evansi, Meekoceras (Koninckites):** Smith Plastoholotype
Smith, 1932, p. 60, pl. 35, figs. 1-3
Idaho; E of Hot Springs, NE of Bear Lake
Lower Triassic, *Meekoceras zone* [holotype USNM 74975]

9017 **evansi, Ptychites:** Smith Plastoholotype
Smith, 1914, p. 47, pl. 21, fig. 3
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74295]

6478 **falcatum, Meekoceras:** Waagen Plastoholotype
Waagen, 1895, p. 242, pl. 36, fig. 4
Punjab, India; Salt Range, Amb
Triassic, Middle Ceratite [holotype Palaeont. Inst. Wiener Univ. 4024]

8743 **fascicostatum, Pachydiscus:** Yabe and Shimizu Plastoholotype
Yabe and Shimizu, 1921, p. 57, pl. 9, fig. 2
Hokkaido, Japan; Abeshinai Valley, Teshio Province
Cretaceous, Santonian, upper Urakawan [cast of holotype GT-I-386 from Kyushu Univ., specimen in Tokyo Univ.]

9041 **fittingensis, Hungarites:** Smith Plastoholotype
Smith, 1914, p. 58, pl. 90, figs. 5-7
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74431]

9008 **foltzense, Acrochordiceras:** Smith Plastoholotype
Smith, 1914, p. 39, pl. 32, figs. 13, 14
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74325]

6491 **frequens, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 295, pl. 87, fig. 1
Tibet; Shangra, E of Puling, Gnari-Khorsum
Jurassic, upper Malm, Spiti Shale

6479 **frequens, Gyronites:** Waagen Plastosyntype
Waagen, 1895, p. 292, pl. 37, fig. 1
Punjab, India; Khoora, Salt Range
Triassic, lower Ceratite [syntype Palaeont. Inst. Wiener Univ. 4037]

8991 **gabbi, Celtites:** Smith Plastosyntype
Smith, 1914, p. 34, pl. 20, figs. 9, 10
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [syntype USNM 74290]

8699 **georgianum, Canadoceras:** Anderson Holotype
Anderson, 1958, p. 234, pl. 32, figs. 3, 3a
Straits of Georgia, B.C., Canada; Sucia Islands
Cretaceous

6473 **gigas, Koninckites:** Waagen Plastoholotype
Waagen, 1895, p. 266, pl. 31, fig. 2
Punjab, India; Salt Range, Choa
Triassic, Ceratite [holotype Palaeont. Inst. Wiener Univ. 4044]

9095 **gilberti, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 84, pl. 98, figs. 1-3
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74353]

8763 **gilberti, Xenodiscus:** Smith Plastoholotype
Smith, 1932, p. 43, pl. 24, figs. 1-3
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74923]

8803 **gracilis, Flemingites russelli:** Smith Plastoholotype
Smith, 1932, p. 53-54, pl. 23, figs. 1-3
SE Idaho; Slug Creek, Aspen Mts., 14 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74918]

524 **grandior, Aturia angustata:** Schenck Holotype
Schenck, 1931, p. 462, pls. 73, 74
Wash.; bluffs on Vance's Creek, 2.5 miles above jct. with Skokomish River, 13 miles above Union Canyon NP loc. 207
Middle Oligocene

525 **grandior, Aturia angustata:** Schenck Paratype
Schenck, 1931, p. 462, pls. 75, 76
Wash.; Port Townsend NP loc. 125
Middle Oligocene

6484 **greppini, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 154
Trimbach, Switzerland; between Olten and Hauenstein tunnel
Jurassic, Callovian

6489 **groteanus, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 283, pl. 80, fig. 4
Tibet; Spiti Province
Jurassic, upper Malm, Spiti Shale

9111 **haguei, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 97, pl. 42, figs. 1, 2
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74347]

7609 **halli, Ammonites:** Meek and Hayden Plastoholotype
Meek and Hayden, 1856, p. 70. Illustrated *in* Meek, 1876, p. 458, pl. 24, figs. 3a-3c
Montana; Missouri River, 150′ above mouth of Milk River
Cretaceous, Bearpaw Shale [holotype USNM 384]

560 **hallidayi, Nautilus:** Waring Holotype
Waring, 1914, p. 783. Illustrated *in* Waring, 1917, pl. 13, fig. 13
Ventura Co., Calif.; Simi Hills
Eocene, Martinez Fm

8491 **haradai, Pachydiscus:** Jimbo Plastoholotype
Jimbo, 1894, p. 29, pl. 2, fig. 2
Hokkaido, Japan; Abeshinai, Teshio Province
Cretaceous, Teshio Fm [holotype Kyushu Univ. GT-I-100]

8891 **harti, Tirolites:** Smith Plastoholotype
Smith, 1932, p. 83, pl. 57, figs. 9, 10
Bear Lake Co., Idaho; Paris Canyon, 1.5 miles W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75022]

9015 **hartzelli, Arcestes (Proarcestes):** Smith Plastoholotype
Smith, 1914, p. 43, pl. 93, figs. 17, 18
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74438]

5415 **hatschekii, Ceratites (Haydenites):** Diener Plastoholotype
Diener, 1907, p. 72, pl. 6, fig. 1
Himalaya Mts.; NNW of Kaga, Spiti
Triassic, Muschelkalk [holotype Palaeont. Inst. Wiener Univ. 4120]

9010 **haugi, Popanoceras (Parapopanoceras):** Hyatt and Smith
9010a Hyatt and Smith, 1905, p. 71, pl. 76, figs. 1-4 Plastosyntypes
Inyo Co., Calif.; Inyo Range, Union Wash
Middle Triassic [syntypes USNM 74280]

5489 **hauthali, Harpoceras:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 16, pl. 1, figs. 18-20
Argentina; Mendoza Province, Cerro Puchĕn
Jurassic, Lower Dogger

8868 **haydeni, Dagnoceras:** Smith Plastoholotype
Smith, 1932, p. 66, pl. 29, figs. 1-3
Idaho; E of Hot Springs, NE end of Bear Lake
Lower Triassic, *Meekoceras* zone [holotype USNM 74948]

5499 **hidimba, Ceratites:** Diener Plastoholotype
Diener, 1895, p. 13, pl. 3, figs. 1a-1c
Himalaya Mts., Tibet, Tsang Tsok Li
Triassic, Muschelkalk [holotype Palaeont. Inst. Wiener Univ. 4088]

8862 **hooveri, Aspidites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 153, pl. 17, figs. 1-3
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75268]

9122 **humboldtensis, Ceratites:** Hyatt and Smith Plastosyntypes
9123 Hyatt and Smith, 1905, p. 170, pl. 7, figs. 1-13
9124 West Humboldt Range, Nevada; Troy Canyon area
9125 Middle Triassic [syntypes USNM 74375]
9126

8995 **humboldtensis, Columbites:** Smith Plastosyntypes
8996 Smith, 1914, p. 36, pl. 20, figs. 26-28; pl. 87, figs. 1-3
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [syntypes USNM 74416]

6462 **hyatti, Acrochordiceras:** Meek Plastosyntypes
6463 Meek, 1877, p. 124, pl. 11, figs. 5 (type 6462), 5a (type 6463)
Nevada; New Pass, Desatoya Mts.
Triassic [syntypes USNM 12514]

8877 **hyatti, Hedenstroemia:** Smith Plastoholotype
Smith, 1932, p. 78, pl. 27, figs. 13-15
SE Idaho; 5 miles E of Grays Lake
Lower Triassic, *Meekoceras zone* [holotype USNM 74938]

5503 **insignis, Cyclolobus:** Diener Plastoholotype
Diener, 1903, p. 164, pl. 6, fig. 5
Himalaya Mts.; Lilang, Spiti
Permian, Kuling Shale [holotype Palaeont. Inst. Wiener Univ.]

10017 **intermedia, Fontannesia:** Imlay Paratype
Imlay, 1973, pp. 57-58, pl. 4, figs. 8, 9
Grant Co., Ore.; SE cor. NE 1/4, NE 1/4 Sec. 19, T 18 S, R 26 E
Middle Jurassic, Bajocian stage, Snowshoe Fm, Weberg Mbr (near top)

7611 **intermedius, Scaphites conradi:** Meek Plastoholotype
Meek, 1876, p. 433, pl. 34, figs. 3a-3c
S. Dakota; Moreau River
Cretaceous, Fox Hills Fm [holotype USNM 408]

8907 **intermontanum, Pseudosageceras:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 99, pl. 4, figs. 1-3
Idaho; Aspen Ridge, Wood Canyon
Lower Triassic, *Meekoceras* zone [holotype USNM 75251]

8764 **intermontanus, Xenodiscus:** Smith Plastoholotype
Smith, 1932, p. 44, pl. 24, figs. 10, 11
Idaho; Slug Creek, 14 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74924]

9009 **inyoense, Acrochordiceras:** Smith Plastoholotype
Smith, 1914, p. 40, pl. 34, figs. 11, 12
Inyo Co., Calif.; Inyo Range, Union Wash
Middle Triassic [holotype USNM 74330]

9157 **inyoense, Cravenoceras:** Gordon Holotype
Gordon, 1964, p. A14, pl. 3, figs. 1, 2, text fig. 4f
Inyo Co., Calif.; Cottonwood Mts., near Rest Spring SU loc. 2776
Upper Mississippian, Perdido Fm

9159 **inyoense, Cravenoceras:** Gordon Paratypes
9160 Gordon, 1964, p. A14, pl. 2, figs. 5, 6 (type 9159)
Inyo Co., Calif.; Cottonwood Mts., near Rest Spring SU loc. 2776
Upper Mississippian, Perdido Fm

9158 **inyoense, Cravenoceras:** Gordon Paratypes
9158b Gordon, 1964, p. A14, pl. 3, figs. 6-9 (type 9158b), 10-13 (type
9158c 9158c), 18-20 (type 9158d)
9158d Inyo Co., Calif.; Cottonwood Mts., near Rest Spring SU loc. 2776
Upper Mississippian, Perdido Fm

8777 **jacksoni, Meekoceras (Prionolobus):** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 151, pl. 62, figs. 11, 12
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75292]

8427 **japonicum, Desmoceras dawsoni:** Yabe Plastoholotype
Yabe, 1904, p. 35, pl. 5, figs. 3, 4
Hokkaido, Japan
Cretaceous [holotype Kyushu Univ. GT-I-260]

7618 **jugifer, Ammonites:** Waagen Plastoholotype
Waagen, 1867, p. 596, pl. 26, figs. 1a, 1b
Schwaben, Germany; Gingen, Vilsthale
Jurassic, Dogger [cast donated by Palaeont. Mus. Wien]

5500 **kamadeva, Ceratites:** Diener Plastoholotype
Diener, 1895, p. 24, pl. 5, fig. 1
Himalaya Mts.; Shalshal cliff near Rimkin Pairar
Triassic, Muschelkalk [holotype Palaeont. Inst. Wiener Univ. 4082]

9132 **karpinskyi, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 100, pl. 44, figs. 4-6
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74351]

8489 **kawanoi, Desmoceras:** Jimbo Plastoholotype
Jimbo, 1894, p. 28, pl. 1, fig. 7
Hokkaido, Japan; Tshashikoto, Ikandai
Cretaceous [holotype Kyushu Univ. GT-I-98]

8698 **kernense, Didymoceras:** Anderson Holotype
Anderson, 1958, p. 196, pl. 65, figs. 1, 2
Kern Co., Calif.; Honolulu Consolidated Oil Company Well, T 32 S, R 24 E, depth 2450′
Cretaceous

9101 **kingi, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 85, pl. 41, figs. 1-3
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74352]

8687 **kingi, Gastroplites:** McLearn Plastoholotype
McLearn, 1931, p. 5, pl. 1, fig. 9
Alberta, Canada; S side Peace River, just above mouth of Deep Creek
Lower Cretaceous, Peace River Ss [holotype Geol. Surv. Canada 6340]

6474 **kingianus, Aspidites:** Waagen Plastoholotype
Waagen, 1895, p. 225, pl. 32, fig. 1; pl. 33, fig. 1
Punjab, India; Virgal, Salt Range
Triassic, Ceratite [holotype Palaeont. Inst. Wiener Univ. 4043]

6466 **kingianus, Sibirites:** Waagen Plastosyntype
Waagen, 1895, p. 108, pl. 18, fig. 1
Punjab, India; Chidroo, Salt Range
Triassic, Ceratite [syntype Palaeont. Inst. Wiener Univ. 4064]

8758 **knechti, Lecanites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 138, pl. 9, figs. 11-13
Inyo Co., Calif.; Inyo Mts., Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75264]

8893 **knighti, Tirolites:** Smith Plastoholotype
Smith, 1932, p. 84, pl. 57, figs. 1, 2
Bear Lake Co., Idaho; Paris Canyon, 1.5 miles W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75020]

8937 **koeneni, Owenites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 83, pl. 10, figs. 1-4
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras zone* [holotype USNM 75261]

8482 **kossmati, Canadoceras:** Matsumoto Plastoholotype
Matsumoto, 1954a, p. 295, pl. 13, fig. 1
Hokkaido, Japan; N of Chiptauchibets River, Tumbets, Kitami Province
Cretaceous [holotype Kyushu Univ. GT-I-381]

8878 **kossmati, Hedenstroemia:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 101, pl. 67, figs. 3-7
Idaho; Aspen Ridge, Wood Canyon
Lower Triassic, *Meekoceras* zone [holotype USNM 75298]

8428 **kotoi, Ammonites:** Yabe Plastoholotype
Yabe, 1904, p. 26, pl. 6, figs. 3, 4
Hokkaido, Japan
Cretaceous [holotype Kyushu Univ. GT-I-254]

5504 **kraffti, Cyclolobus (Krafftoceras):** Diener Plastoholotype
Diener, 1903, p. 165, pl. 6, figs. 9a-9c
Himalaya Mts.; Lilang, Spiti
Permian, Kuling Shale [holotype Paleont. Inst. Wiener Univ.]

9054 **lahontanum, Eutomoceras:** Smith Plastoholotype
Smith, 1914, p. 63, pl. 28, figs. 8-11
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74313]

8972 **lahontanus, Tropigastrites:** Smith Plastoholotype
Smith, 1914, p. 28, pl. 19, figs. 14, 15
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74288]

8721 **laqueus, Ammonites:** Quenstedt Syntype
Quenstedt, 1885, p. 18, pl. 1, fig. 15
Quedlinburg, Germany
Lower Jurassic, Lias

7606 **larvaeformis, Scaphites:** Meek and Hayden Plastoholotype
Meek and Hayden, 1858, p. 58. Illustrated *in* Meek, 1876, p. 418, pl. 6, figs. 6a-6c
S. Dakota; E base of Black Hills
Cretaceous, Carlile Shale (lower part) [holotype USNM 229]

8487 **laticarinatus, Damesites:** Saito and Matsumoto Plastoholotype
Saito and Matsumoto, 1956, p. 192, text fig. 1
Hokkaido, Japan; Ikushumbets River, Ishikari Province
Cretaceous, Cenomanian [holotype Kyushu Univ. GT-T-3245]

7600 **leei, Scaphites:** Reeside Plastoholotype
Reeside, 1927b, p. 26, pl. 20, figs. 17-22
Santa Fe Co., New Mexico; 1 mile S of Waldo
Upper Cretaceous, Mancos Shale, uppermost part [holotype USNM 73354]

6498 **lemoinei, Perisphinctes (Virgatosphinctes):** Uhlig Plastoholotype
Uhlig, 1910, p. 343, pl. 92, fig. 1 (fig. reversed)
Himalaya Mts.; Tibet, Shangra, Gnari-Khorsum
Upper Jurassic, Spiti Shale

7602 **levis, Scaphites:** Reeside Plastoholotype
Reeside, 1927b, p. 26, pl. 20, figs. 7-12
Park Co., Wyoming; Sec. 25, T 58 N, R 100 W
Upper Cretaceous, Telegraph Creek Fm, Elk Basin Ss Mbr [holotype USNM 73353]

8951 **ligatus, Columbites:** Smith Plastoholotype
Smith, 1932, p. 106, pl. 47, figs. 1-3
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74985]

8874 **lindgreni, Anasibirites:** Smith Plastoholotype
Smith, 1932, p. 73, pl. 53, figs. 13-15
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Owenites* subzone [holotype USNM 75008]

6499 aff. **lorioli,** n. sp., **Aulacosphinctes:** Steiger Plastoholotype
Steiger, 1914, p. 460, pl. 101, fig. 1
Himalaya Mts., Shangra, Gnari-Khorsum
Upper Jurassic, Spiti Shale

8975 **louderbacki, Sibyllites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 58, pl. 74, figs. 10-12
West Humboldt Range, Nevada; N of Troy Canyon
Middle Triassic [holotype USNM 74400]

9854 **lupheri, Arieticeras:** Imlay Paratype
Imlay, 1968, pp. C34-C35, pl. 4, fig. 15
Grant Co., Ore.; Delintment Lake Qd, SW 1/4 Sec. 28, T 18 S, R 26 E
Upper Lower Jurassic, Nicely Shale

9165 **macallisteri, Anthracoceras:** Gordon Holotype
Gordon, 1964, p. A18, pl. 4, figs. 1-3, text fig. 8
Inyo Co., Calif.; Panamint Range, Cottonwood Mts., near Rest Spring
Upper Mississippian, Perdido Fm

9166 **macallisteri, Anthracoceras:** Gordon Paratypes
9166a Gordon, 1964, p. A18, pl. 4, figs. 7-9 (type 9166)
Inyo Co., Calif.; Panamint Range, Cottonwood Mts., near Rest Spring
Upper Mississippian, Perdido Fm

5873 **madagascariensis, Aspidites:** Diener Holotype
Diener, 1914, p. 914, pl. 1, fig. 2
Madagascar
Lower Triassic

5874 **madagascariensis, Aspidites:** Diener Paratype
Diener, 1914, p. 914, pl. 1, fig. 3
Madagascar
Lower Triassic

5487 **malarguense, Harpoceras:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 12, pl. 1, figs. 9, 10
Argentina; Mendoza Province, Cerro Puchén
Lower Jurassic, Upper Lias

8773 **marcoui, Xenodiscus:** Hyatt and Smith Plastosyntype
Hyatt and Smith, 1905, p. 116, pl. 7, fig. 26
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [syntype USNM 75258]

7899 **marksi, Eutrephoceras:** Miller Holotype
Miller, 1947, p. 33, pl. 20, figs. 1, 2
Kern Co., Calif.; Reed Canyon, elev. 2350′, NW cor. Tejon Qd
Eocene, Tejon Fm

9168 **masoni, Dombarocanites:** Gordon Holotype
Gordon, 1964, p. A21, pl. 4, figs. 4-6, text fig. 10a
Inyo Range, Calif.; 2.25 miles N of Cerro Gordo mine
Upper Mississippian, Chainman Fm

9169 **masoni, Dombarocanites:** Gordon Paratype
Gordon, 1964, p. A21, pl. 4, fig. 14
Inyo Range, Calif.; 2.25 miles N of Cerro Gordo mine
Upper Mississippian, Chainman Fm

7617 **mesacanthus, Ammonites:** Waagen Plastoholotype
Waagen, 1867, p. 594, pl. 28, figs. 1a, 1b
Schwaben, Germany; Gingen, Vilsthale
Jurassic, Dogger

8825 **micromphalus, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 58, pl. 49, figs. 5-8
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74992]

7588 **moreauensis, Ammonites:** Owen Plastoholotype
Owen, 1852, p. 579, pl. 8, fig. 7
Fox Hills, S. Dakota
Cretaceous, Fox Hills Ss [holotype USNM 20244]

6488 **morikeanus, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 281, pl. 80, fig. 2
Tibet; Ki, Spiti Province
Jurassic, Spiti Shale

5417 **moorei, Ceratites (Hollandites):** Diener Plastoholotype
Diener, 1907, p. 65, pl. 8, fig. 1
Himalaya Mts., Muth, Spiti
Triassic, Muschelkalk Fm [holotype Palaeont. Inst. Wiener Univ. 4089]

7608 **mullananus, Ammonites ?:** Meek and Hayden Plastoholotype
Meek and Hayden, 1863, p. 23. Illustrated *in* Meek, 1876, p. 607, pl. 8, figs. 1a-1c
Near Fort Benton, Montana; Chippewa Point
Cretaceous, Colorado Shale (upper part) [holotype USNM 1924]

8027 **mulleri, Choanoteuthis:** Fischer Holotype
8028 Fischer, 1951, p. 387, pl. 1, figs. 1-3; pl. 2, figs. 1, 2
Mineral Co., Nevada; Gabbs Valley Range, 4 miles E of Luning Hawthorne Qd SU loc. 781
Triassic, Gabbs Fm [2 sections of a single specimen]

8613 **mulleri, Sonneratia:** Anderson Paratype
Anderson, 1938, p. 195, pl. 54, fig. 3
Shasta Co., Calif.; Hulen Creek
Late Cretaceous, Horsetown Fm

9039 **multicameratus, Xenodiscus:** Smith Plastoholotype
Smith, 1914, p. 57, pl. 34, fig. 5
Inyo Co., Calif.; Inyo Range, Union Wash
Middle Triassic [holotype USNM 74329]

5501 **nalikanta, Meekoceras:** Diener Plastosyntype
Diener, 1895, p. 45, pl. 9, figs. 5a, 5b
Himalaya Mts.; Shalshal cliff near Rimkin Paiar
Triassic, Muschelkalk [syntype Palaeont. Inst. Wiener Univ. 4030]

5502 **nanda, Meekoceras:** Diener Plastoholotype
Diener, 1895, p. 48, pl. 9, fig. 8
Himalaya Mts.; Shalshal cliff near Rimkin Paiar
Triassic, Muschelkalk [holotype Palaeont. Inst. Wiener Univ. 4098]

7599 **nanus, Scaphites aquilaensis:** Reeside Plastoholotype
Reeside, 1927b, p. 26, pl. 19, figs. 14-19
Park Co., Wyoming; Sec. 25, T 58 N, R 100 W
Upper Cretaceous, Telegraph Creek Fm, Elk Basin Ss Mbr [holotype USNM 73352]

7587 **nebrascensis, Ammonites:** Owen Plastosyntype
Owen, 1852, p. 577, pl. 8, figs. 3, 3a
Fox Hills, S. Dakota
Cretaceous, Fox Hills Fm [syntype USNM 20242]

8774 **nevadanus, Xenodiscus (Xenaspis):** Smith Plastoholotype
Smith, 1932, p. 47, pl. 56, figs. 1, 2
Elko Co., Nevada; 70 miles S of Wells
Lower Triassic, *Meekoceras* zone [holotype USNM 75019]

8857 **newberryi, Meekoceras (Konickites):** Smith Plastoholotype
Smith, 1932, p. 62, pl. 53, figs. 1-3
Inyo Co., Calif.; Union Wash, 15 miles SE of Independence
Lower Triassic, *Owenites* subzone [holotype USNM 75005]

8725 **newpassense, Hannaoceras:** Johnston Paratype
Johnston, 1941, p. 454 (cited as No. 4)
Lander Co., Nevada; New Pass Range SU loc. 730
Upper Triassic, Star Peak Fm

5877 **newsomi, Goniatites:** Smith Holotype
Smith, 1903, p. 78, pl. 17, figs. 2-5
Batesville, Arkansas
Lower Carboniferous, Fayetteville Shale

5608 **newsomi, Paralegoceras:** Smith Holotype
5609 Smith, 1903, p. 101, pl. 12, figs. 4-9
Conway Co., Arkansas; Morrillton, N 1/2 Sec. 17, T 5 N, R 16 W
Lower Carboniferous [5609 is inner whorl of 5608]

5495 **noetlingi, Macrocephalites:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 31, pl. 3, figs. 5, 6
Chile; Comisaria Lonquimay, Rio Colorado
Jurassic, Callovian

8875 **noetlingi, Sibirites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 49, pl. 9, figs. 1-3
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75262]

7592 **novimexicanus, Desmoscaphites:** Reeside Plastoholotype
Reeside, 1927b, p. 17, pl. 11, figs. 1-4
Santa Fe Co., New Mexico; 1 mile E of head of Canyon del Yeso
Upper Cretaceous, Mancos Shale, uppermost part [holotype USNM 73312]

9068 **nudus, Lecanites:** Smith Plastoholotype
Smith, 1914, p. 66, pl. 98, figs. 8, 9
West Humbolt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74456]

5414 **oberhummeri, Ceratites (Salterites):** Diener Plastoholotype
Diener, 1907, p. 70, pl. 5, fig. 1
Himalaya Mts., Muth, Spiti
Triassic, Muschelkalk [holotype Palaeont. Inst. Wiener Univ. 4081]

8978 **obliterans, Tropigastrites:** Smith Plastoholotype
Smith, 1914, p. 30, pl. 87, figs. 27-32
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74418]

8906 **obtusus, Aspenites:** Smith Plastoholotype
Smith, 1932, p. 86, pl. 31, figs. 8-10
Idaho; E of Hot Springs, NE end of Bear Lake
Lower Triassic, *Meekoceras* zone [holotype USNM 74958]

9096 **occidentalis, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 84, pl. 44, figs. 21, 22
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74352]

8921 **occidentalis, Ussuria:** Smith Plastoholotype
Smith, 1932, p. 91, pl. 27, figs. 8-10
Idaho; Wood Canyon, 9 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [holotype USNM 74937]

9855 **ochocoense, Protogrammoceras ?:** Imlay Paratype
Imlay, 1968, p. C40, pl. 6, fig. 26
Grant Co., Ore.; Izee Qd, concretions on E slope Pole Canyon, NW 1/4, SW 1/4 Sec. 36, T 17 S, R 27 E
Lower Jurassic, Nicely Shale, about 75' above andesite flow

7892 **olssoni, Aturoidea:** Miller Holotype
Miller, 1947, p. 73, pl. 51, figs. 1, 2; pl. 52, fig. 1; pl. 53, figs. 3, 4
Peru; 2 miles N, 3 miles E of Punta Parinas
Eocene, Salina Fm

7893 **olssoni, Aturoidea:** Miller Paratype
Miller, 1947, p. 73, pl. 54, figs. 1, 2
Peru; 2 miles N, 3 miles E of Punta Parinas
Eocene, Salina Fm

7894 **olssoni, Aturoidea:** Miller Paratypes
7895 Miller, 1947, p. 73, pl. 92, figs. 3-5 (type 7894)
Peru; 2 miles N, 3 miles E of Punta Parinas
Eocene, Salina Fm

6753 **ornatum, Yokoyamaoceras:** Matsumoto Plastoholotype
Matsumoto, 1956, p. 183, pl. 16, fig. 3
Hokkaido, Japan; Abeshinai Valley, Teshio Province
Upper Cretaceous [holotype Kyushu Univ., GK-H-5210]

8954 **ornatus, Columbites:** Smith Plastoholotype
Smith, 1932, p. 107, pl. 46, figs. 14, 15
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74984]

8882 **oweni, Inyoites:** Hyatt and Smith Plastosyntypes
8883 Hyatt and Smith, 1905, p. 134, pl. 6, figs. 1 (type 8882), 3, 4 (type
8884 8883), 6 (type 8884)
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [syntypes USNM 75255]

8885 **oweni, Inyoites:** Hyatt and Smith Plastosyntypes
8886 Hyatt and Smith, 1905, p. 134, pl. 69, figs. 1 (type 8885), 2, 3 (type
8887 8886), 4-6 (type 8887), 7-9 (type 8888)
8888 Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [syntypes USNM 75301]

8889 **oweni, Inyoites:** Hyatt and Smith Plastosyntype
Hyatt and Smith, 1905, p. 134, pl. 40, figs. 1-8
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [syntype USNM 75280]

8742 **pacifica, Mesopuzosia:** Matsumoto Plastoholotype
Matsumoto, 1954b, p. 82, pl. 15, fig. 1
Hokkaido, Japan; Ishikari Province, Shiyubari Valley
Cretaceous, Saku Fm [holotype Kyushu Univ. GK-H-1257]

9078 **pacificus, Tirolites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 159, pl. 21, figs. 14, 15
Inyo Co., Calif.; Inyo Range, Union Wash
Middle Triassic [holotype USNM 74461]

5899 **packardi, Tritropidoceras:** Schenk Holotype
Schenk, 1935, p. 402, pl. 17, figs. 1, 2, 13
Grant Co., Ore.; 10 miles E of Suplee, 1.5 miles S of Bailey Ranch
Upper Triassic, upper Karnic

5900 **packardi, Tritropidoceras:** Schenk Paratype
Schenk, 1935, p. 402, pl. 17, figs. 5-12, 14, 15, 16b-16f
Grant Co., Ore.; 10 miles E of Suplee, 1.5 miles S of Bailey Ranch
Upper Triassic, upper Karnic

8956 **parisianus, Columbites:** Hyatt and Smith — Plastoholotype
Hyatt and Smith, 1905, p. 51, pl. 1, figs. 9-11
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75246]

8783 **parvum, Ophiceras:** Smith — Plastoholotype
Smith, 1932, p. 49, pl. 54, figs. 25-27
Inyo Co., Calif.; Inyo Range, 15 miles SE of Independence, Union Wash
Lower Triassic, *Owenites* subzone [holotype USNM 75011]

9044 **parvus, Dalmatites:** Smith — Plastoholotype
Smith, 1914, p. 60, pl. 30, figs. 1, 2
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74317]

9069 **parvus, Lecanites:** Smith — Plastoholotype
Smith, 1914, p. 66, pl. 30, figs. 25, 26
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74320]

7601 **parvus, Scaphites leei:** Reeside — Plastoholotype
Reeside, 1927b, p. 27, pl. 21, figs. 8-14
Sandoval Co., New Mexico; 3/4 mile N of Copper City
Upper Cretaceous, Mesaverde Fm (near base) [holotype USNM 73356]

8718a **patagiosus, Ammonites:** Schluter — Plastosyntypes
8718b Schluter, 1867, p. 22, pl. 4, figs. 4, 5
8718c Coesfeld, Germany [type species of *Patagiosites* Spath, 1953]
Cretaceous [syntypes Geol.-Pal. Inst. Univ. Bonn]

8826 **patelliforme, Meekoceras:** Smith — Plastoholotype
Smith, 1932, p. 58, pl. 28, figs. 21-23
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74945]

9163 **paucinodum, Eumorphoceras:** Gordon — Holotype
Gordon, 1964, p. A17, pl. 2, figs. 7-9, text fig. 7
Inyo Co., Calif.; Panamint Range, Cottonwood Mts., near Rest Spring
Upper Mississippian, Perdido Fm

9164 **paucinodum, Eumorphoceras:** Gordon — Paratype
Gordon, 1964, p. A17
Inyo Co., Calif.; Panamint Range, Cottonwood Mts., near Rest Spring
Upper Mississippian, Perdido Fm

8895 **pealei, Tirolites:** Smith — Plastoholotype
Smith, 1932, p. 84, pl. 57, figs. 5, 6
Bear Lake Co., Idaho; Paris Canyon, 1.5 miles W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75021]

5625 **perrini, Scaphites:** Anderson — Holotype
Anderson, 1902, p. 114, pl. 2, figs. 71-73
Jackson Co., Ore.; Phoenix, near Smith's ranch
Upper Cretaceous, lower Chico Fm

8829 **pilatum, Meekoceras:** Hyatt and Smith — Plastosyntypes
8830 Hyatt and Smith, 1905, p. 144, pl. 63, figs. 3-9
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Meekoceras* zone [syntypes USNM 75294]

9140 **pilatus, Ceratites:** Smith — Plastoholotype
Smith, 1914, p. 102, pl. 89, figs. 10-13
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74427]

8492 **planulatiforme, Desmoceras:** Jimbo — Plastoholotype
Jimbo, 1894, p. 27, pl. 1, fig. 4. Also *in* Matsumoto, 1954, p. 96, pl. 20, fig. 1 (as type of *Jimboiceras*)
Hokkaido, Japan; Obirashibets, Teshio Province
Cretaceous [holotype Kyushu Univ. GT-I-94]

7605 **plenus, Scaphites nodosus:** Meek and Hayden Plastoholotype
Meek and Hayden, 1860, p. 177. Illustrated *in* Meek, 1876, p. 429, pl. 26, figs. 1a-1c
Montana; Yellowstone River near Miles City
Cretaceous, Pierre Shale [holotype USNM 364]

8997 **plicatulus, Columbites:** Smith Plastoholotype
Smith, 1914, p. 37, pl. 20, figs. 15, 16
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74291]

8720 **plicatus, Ammonites psilonotus:** Quenstedt Holotype
Quenstedt, 1885, p. 14, pl. 1, fig. 9
Nellingen, Germany
Jurassic, Lias

8992 **polygyratus, Celtites:** Smith Plastoholotype
Smith, 1914, p. 35, pl. 20, figs. 1, 2
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74289]

8979 **powelli, Tropigastrites:** Smith Plastoholotype
Smith, 1914, p. 31, pl. 97, figs. 1-4
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74451]

6482 **psilogyrus, Lecanites:** Waagen Plastoholotype
Waagen, 1895, p. 280, pl. 39, fig. 5
Punjab, India; Khoora, Salt Range
Triassic, lower Ceratite Ss [holotype Palaeont. Inst. Wiener Univ. 4006]

8745 **pusillus, Menuites:** Matsumoto Plastoholotype
Matsumoto, 1955b, p. 165, pl. 32, fig. 1
Hokkaido, Japan; Hidaka Province, Ikandai, Urakawa area
Cretaceous, upper Yezo group

7595 **pusillus, Scaphites hippocrepis:** Reeside Plastoholotype
Reeside, 1927b, p. 23, pl. 17, figs. 1-5
Park Co., Wyoming; Sec. 25, T 58 N, R 100 W
Upper Cretaceous, Telegraph Creek Fm, Elk Basin Ss Mbr [holotype USNM 73334]

9081 **pygmaeus, Dinarites:** Smith Plastoholotype
Smith, 1914, p. 70, pl. 89, figs. 8, 9
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74426]

7614 **quadrangularis, Scaphites nodosus:** Meek Plastoholotype
Meek, 1876, p. 428, pl. 25, figs. 3a-3c
S. Dakota; Cheyenne River
Cretaceous, Pierre Shale [holotype USNM 366]

6481 **radiosum, Meekoceras:** Waagen Plastoholotype
Waagen, 1895, p. 257, pl. 36, fig. 2
Punjab, India; Chitta-wan, Salt Range
Triassic, lower Ceratite Ss [holotype Palaeont. Inst. Wiener Univ. 4036]

9104 **rectangularis, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 85, pl. 41, figs. 14, 15
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74345]

7589 **reesidei, Scaphites:** Wade Plastoholotype
Wade, 1926, p. 183, pl. 61, figs. 3-6
McNairy Co., Tenn.; Coon Creek, Dave Weeks' farm
Upper Cretaceous, Ripley Fm, Coon Creek tongue [holotype USNM 73112]

6494 **regalis, Hoplites:** Pavlow Plastosyntypes
6495 Pavlow, 1891, p. 102, pl. 17, figs. 1, 2
Speeton, England
Cretaceous, Neocomian

5867 **regiforme, Pinacoceras:** Diener Holotype
Diener, 1916, p. 450, pl. 1, figs. 6a, 6b
Siberia; New Siberian Islands, at the head of Balykatch River, Kotelny Island
Upper Triassic, Noric

6505 **rehmanni, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 153, pl. 48, figs. 1a-1c
Baden, Germany; Geisingen, Donaueschingen
Jurassic, Malm, Callovian

511 **rogersi, Sonneratia:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 69. Illustrated *in* Wiedey, 1929, pl. 1, fig. 7
Alameda Co., Calif.; Tesla Qd, 3/4 mile S of Carnegie, Corral Hollow
Middle Cretaceous, Horsetown Fm

8700 **roguense, Cunningtoniceras:** Anderson Holotype
Anderson, 1958, p. 246, pl. 15, figs. 1, 1a
Jackson Co., Ore.; "Forty nine" mine
Cretaceous

9034 **rosenbergi, Gymnites (Anagymnites):** Smith Plastoholotype
Smith, 1914, p. 54, pl. 26, figs. 2, 3
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74307]

8746 **rotalinoides, Pachydiscus:** Yabe Plastolectotype
Matsumoto, 1955b, p. 169, pl. 34, figs. 1a-1c
Hokkaido, Japan; Urakawa, Hidaka Province
Cretaceous [cast of I.G.P.S. 54438, designated lectotype of *Urakawites*]

8984 **rothpletzi, Tropigastrites:** Smith Plastoholotype
Smith, 1914, p. 31, pl. 19, figs. 1-3
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74286]

9084 **rotuloides, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 80, pl. 47, figs. 1-3
West Humboldt Range, Nevada; N fork Cottonwood Canyon
Middle Triassic [holotype USNM 74356]

6480 **rotundatus, Prionolobus:** Waagen Plastosyntype
Waagen, 1895, p. 310, pl. 34, fig. 1
Punjab, India; Virgal, Salt Range
Triassic, Ceratite Marl [syntype Paleont. Inst. Wiener Univ. 4034]

8944 **rotundus, Proteusites:** Smith Plastoholotype
Smith, 1932, p. 102, pl. 53, figs. 5, 6
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Owenites* subzone [holotype USNM 75006]

8800 **russelli, Flemingites:** Smith Plastoholotype
Smith, 1904, p. 378, pl. 42, fig. 5; pl. 43, figs. 5, 6
Idaho; 9 miles NE of Soda Springs, Wood Canyon
Lower Triassic, *Meekoceras* zone [holotype USNM 75302]

185 **sanctaemonicae, Placenticeras:** Waring Holotype
Waring, 1915, fig. 11. Also in Waring, 1917, p. 70, pl. 9, fig. 21
Los Angeles Co., Calif.; 4 miles NW of Santa Monica
Upper Cretaceous, Chico Fm

5614 **sanctijohanis, Eumorphoceras:** Wiedey Holotype
Wiedey, 1929a, p. 323, figs. 1-4, 6
Greene Co., Iowa; Bussey's Coal Bank, NE 1/4 Sec. 30, T 32 N, R 29 W
Pennsylvanian, Lower Coal Measures

5615 **sanctijohanis, Eumorphoceras:** Wiedey Paratype
Wiedey, 1929a, p. 323, figs. 5, 7
Greene Co., Iowa; Bussey's Coal Bank, NE 1/4 Sec. 30, T 32 N, R 29 W
Pennsylvanian, Lower Coal Measures

8833 **sanctorum, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 59, pl. 49, figs. 1, 2
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74991]

8592 **schencki, Baculites:** Matsumoto Paratypes
8593 Matsumoto, 1959a, p. 113, text figs. 22 (type 8593), 25 (type 8592)
Yolo Co., Calif.; Rumsey Hills, Sec. 19, T 12 N, R 3 W SU loc. 2004
Upper Cretaceous, Funks Shale

8594 **schencki, Baculites:** Matsumoto Paratypes
8595 Matsumoto, 1959a, p. 113
Yolo Co., Calif.; Rumsey Hills, Sec. 30, T 12 N, R 3 W SU loc. 2001
Upper Cretaceous, Funks Shale

8576 **schencki, Baculites:** Matsumoto Paratype
Matsumoto, 1959a, p. 113, text fig. 24
Fresno Co., Calif.; Panoche Qd, Sec. 28, T 14 S, R 11 E SU loc. 3315
Upper Cretaceous, Panoche Fm

6490 **schenki, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 286, pl. 81, fig. 4
Tibet; Shangra, E of Puling, Gnari-Khorsum
Jurassic, Spiti Shale

9011 **septentrionalis, Megaphyllites:** Smith Plastoholotype
Smith, 1914, p. 42, pl. 21, figs. 4, 5
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74296]

123 **shastense, Acanthoceras:** Reagan Holotype
Reagan, 1924, p. 179, pl. 18, fig. 1. Also *in* Anderson, 1958, p. 242, pl. 20, figs. 1, 2
Shasta Co., Calif.; Cottonwood Creek SU loc. 121
Cretaceous, Horsetown Fm

5607 **siebenthali, Pronorites:** Smith Holotype
Smith, 1903, p. 47, pl. 11, figs. 5-7
Scott Co., Arkansas; SE 1/4 SE 1/4 Sec. 4, T 1 N, R 28 W
Upper Carboniferous

99 **silviesi, Uptonia:** Hertlein Holotype
Hertlein, 1925b, p. 39, pl. 3, figs. 1, 2, 5
Harney Co., Ore.; Sec. 7, T 20 S, R 30 E, 18 miles N of Burns SU loc. 27
Middle Lower Jurassic, Hardgrave Ss

5621 **simondsi, Shumardites:** Smith Holotype
Smith, 1903, p. 135, pl. 3, figs. 11-13
Young Co., Texas; Salt Creek, Graham
Pennsylvanian, Cisco Fm

5622 **simondsi, Shumardites:** Smith Paratype
Smith, 1903, p. 135
Young Co., Texas; Salt Creek, Graham
Pennsylvanian, Cisco Fm

10028 **sparsicostatum, Docidoceras:** Imlay Holotype
Imlay, 1973, p. 79, pl. 37, figs. 5-7
Grant Co., Ore.; SW 1/4 SW 1/4 Sec. 27, T 18 S, R 26 E. Float along irrigation ditch 400′ W of Freeman Creek, 1300′ S of Beaver Creek
Middle Jurassic, Bajocian stage, Snowshoe Fm, Weberg Mbr

8999 **spencei, Columbites:** Smith Plastoholotype
Smith, 1914, p. 36, pl. 70, figs. 1, 2
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 75309]

610 **spencei, Ophiceras:** Hyatt and Smith Paratype
Hyatt and Smith, 1905, p. 119
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic

8786 **spencei, Ophiceras:** Hyatt and Smith Plastosyntypes
8787 Hyatt and Smith, 1905, p. 119, pl. 62, figs. 1-7
Bear Lake Co., Idaho; 1 mile W of Paris
Lower Triassic [syntypes USNM 75291]

8686 **spiekeri, Gastroplites:** McLearn Plastoholotype
McLearn, 1931, p. 5, pl. 2, fig. 2
Alberta, Canada; Peace River, 8 miles below Cadotte River
Lower Cretaceous, Peace River Ss [holotype Geol. Surv. Canada 6339]

6486 **stanleyi, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 282, pl. 79, fig. 1
Tibet; Laptel, Gnari-Khorsum
Jurassic, upper Malm, Spiti Shale

8683 **stantoni, Gastroplites:** McLearn Plastoholotype
McLearn, 1931, p. 5, pl. 1, fig. 4
Alberta, Canada; W bank of Peace River, about 15 miles below Cadotte River mouth
Lower Cretaceous, Peace River Ss [holotype Geol. Surv. Canada 6336]

7590 **stantoni, Scaphites ventricosus:** Reeside Plastoholotype
Reeside, 1927a, p. 7, pl. 4, figs. 9, 10
Park Co., Montana; Devil's Slide, Cinnabar Mt.
Upper Cretaceous, Colorado Mt. Shale (upper part) [holotype USNM 18817]

7596 **"stantoni," Scaphites:** Reeside Plastoholotype
Reeside, 1927b, p. 23, pl. 17, figs. 16-21
Fergus Co., Montana; Willow Creek, 6 miles above old Fort Maginnis-Junction City road
Upper Cretaceous, Eagle Ss [holotype USNM 73338]

8719 **stansoni, Sonneratia:** Anderson Plastoholotype
Anderson, 1902, p. 105, pl. 3, figs. 91-92; pl. 10, fig. 198
Shasta Co., Calif.; near Horsetown
Lower Cretaceous, Horsetown Fm [= type species of *Coloboceras* Crickmay, 1927, p. 511: holotype UCMP]

8897 **strongi, Danubites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 165, pl. 9, figs. 4-6
Inyo Co., Calif.; Union Wash, Inyo Range
Lower Triassic, *Meekoceras* zone [holotype USNM 75263]

8858 **strongi, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 62, pl. 52, figs. 12-14
Inyo Co., Calif.; Inyo Range, Union Wash, 15 miles SE of Independence
Lower Triassic, *Owenites* subzone [holotype USNM 75003]

6752a **subcostatus, Tragodesmoceroides:** Matsumoto Plastoholotype
Matsumoto, 1942, p. 25, fig. 1d. Also *in* Matsumoto, 1954, p. 263, pl. 4, fig. 1
Hokkaido, Japan; Abeshinai district, Teshio Province
Cretaceous, Turonian (Neogyliakian) Saku Fm [holotype Kyushu Univ. GT-I-3087]

8788 **subquadratum, Ophiceras:** Smith Plastoholotype
Smith, 1932, p. 50, pl. 54, figs. 18-20
Inyo Co., Calif.; Inyo Range, Union Wash, 15 miles SE of Independence
Lower Triassic, *Owenites* subzone [holotype USNM 75010]

6472 **superbus, Aspidites:** Waagen Plastoholotype
Waagen, 1895, p. 218, pl. 23, fig. 1; pl. 24, fig. 1
Punjab, India; Salt Range, Chidroo
Triassic, upper Ceratite Ss ? [holotype Palaeont. Inst. Wiener Univ. 4042]

8835 **sylvanum, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 59, pl. 33, figs. 1-3
Idaho; 5 miles E of Grays Lake
Lower Triassic, *Meekoceras* zone [holotype USNM 74970]

8768 **tarpeyi, Xenodiscus:** Smith Plastoholotype
Smith, 1932, p. 45, pl. 25, figs. 4-6
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74929]

117 **tehamaensis, Schloenbachia:** Reagan Holotype
Reagan, 1924, p. 182, pl. 19, fig 3
Tehama Co., Calif.; 30 miles W of Red Bluff
Upper Cretaceous, Chico Fm

512 **templetoni, Schloenbachia:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 78. Illustrated *in* Wiedey, 1929b, pl. 2, fig. 4
Alameda Co., Calif.; Tesla Qd, Western Pacific R.R. cut between Altamont and Greenway
Upper Cretaceous, upper Chico Fm

8881 **tenuis, Clypites:** Hyatt and Smith Plastosyntype
Hyatt and Smith, 1905, p. 103, pl. 1, figs. 4-6
Idaho; Wood Canyon, 9 miles NE of Soda Springs
Lower Triassic, *Meekoceras* zone [syntype USNM 75245]

7593 **tenuis, Scaphites hippocrepis:** Reeside Plastoholotype
Reeside, 1927b, p. 23, pl. 16, figs. 12, 13
Carbon Co., Wyoming; near Mahoney Ranch, Sec. 7, T 26 N, R 88 W
Upper Cretaceous, Steele Shale (1728' above base) [holotype USNM 73331]

9087 **tenuispiralis, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 81, pl. 46, figs. 17-19
West Humboldt Range, Nevada; Fossil Hill, S fork American Canyon
Middle Triassic [holotype USNM 74355]

6504 **theodorii, Ammonites:** Oppel Plastoholotype
Oppel, 1862, p. 280, pl. 83, figs. 2a, 2b
Tibet; Laptel, Gnari-Khorsum
Jurassic, upper Malm, Spiti Shale

5862 **tolli, Cladiscites:** Diener Holotype
Diener, 1916, p. 455, pl 1, figs. 1a, 1b
New Siberian Islands; Kotelny Island, at the head of Balykatch River
Upper Triassic, Noric

8769 **toulai, Xenodiscus:** Smith Plastoholotype
Smith, 1932, p. 45, pl. 53, figs. 9-12
Inyo Co., Calif.; Inyo Range, Union Wash, 15 miles SE of Independence
Lower Triassic, *Owenites* subzone [holotype USNM 75007]

390 **transitionale, Hauericeras:** Waring Holotype
Waring, 1917, p. 69, pl. 9, fig. 15
Ventura Co., Calif.; Chico area in Bells Canyon, N of Simi fault
Upper Cretaceous, Chico Fm

8988 **trojanus, Tropigastrites:** Smith Plastoholotype
Smith, 1914, p. 65, pl. 29, figs. 1-4
West Humboldt Range, Nevada; Fossil Hill
Middle Triassic [holotype USNM 74281]

8860 **tuberculatum, Meekoceras:** Smith Plastoholotype
Smith, 1932, p. 62, pl. 50, figs. 1-3
Inyo Co., Calif.; Union Wash, 15 miles SE of Independence
Lower Triassic, *Meekoceras* zone [holotype USNM 74995]

6465 **tuberculatus, Prionites:** Waagen Plastoholotype
Waagen, 1895, p. 58, pl. 5, fig. 2
Punjab, India; Salt Range, Chidroo
Triassic, Ceratite [holotype Palaeont. Inst. Wiener Univ. 4038]

8897 **ursensis, Celtites:** Smith Plastoholotype
Smith, 1932, p. 104, pl. 47, figs. 11, 12
Bear Lake Co., Idaho; Paris Canyon, 1 mile W of Paris
Lower Triassic, *Columbites* zone [holotype USNM 74987]

7603 **ventricosus, Scaphites:** Meek and Hayden Plastoholotype
Meek and Hayden, 1863, p. 22. Illustrated in Meek, 1876, p. 425, pl. 6, figs. 7a, 7b
Montana; Chippewa Point, near Fort Benton
Cretaceous, Colorado Shale (upper part) [holotype USNM 1903]

5493 **vergarensis, Macrocephalites:** Burckhardt Plastoholotype
Burckhardt, 1903, p. 29, pl. 2, figs. 18-20; pl. 3, fig. 4
Chile; Vergara, Rio Teno
Jurassic, Bathonian

7612 **vermiformis, Scaphites:** Meek and Hayden Plastoholotype
Meek and Hayden, 1863, p. 22. Illustrated *in* Meek, 1876, p. 423, pl. 6, figs. 4a, 4b
Montana; Chippewa Point, near Fort Benton
Cretaceous, Colorado Shale (upper part) [holotype USNM 1902]

9071 **vogdesi, Lecanites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 139, pl. 60, figs. 12-15
West Humboldt Range, Nevada; between Troy Canyon and S fork American Canyon
Middle Triassic [holotype USNM 74385]

8771 **waageni, Meekoceras (Prionolobus):** Hyatt and Smith Plastosyntype
Hyatt and Smith, 1905, p. 150, pl. 77, figs. 3-5
Inyo Co., Calif.; Inyo Range, Union Wash, 1.5 mi E of Union Spring
Lower Triassic, *Meekoceras* zone [syntypes USNM 75278]

8922 **waageni, Ussuria:** Hyatt and Smith Plastosyntypes
8923 Hyatt and Smith, 1905, p. 90, pl. 66, figs. 4-6 (type 8922); pl. 67, figs. 1, 2 (type 8923)
SE Idaho; Wood Canyon, Aspen Ridge
Lower Triassic, *Meekoceras* zone [syntype USNM 75297]

8941 **walcotti, Proptychites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 85, pl. 19, figs. 1-3
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 75270]

7610 **warreni, Scaphites:** Meek and Hayden Plastoholotype
Meek and Hayden, 1860, p. 177. Illustrated *in* Meek, 1876, p. 420, pl. 6, fig. 5
S. Dakota; southern base of Black Hills
Cretaceous, Carlisle Shale (upper part) [holotype USNM 225]

9088 **weaveri, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 82, pl. 98, figs. 4-7
Desatoya Mts., Nevada; New Pass
Middle Triassic [holotype USNM 74455]

10026 **webergi, Pelekodites:** Imlay Paratype
Imlay, 1973, pp. 73-74, pl. 34, fig. 19
Grant Co., Ore.; SE 1/4 SW 1/4 Sec. 29, T 18 S, R 26 E, S slope pyramidal hill directly S of South Ammonite Hill
Middle Jurassic, Bajocian, Snowshoe Fm, Weberg Mbr, 100' below top

5898 **welleri, Gonioloboceras:** Smith Lectotype
Smith, 1903, p. 125, pl. 21, figs. 3, 4 (designated lectotype by Elias, 1938, p. 94, 97, pl. 19, figs. 1a, 1b)
Young Co., Texas; W of Marr's Hill, Graham
Pennsylvanian, Graham Fm, Cisco group

5616 **welleri, Gonioloboceras:** Smith Paralectotype
Smith, 1903, p. 125, pl. 21, figs. 1, 2 (designated lectotype by Elias, 1938, p. 94, pl. 19, figs. 3a, 3c)
Young Co., Texas; W of Marr's Hill, Graham
Pennsylvanian, Graham Fm, Cisco group

5617 **welleri, Gonioloboceras:** Smith Paratypes
5620 Smith, 1903, p. 125, pl. 21, fig. 3 (type 5617)
Young Co., Texas; W of Marr's Hill, Graham
Pennsylvanian, Graham Fm, Cisco group

5618 **welleri, Gonioloboceras:** Smith Paratypes
5619 Smith, 1903, p. 125, pl. 20, figs. 9-11 (type 5618). Also *in* Elias, 1938, p. 94, 97, pl. 19, figs. 4a, 4b (type 5618); pl. 19, figs. 2a, 2b (type 5619)
Young Co., Texas; W of Marr's Hill, Graham
Pennsylvanian, Graham Fm, Cisco group

8321 **wilkinsoni, Engonoceras:** Packard Holotype
Packard, 1956, pp. 399-401, fig. 1
Wheeler Co., Ore.; Mitchell Qd, SW 1/4, SE 1/4 Sec. 29, T 11 N, R 22 E
Cretaceous

9089 **williamsi, Ceratites:** Smith Plastoholotype
Smith, 1914, p. 82, pl. 47, figs. 11-14
West Humboldt Range, Nevada; N fork Cottonwood Canyon
Middle Triassic [holotype USNM 74358]

8927 **woodini, Sturia:** Smith Plastoholotype
Smith, 1932, p. 94, pl. 51, figs. 5, 6
Inyo Co., Calif.; Inyo Range, Union Wash
Lower Triassic, *Meekoceras* zone [holotype USNM 74997]

7801 **woodsi, Mortoniceras:** Spath Plastoholotype
Spath, 1921, p. 232, pl. 21, fig. 1
Zululand, South Africa; Umkwelane Hill, Umfolozi
Cretaceous [holotype in South African Museum]

119 **wyomingensis, Metoicoceras:** Reagan Holotype
Reagan, 1924, p. 181, pl. 19, figs. 1, 2
Big Horn, Wyoming; Salt Creek region
Cretaceous, Colorado Fm

9043 **yatesi, Hungarites:** Hyatt and Smith Plastoholotype
Hyatt and Smith, 1905, p. 129, pl. 30, figs. 1-4
Inyo Co., Calif.; Inyo Range, Union Wash
Middle Triassic [holotype USNM 74292]

8429 **yokoyamai, Gaudryceras:** Yabe Plastoholotype
Yabe, 1904, p. 36, pl. 6, fig. 1
Hokkaido, Japan
Cretaceous [holotype Kyushu Univ. GT-I-197]

8939 **zitteli, Owenites:** Smith Plastoholotype
Smith, 1932, p. 100, pl. 52, figs. 1-3
Inyo Co., Calif.; Inyo Range, Union Wash, 15 miles SE of Independence
Lower Triassic, *Owenites* subzone [holotype USNM 75000]

SCAPHOPODA

5445 **hannai, Dentalina:** Baker — Paratype
Baker, 1925, p. 84
Gulf of California; off South Coronado Island, 10-18 fms

6398 **vallicolens, Dentalium:** Raymond — Paratype
Raymond, 1904, p. 123. Illustrated in Oldroyd, 1927, p. 13, pl. 1, fig. 2
Santa Monica Bay, Calif.; off Redondo, 145 fms

6397 **vallicolens, Dentalium:** Raymond — Paratypes
6399 Raymond, 1904, p. 123
Santa Monica Bay, Calif.; off Redondo, 145 fms

GASTROPODA

9311 **ablita, Epiginella:** Laseron — Paratype
Laseron, 1957, p. 291
Queensland, Australia; Rocky Island

6259 **abreojosensis, Melanella (Melanella):** Bartsch — Paratypes
Bartsch, 1917, p. 315
Baja California, Mexico; Point Abreojos

9964 **acclivicosta, Bellaspira:** McLean and Poorman — Paratype
McLean and Poorman, 1970, pp. 6-8
Sonora, Mexico; 1 km S of the E point at entrance to Bahia San Carlos, 27° 56′ N, 111° 03′ W, 15-20 fms, rock and shell substrate

7863 **acerva, Uberella:** Laws — Paratype
Laws, 1933, p. 321
Blue Cliffs, South Canterbury, New Zealand
Lower Miocene, White Rock River Fm

9507 **acutapex, "Acmaea":** Berry — Holotype
Berry, 1960, p. 117. Illustrated in Keen, 1971, p. 323, fig. 45 (as *Collisella*)
Sonora, Mexico; Punta Cholla, W of Puerto Penasco

6528 **adelae, Cancellaria reticulata:** Pilsbry — Paratype
Pilsbry, 1940, p. 54
Little Duck Key, Fla.

10285 **adusta, Arena:** McLean — Paratype
McLean, 1970c, p. 123
Baja California, Mexico; cove adjoining W sides of Isla Partida and Espiritu Santo Islands, 24° 25′ N, 110° 25′ W. LACM Sta. 66-28 hermit crab specimen from approx. low water line

7089 **aedificata, Turritella uvasana:** Merriam — Plastoholotype
Merriam, 1941, p. 90, pl. 17, fig. 11
Contra Costa Co., Calif.; Carquinez Qd, Vine Station UCMP loc. 1421
Eocene, "Domengine" Fm [holotype UCMP 33988]

8710 **agna, Tectonatica:** Woodring — Paratypes
Woodring, 1957, p. 88
Panama Canal Zone; Panama R.R. cut, 3500′ SE of Gatun Station
Miocene, middle Gatun Fm

8069 **agnesae, Micrarionta:** Kanakoff — Paratypes
Kanakoff, 1950, p. 85
San Clemente Island, Calif.; China Point
Upper Pleistocene?

8612 **aguilerai, Tylostoma:** Alencaster de Cserna Paratypes
Alencaster de Cserna, 1956, p. 24
Puebla, Mexico; San Juan Raya
Cretaceous, San Juan Raya Fm

6206 **albemarlensis, Bulimulus (Naesiotus):** Dall Paratypes
Dall, 1917c, p. 377
Albermarle Island, Galápagos; near Villamil, 2300-3300′, on grass and bushes

6226 **albemarlensis, Drillia:** Pilsbry and Vanatta Syntypes
Pilsbry and Vanatta, 1902, p. 558
Albemarle Island, Galápagos; Tagus Cove

9987 **albicarinata, Littorina:** McLean Paratypes
McLean, 1970, p. 127
Concepcion Bay, Baja California, Mexico; El Requeson, 26° 38′ N, 111° 50′ W

8075 **alfi, Helminthoglypta:** Taylor Holotype
Taylor, 1954, p. 76, pl. 20, figs. 30-32
San Bernardino Co., Calif.; Barstow Hills, volcanic ash stratum in NW cor. Rainbow Basin
Upper Miocene, Barstow Fm

8076 **alfi, Helminthoglypta:** Taylor Paratypes
Taylor, 1954, p. 76
San Bernardino Co., Calif.; Barstow Hills, volcanic ash stratum in NW cor. Rainbow Basin
Upper Miocene, Barstow Fm

7908 **allyni, Ammonitella yatesi:** Chace Paratypes
Chace, 1951, p. 122
Fresno Co., Calif.; near Boyden's Cave, Kings Canyon

9994 **allyni, Terebra:** Bratcher and Burch Paratype
Bratcher and Burch, 1970a, p. 298
Tres Marias Islands, W Mexico; off Maria Madre Island, 5-10 fms

6260 **almo, Strombiformis:** Bartsch Paratypes
Bartsch, 1917, p. 342
Off San Pedro, Calif., in deep water

7134 **altacorona, Turritella inezana:** Loel and Corey Plastoholotype
Loel and Corey, 1932, p. 256, pl. 57, fig. 6. Also *in* Merriam, 1941, p. 109, pl. 25, fig. 4
Santa Barbara Co., Calif.; western Santa Ynez Mts. UCMP loc. A-602
Lower Miocene, Vaqueros Fm [holotype UCMP 31676]

8568 **altatae, Olivella (Olivella):** Burch and Campbell Paratypes
Burch and Campbell, 1963, p. 123
Sinaloa, Mexico; Altata, in sand at low tide

8348 **altispira, Neptunea:** Gabb Plastoholotype
Gabb, 1866, p. 44, pl. 14, fig. 2. Also *in* Stewart, 1927, p. 395, pl. 31, fig. 6.
Humboldt Co., Calif.; Eagle Prairie
Pliocene [holotype ANSP 4322]

5145 **amandusi, Cypraea:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 628, pl. 18, fig. 1; pl. 19, fig. 1
Baja California, Mexico; San Ignacio Arroyo, 8 kms W of San Ignacio SU loc. 66
Miocene, Isidro Fm

5124 **amandusi, Cypraea:** Hertlein and Jordan Paratype
Hertlein and Jordan, 1927, p. 628
Baja California, Mexico; San Ignacio Arroyo, 8 kms W of San Ignacio
Miocene, Isidro Fm

10070 **amara, Nicema:** Woodring — Paratypes
Woodring, 1964, p. 268
Panama; Transisthmian Highway, lat. 9° 21′ + 1100 feet N, long. 79° 49′ W SU loc. 2611 = USGS loc. 16912
Middle Miocene, lower Gatun Fm

8715 **ame, Dirocerithium:** Woodring — Paratype
Woodring, 1959, p. 175
Panama Canal Zone; Rio Casaya area USGS loc. 17166
Middle Eocene, Gatuncillo Fm

10043 **amictoideum, Cymatium (Gutturnium):** Keen — Holotype
Keen, 1971, p. 505, fig. 954
Panama Bay, off NW end San Jose Island, 27-55 m

7805 **amputatus, Homorus (Subulona):** Pilsbry — Paratypes
Pilsbry, 1919, p. 118
Medje, Belgian Congo

8509 **anactor, Turritella:** Berry — Holotype
Berry, 1957, p. 78. Ilustrated *in* Keen, 1971, p. 392, fig. 433
Baja California, Mexico; 12 miles N of San Felipe

8509a **anactor, Turritella:** Berry — Paratype
Berry, 1957, p. 78
Baja California, Mexico; 12 miles N of San Felipe

7539 **anchuela, Mitrella (Mitrella):** Keen — Holotype
Keen, 1943, p. 48, pl. 4, fig. 12
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

195 **andersoni, Lyria:** Waring — Holotype
Waring, 1917, p. 97, pl. 15, fig. 12
Ventura Co., Calif.; McCray Wells
Upper Eocene, Tejon Fm

196 **andersoni, Lyria:** Waring — Paratype
Waring, 1917, p. 97, pl. 15, fig. 12
Ventura Co., Calif.; McCray Wells
Upper Eocene, Tejon Fm

463 **andersoniana, Lioplax:** Hannibal — Holotype
Hannibal, 1912b, p. 196, pl. 8, fig. 33. Also *in* Taylor and Smith, 1971, figs. 32, 33 (as *Campeloma*)
Tesla, Calif.; 1/4 mile above Carnegie Pottery, Corral Hollow
Eocene

8704 **andrium, Teinostoma (Aepystoma):** Woodring — Paratype
Woodring, 1957, p. 70
Panama; highway 1.7 km NW of Sabanita
Miocene, Gatun Fm

8708 **anebus, Solariorbis (Haplorbis) hyptius:** Woodring — Paratype
Woodring, 1957, p. 75
Canal Zone; N end of third locks excavation SU loc. 2654
Miocene, upper Gatun Fm

6246 **angelena, Helminthoglypta tudiculata:** Berry — Paratype
Berry, 1938a, p. 21
Redlands, Calif.; NE side of lower Timoteo Canyon

317 **angelensis, Solenosteira:** Carson — Holotype
Carson, 1925, p. 32, pl. 1, figs. 3, 5
Los Angeles Co., Calif.; Puente Hills, mouth of Brea Canyon
Lower Pliocene, Fernando Fm

6563 **angelica, Acanthina:** Oldroyd — Holotype
Oldroyd, 1918a, p. 26. Illustrated *in* Keen, 1971, p. 552, fig. 1082
Gulf of California; Redondo Bay, Angel Island

6436 **angelina, Olivella biplicata:** Oldroyd Holotype
Oldroyd, T. S., 1921b, p. 119, pl. 5, fig. 6. Also *in* Oldroyd, I. S., 1927, p. 161, pl. 26, figs. 17, 17a
San Pedro, Calif.

6437 **angelina, Olivella biplicata:** Oldroyd Paratype
Oldroyd, T. S., 1921b, p. 119
San Pedro, Calif.

6140 **angigyra, Ashmunella levettei:** Pilsbry Paratypes
Pilsbry, 1905, p. 240
Huachuca Mts., Arizona; Ramsey Canyon, near Ft. Huachuca

7964 **angosturana, Cancellaria (Hertleinia):** Marks Paratype
Marks, 1949, p. 463, pl. 78, fig. 2
Ecuador; Angostura Cave, Santiago River, Esmeraldas Province
Miocene, Angostura Fm

6142 **angulata, Ashmunella:** Pilsbry Paratypes
Pilsbry, 1905, p. 244
Chiricahua Mts., Arizona; Cave Creek

8530 **anitae, Nassarina (Zanassarina):** Campbell Holotype
Campbell, 1961b, p. 26, pl. 5, fig. 4. Also *in* Keen, 1971, p. 596, fig. 1253
Guaymas, Mexico; off Cabo Haro, 30 fms

7079 **applini, Turritella:** Hanna Plastoholotype
Hanna, 1927, p. 307, pl. 49, fig. 4. Also *in* Merriam, 1941, p. 16, fig. 5 (as *Turritella uvasana applini*)
San Diego Co., Calif.; La Jolla Qd UCMP loc. 3993
Eocene, La Jolla Fm [holotype UCMP 30971]

10296 **approximatus, Bulimulus:** Dall Paratype
Dall, 1900a, p. 90
Galápagos; Hood Island

599 **apta, Galeodea:** Tegland Paratype
Tegland, 1931, p. 415, pl. 64, figs. 1, 2
Wash.; sea cliffs ½ to 3 miles E of Twin SU loc. NP 122
Oligocene, Twin Rivers Fm

8093 **arenaense, Bittium (Lirobittium):** Hertlein and Strong Paratypes
Hertlein and Strong, 1951a, p. 107
Gulf of California; Arena Bank, 23° 32′ N, 109° 25′ W, 45 fms

8090 **arenensis, Cymatosyrinx:** Hertlein and Strong Paratype
Hertlein and Strong, 1951a, p. 76
Gulf of California; near Arena Bank, 23° 32′ N, 109° 27′ W, 55 fms

6581 **aresta, Margarites (Lirularia):** Berry Paratype
Berry, 1941, p. 13
San Pedro, Calif.; upper sands at Hilltop Quarry
Lower Pleistocene, Lomita Fm

6178 **argus, Sonorella:** Edson Paratype
Edson, 1912, p. 37
Inyo Co., Calif.; Iron Cap Mine, Argus Range

9737 **arnaldoi, Epitonium (Epitonium):** Tursch and Pierret Holotype
Tursch and Pierret, 1964, p. 36, fig. 4
Rio de Janeiro, Brazil; off Punta de Juatinga, 23° 22′ S, 48° 28′ W, 50 m

6534 **arnoldi, Melanella (Balcis):** Bartsch Paratype
Bartsch, 1917, p. 322
San Pedro, Calif.; Deadman's Island, Sand Rock
Pleistocene, San Pedro Fm

7621 **arnoldi, Turcicula:** Durham Holotype
Durham, 1944, p. 153, pl. 15, fig. 10
Port Townsend, Wash.; Scow Bay, S shore of Mystery Inlet SU loc. NP 126
Middle Oligocene, Marrowstone Shale

7622 **arnoldi, Turcicula:** Durham Paratype
Durham, 1944, p. 153
Port Townsend, Wash.; Scow Bay, S shore of Mystery Inlet SU loc. NP 126
Middle Oligocene, Marrowstone Shale

8515 **artia, Pleuroliria:** Berry Holotype
Berry, 1957, p. 82. Illustrated *in* Keen, 1971, p. 708, fig. 1648 [as *Polystira oxytropis* (Sowerby, 1834)]
Gulf of California; off Angel de la Guarda Island, 67 fms

304 **ashleyi, Cantharus:** Carson Holotype
Carson, 1925, p. 31, pl. 1, figs. 6, 7
Los Angeles Co., Calif.; San Fernando, near tunnel
Pliocene, Fernando Fm

305 **ashleyi, Cantharus:** Carson Paratype
Carson, 1925, p. 31
Los Angeles Co., Calif.; Camulos sheet, Gavin Canyon
Pliocene, Fernando Fm

5381 **ashleyi, Lirofusus:** Arnold Paratypes
5382 Arnold, 1908a, p. 372
5383 Santa Cruz Co., Calif.; San Lorenzo River, 3 miles above Boulder Creek
Oligocene, San Lorenzo Fm

6139 **ashmuni, Polygyra:** Dall Paratypes
Dall, 1897b, p. 342
Bland, New Mexico

9835 **aureola, Pyrene:** Howard Paratypes
Howard, 1963a, p. 2. [= *Pyrene aureomexicana* Howard, 1963b]
Sonora, Mexico; Puerto Penasco, Norse Beach

6162 **avalonensis, Helix:** Hemphill Paratypes
Hemphill, 1911, p. 104
Santa Catalina Island, Calif.

6567 **avawatzica, Micrarionta (Eremarionta):** Berry Paratypes
Berry, 1930c, p. 190
San Bernardino Co., Calif.; Avawatz Mts., 5 miles S of Cave Spring

8331 **avenosooki, Margarites:** MacGinitie Paratype
MacGinitie, 1959, p. 77, pl. 1, fig. 8
About 4 miles off Point Barrow, Alaska, 70 fms

8611 **azteca, Nerinea:** Alencaster de Cserna Paratype
Alencaster de Cserna, 1956, p. 37
Puebla, Mexico; San Juan Raya
Lower Cretaceous, San Juan Raya Fm

10284 **badia, Agladrillia:** McLean and Poorman Paratype
McLean and Poorman, 1971, p. 94, fig. 11
Galápagos; off S coast Isla Santa Cruz, 0° 47′ S, 90° 21′ W, 170-200 m

6043 **bakeri, Gundlachia:** Pilsbry in Baker Paratype
Pilsbry *in* Baker, Fred, 1914, p. 670
Paria, Brazil

8328 **baldwini, Pleurotomaria (Entemnotrochus?):** Hickman Paratype
Hickman, 1976b, p. 1095-1096
Polk Co., Ore.; Dallas Qd, SW 1/4 Sec. 25, T 7 S, R 6 W, Ellendale Basalt Quarry SU loc. 3221 = UCMP A4753
Early Eocene, Siletz River volcanics

8329 **baldwini, Pleurotomaria (Entemnotrochus?):** Hickman Paratype
Hickman, 1976b, p. 1095-1096, pl. 2, figs. 6, 7
Polk Co., Ore.; Dallas Qd, SW 1/4 Sec. 25, T 7 S, R 6 W, Ellendale Basalt Quarry SU loc. 3221 = UCMP A4753
Early Eocene, Siletz River volcanics

8329a **baldwini, Pleurotomaria (Entemnotrochus?):** Hickman Paratype
Hickman, 1976b, p. 1095-1096, pl. 2, fig. 5
Polk Co., Ore.; Dallas Qd, SW 1/4 Sec. 25, T 7 S, R 6 W, Ellendale Basalt Quarry SU loc. 3221 = UCMP A4753
Early Eocene, Siletz River volcanics

6592 **bandera, Persicula:** Coan and Roth Paratypes
Coan and Roth, 1965, p. 67
Jalisco, Mexico; Banderas Bay

8341 **baratariae, Corambella:** Harry Paratypes
Harry, 1953, pp. 1-9
Lower Barataria Bay, La., in oyster beds

6154 **barbata, Oreohelix:** Pilsbry Paratypes
Pilsbry, 1905, p. 279
Chiricahua Mts., Arizona; Cave Creek Canyon

9923 **bassetti, Protorcula:** Smith Plastoholotype
Smith, 1927, p. 109, pl. 101, fig. 7
SE Alaska; Gravina Island, N arm Threemile Cove
Upper Triassic [holotype USNM 74197]

8664 **baxteriana, Monadenia fidelis:** Talmadge Paratype
Talmadge, 1954, p. 52
Curry Co., Ore.; Sisters Rocks

115 **beali, Conus:** Carson Holotype
Carson, 1926, p. 49, pl. 1, fig. 2
Orange Co., Calif.; Puente Hills
Pliocene, Fernando Fm

6526 **beali, Marginella:** McGinty Paratypes
McGinty, 1940, p. 63
Off Lake Worth, Fla., 84 fms

8670 **beaui, Tricolia affinis:** Robertson Paratypes
Robertson, 1958, p. 265
Barbados; Bathsheba

8046 **beebei, Trophon (Boreotrophon):** Hertlein and Strong Paratypes
Hertlein and Strong, 1947b, p. 79
Gulf of California; Gorda Banks, S end of the gulf

7846 **bellamaris, Neosimnia:** Berry Holotype
Berry, 1946b, p. 191, fig. 1, as *bella-maris*
Off entrance to San Diego Bay, Calif.; 18 fms

7846a **bellamaris, Neosimnia:** Berry Paratype
Berry, 1946b, p. 191, as *bella-maris*
Off entrance to San Diego Bay, Calif.; 18 fms

9172 **belvederica, Berthelinia (Edenttellina) chloris:** Keen and Smith Paratype
Keen and Smith, 1961, pp. 53-54
Baja California, Mexico; Puerto Ballandra, Candelero Bay, Espiritu Santo Island, off La Paz

8062 **bermudezi, Cyclostremiscus:** Aguayo and Borro Paratype
Aguayo and Borro, 1946a, p. 10
Matanzas, Cuba; Barranco E of Rio Canimar
Upper Miocene, Yumuri Fm

8064 **bermudezi, Mecoliotia:** Clench and Aguayo Paratype
Clench and Aguayo, 1936, p. 92
Matanzas, Cuba; near mouth of Rio Canimar
Upper Miocene [erroneously cited as Pleistocene]

9990 **berryi, Cantharus (Gemophos):** McLean Paratypes
McLean, 1970a, p. 314
Jalisco, Mexico; Banderas Bay, off La Cruz, in 10-15 fms

9752 **berryi, Homalopoma:** McLean Paratypes
McLean, 1964, p. 132
San Pedro, Calif.; on bluff E of 22nd St.
Pleistocene, Timms Point Fm

8622 **bicarinata, Clathrodrillia (Carinodrillia):** Shasky Holotype
Shasky, 1961, p. 21, pl. 4, fig. 10
Gulf of California; off Isla Espiritu Santo, 45-90 fms

10204 **biconica, Comitas (Boreocomitas):** Hickman Paratype
Hickman, 1976, p. 44-46, pl. 2, fig. 6
NW Ore. SU loc. Holman 46
Eocene, Cowlitz Fm

10205 **biconica, Comitas (Boreocomitas):** Hickman Paratype
Hickman, 1976, p. 44-46
NW Ore. SU loc. Holman 46
Eocene, Cowlitz Fm

8681 **biconica, Siphonalia declivis:** Makiyama Paratypes
Makiyama, 1941, p. 85
Shizuoka Prefecture, Japan; Tonbe, near Kakegawa
Pliocene, Nango Fm

9749 **bicostata, Lirularia:** McLean Paratype
McLean, 1954, p. 129
Gulf of California; off N side of Middle Coronado Island, 15 m

8656 **bifasciata, Nassa perpinguis:** Berry Holotype
Berry, 1908, p. 39
San Pedro, Calif.

9174 **billeeana, Scalina:** DuShane and Bratcher Paratype
DuShane and Bratcher, 1965, p. 160
Gulf of California; SW end of Cerralbo Island, 8-10′

6243 **binneyanum, Glyptostoma pilsbryanum:** Berry Paratype
Berry, 1938c, p. 56
Los Angeles Co., Calif.; Dominguez Hills

8358 **blakeana, Pyrgulopsis:** Taylor Paratypes
Taylor, 1950, p. 30
Imperial Co., Calif.; Salton Sea, shore by Fish Springs
Upper Pleistocene

6517 **boninensis, Patella:** Pilsbry Paratype
Pilsbry, 1891, p. 79
Bonin Islands, Japan; Ogasawa

6045 **bormanni, Epitonium (Nitidoscala) tinctum:** Strong Paratypes
Strong, 1941, p. 47
San Diego Co., Calif.; Mission Bay

5157 **bosei, Turritela:** Hertlein and Jordan Syntype
Hertlein and Jordan, 1927, p. 634, pl. 21, fig. 1
Baja California, Mexico; San Ignacio Arroyo, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

5893 **bosei, Turritella:** Hertlein and Jordan Syntype
Hertlein and Jordan, 1927, p. 634, pl. 21, fig. 2. Also *in* Merriam, 1941 p. 114, pl. 29, fig. 3 (as *Turritella ocoyana bosei*)
Baja California, Mexico; San Ignacio Arroyo, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm [middle Miocene, *fide* Merriam, 1941]

193 **boundeyi, Bathytoma:** Waring Holotype
Waring, 1917, p. 81
Ventura Co., Calif.; Simi Hills, Calabasas sheet SU loc. 2695
Eocene, Martinez Fm

8025 **brandi, Amnicola:** Drake Paratypes
Drake, 1953, p. 27
Chihuahua, Mexico; Las Palomas, Distrito Galeana

510 **branneri, Cerithium:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 70. Illustrated *in* Wiedey, 1929b, p. 25, pl. 1, fig. 6. [Renamed *Cerithium ? teslaensis* Hanna by Hanna, 1924, p. 162]
Alameda Co., Calif.; 1 mile N 20° W of Tesla and Corral Hollow
Upper Cretaceous, middle Chico Fm

6188 **branneri, Drymaeus:** Baker Paratypes
Baker, 1914, p. 637
Matto Grosso, Brazil; Madeira-Mamore R.R., 292 km above Porto Velho

6190 **branneri, Odontostomus (Cyclodontina):** Dall Paratype
Dall, 1909b, p. 363
Bahia, Brazil; Rio San Francisco, Serra do Mulato

216 **branneri, Searlesia:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 159, pl. 30, figs. 3a, 3b
Vancouver Island, British Columbia, Canada; W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

7546 **bravoensis, Turbonilla (Pyrgiscus):** Keen Holotype
Keen, 1943, p. 51, pl. 4, fig. 26
Kern Co., Calif.; Caliente Qd in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

7546a **bravoensis, Turbonilla (Pyrgiscus):** Keen Paratype
Keen, 1943, p. 51, pl. 4, fig. 27
Kern Co., Calif.; Caliente Qd, near center SW 1/4 Sec. 6, T 29 S, R 30 E
Miocene, Temblor Fm, Round Mountain Silt

7546b **bravoensis, Turbonilla (Pyrgiscus):** Keen Paratype
Keen, 1943, p. 51, pl. 4, fig. 20
Kern Co., Calif.; Caliente Qd, near center SW 1/4 Sec. 6, T 29 S, R 30 E
Miocene, Temblor Fm, Round Mountain Silt

116 **breaensis, Astrea:** Carson Holotype
Carson, 1926, p. 57, pl. 4, figs. 3, 4
Orange Co., Calif.; Puente Hills, at mouth of Brea Canyon
Lower Pliocene, Fernando Fm

306 **breaensis, Cantharus:** Carson Holotype
Carson, 1925, p. 31, pl. 1, fig. 2
Los Angeles Co., Calif.; Puente Hills, at mouth of Brea Canyon
Lower Pliocene, Fernando Fm

307 **breaensis, Cantharus:** Carson Paratype
Carson, 1925, p. 31
Los Angeles Co., Calif.; Camulos Qd
Lower Pliocene, Fernando Fm

8098 **bristolae, Calotrophon:** Hertlein and Strong Paratype
Hertlein and Strong, 1951a, p. 87
Gulf of California; Gorda Banks, lat. 23° 01′ N, long. 109° 29′ W, 60 fms

8036 **burchi, Calyptraea:** Smith and Gordon Paratypes
Smith and Gordon, 1948, p. 227
Monterey Bay, Calif.; off Del Monte, 15 fms

5152 **burkhardti, Terebra:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 632, pl. 21, fig. 6
Baja California, Mexico; San Ignacio Arroyo, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

6218 **buttoni, Cypraea undata:** Oldroyd Holotype
Oldroyd, 1916, p. 107. [Renamed *Palmadusta diluculum virginalis* by Schilder and Schilder, 1938, p. 160]
Fiji Islands

5774 **buttoni, Stagnicola proxima:** Henderson ex Baker Ms Holotype
Henderson, 1934b, pl. 14, fig. 4 center. Described *in* Baker, 1934b, p. 18 [as *S. palustris buttoni*]
Near Salt Lake City, Utah

5774a **buttoni, Stagnicola proxima:** Henderson ex Baker Ms Paratype
Henderson, 1934b, pl. 14, fig. 4 left. Described *in* Baker, 1934b, p. 18 [as *Stagnicola palustris buttoni*]
Near Salt Lake City, Utah

5774b **buttoni, Stagnicola proxima:** Henderson ex Baker Ms Paratype
Henderson, 1934b, pl. 14, fig. 4 right. Described *in* Baker, 1934b, p. 18 [as *Stagnicola palustris buttoni*]
Near Salt Lake City, Utah

9500 **californiana, Rimula:** Berry Holotype
Berry, 1964, p. 147
Santa Catalina Island, Calif.; Long Point, NE bay, 9-25 fms

9504 **californianus, Melampus olivaceous:** Berry Holotype
Berry, 1964, p. 153
San Diego Co., Calif.; Pacific Beach, N shore of Mission Bay

266 **californica, Aporrhais:** Gabb Paratypes
Gabb, 1864, p. 128
Siskiyou Mts., Calif.
Cretaceous

6569 **californica, Oreohelix:** Berry Paratypes
Berry, 1931c, p. 115
NE San Bernardino Co., Calif.; at 7500′ on W slope of Clark Mt.

5320 **californica, Strepsidura:** Arnold Paratype
Arnold, 1908a, p. 370
Santa Cruz Co., Calif.; Kings Creek, 1/2 mile above San Lorenzo River
Oligocene, San Lorenzo Fm

6446 **californicum, Sinum:** Oldroyd Holotype
Oldroyd, I. S., 1917, p. 13. Also *in* Oldroyd, I. S., 1927, p. 130, pl. 92, figs. 13, 14
San Pedro, Calif.

8627 **californicus, Megomphix:** Smith Paratypes
Smith, 1960, pp. 1-3
Trinity Co., Calif.; Natural Bridge Cave

6272 **californicus, Pleurobranchus:** Dall Syntypes
Dall, 1900c, p. 92
San Pedro, Calif.

8343 **californicus, Velates:** Vokes Plastosyntype
Vokes, 1935, p. 384, pl. 26, figs. 3, 5
Simi Valley, Calif. UCMP loc. 3792
Eocene, lower Llajas Fm [syntype UCMP 15482]

8344 **californicus, Velates:** Vokes Plastosyntype
Vokes, 1935, p. 384, pl. 26, fig. 4
Simi Valley, Calif. UCMP loc. 3792
Eocene, lower Llajas Fm [syntype UCMP 15483]

5853 **californiense, Helisoma tenue:** Baker Holotype
Baker, 1934a, p. 140
Santa Clara Co., Calif.; San Jose, Guadalupe Creek

472 **calli, Valvata:** Hannibal Holotype
Hannibal, 1910, p. 107. Illustrated *in* Taylor and Smith, 1971, figs. 47, 48, 51, 52
Near Summer Lake, Ore.
Quaternary, upper Lahontan [Pliocene, probably Blancan, *fide* Taylor and Smith]

6557 **callidina, Monadenia fidelis:** Berry Paratype
Berry, 1940a, p. 13
Del Norte Co., Calif.; S side of Klamath River, near mouth

8651 **callidinus, Muricanthus:** Berry Holotype
Berry, 1958a, p. 84. Illustrated *in* Keen, 1971, p. 523, fig. 1000 (left)
Costa Rica; Bahia Culebra

6165 **callinepius, Micrarionta (Eremarionta):** Berry Paratypes
Berry, 1930b, p. 544
San Diego Co., Calif.; S slope Santa Rosa Mts., E of mouth of Rockhouse Canyon

8572 **callista, Thyca (Bessomia):** Berry Paratype
Berry, 1959, p. 110
Sonora, Mexico; Bahia San Carlos, near Guaymas, 3-4 fms

9836 **calodinota, Mitra (Tiara):** Berry Holotype
Berry, 1960, p. 121. Illustrated *in* Keen, 1971, p. 644, fig. 1435
Gulf of Nicoya, Costa Rica; off Islas Tortugas

8620 **campbelli, Trigonostoma:** Shasky Holotype
Shasky, 1961, p. 20, pl. 4, fig. 5
Sonora, Mexico; off Cabo Haro, 30-50 fms

8512 **capitanea, Hanetia:** Berry Holotype
Berry, 1957, p. 80. Illustrated *in* Keen, 1971, p. 563, fig. 1118
Baja California, Mexico; about 8 miles N of San Felipe

7791 **caribaea, Rissoella (Phycodrosus):** Rehder Paratypes
Rehder, 1943, p. 194
Bonefish Key, Fla.

6593 **carmelensis, Skenea:** Smith and Gordon Paratype
Smith and Gordon, 1948, p. 239
Carmel Bay, Calif.; 25 fms

6042 **Carmen, Bulimulus:** Pilsbry and Lowe Paratypes
Pilsbry and Lowe, 1932b, p. 50
Baja California, Mexico; Salinas Bay, Carmen Island

6217 **caroli, Opisthosiphon:** Aguayo Paratypes
Aguayo, 1932a, p. 94
Cuba; Loma de la Caridad, Holguin, Oriente

7965 **casicalva, Cancellaria:** Marks Paratype
Marks, 1949, p. 464
Ecuador; near Jerusalém, Guayas Province
Middle Miocene, Daule Fm

5826 **castanea, Chilina:** Marshall Paratypes
Marshall, 1924, p. 2
Chubut Province, Argentina; Rio Corcavado

9716 **castellum, Crucibulum:** Berry Holotype
Berry, 1963, p. 143. Illustrated *in* Keen, 1971, p. 465, fig. 828 (above)
Guerrero, Mexico; off Acapulco, 6-10 fms

6258 **catalinensis, Melanella (Balcis):** Bartsch Paratype
Bartsch, 1917, p. 329
Off San Pedro, Calif.; in deep water

6270 **catalinensis, Odostoma (Chrysallida):** Bartsch Paratypes
Bartsch, 1927, p. 17
Santa Catalina Island, Calif.; Isthmus Cove

6196 **catalinensis, Selenites duranti:** Hemphill in Binney Paratypes
Hemphill *in* Binney, 1890, p. 221
Santa Catalina Island, Calif.

6452 **catalinensis, Trophon:** Oldroyd Holotype
Oldroyd, I. S., 1927, p. 69, pl. 34, figs. 1, 2
Off San Pedro, Calif.; 25 fms
6453 **catalinensis, Trophon:** Oldroyd Paratype
Oldroyd, I. S., 1927, p. 69, pl. 34, fig. 4
Off San Pedro, Calif.; 25 fms
6454 **catalinensis, Trophon:** Oldroyd Paratype
Oldroyd, I. S., 1927, p. 69, pl. 34, fig. 5
Off San Pedro, Calif.; 25 fms
6929 **catalinensis, Trophon:** Oldroyd Paratypes
Oldroyd, I. S., 1927, p. 69, pl. 34, fig. 3
Off San Pedro, Calif.; 25 fms
6929a **catalinensis, Trophon:** Oldroyd Paratypes
Oldroyd, I. S. 1927, p. 69
Off San Pedro, Calif.; 25-30 fms
10046 **caulerpae, Mitrella:** Keen Paratype
Keen, 1971, p. 590, fig. 1232
Baja California, Mexico; Puerto Ballandra, about 10 miles NE of La Paz, in sand among holdfasts of the green alga *Caulerpa*
10334 **cavagnaroi, Naesiotus:** Smith Paratype
Smith, 1972, pp. 12-17
Galapagos; Isla Santa Cruz, near top of Mt. Crocker CAS loc. 27538
10334a **cavagnaroi, Naesiotus:** Smith Paratype
Smith, 1972, pp. 12-17
Galapagos; Isla Santa Cruz, 2 miles W of Mt. Crocker on ground under small trees CAS loc. 43333
10334b **cavagnaroi, Naesiotus:** Smith Paratype
Smith, 1972, pp. 12-17
Galapagos; Isla Santa Cruz, ca. 7 km NE of Santa Rosa, *Scalesia* zone CAS loc. 40303
10334c **cavagnaroi, Naesiotus:** Smith Paratype
Smith, 1972, pp. 12-17
Galapagos; Isla Santa Cruz, top of Mt. Crocker, 2900′ elev., sedge fern zone CAS loc. 27537
477 **cerritensis, Ocinebra lurida:** Arnold Paratype
Arnold, 1903, p. 258
Los Angeles Co., Calif.; Los Cerritos, Long Beach
Pleistocene, upper San Pedro Fm
6555 **chaceana, Monadenia:** Berry Paratype
Berry, 1940a, p. 9
Siskiyou Co., Calif.; Badger Mts., W side of Shasta Canyon
5834 **chacei, Goniobasis:** Henderson Paratypes
Henderson, 1935, p. 2
Del Norte Co., Calif.; near Crescent City
6577 **chacei, Moniliopsis:** Berry Paratype
Berry, 1941, p. 6
San Pedro, Calif.; Hilltop Quarry
Lower Pleistocene, Lomita Fm
7071 **chaneyi, Turritella:** Merriam Plastoholotype
Merriam, 1941, p. 71, pl. 6, fig. 8
Santa Clara Co., Calif.; Pacheco Pass region UCMP loc. 10043
Upper Cretaceous, upper Moreno Fm [holotype UCMP 33954]
6573 **charybdis, Verticumbo:** Berry Holotype
Berry, 1940b, p. 154, pl. 17, figs. 6, 7
San Pedro, Calif.; alley S of Second St. and E of Pacific St.
Lower Pleistocene, San Pedro Fm

6573a **charybdis, Verticumbo:** Berry Paratype
Berry, 1940b, p. 154
San Pedro, Calif.; alley S of Second St. and E of Pacific St.
Lower Pleistocene, San Pedro Fm

7086 **chehalisensis, Turritella uvasana:** Merriam Plastoholotype
Merriam, 1941, p. 94, pl. 16, fig. 13
Grays Harbor Co., Wash.; near Balch UCMP loc. 7170
Eocene, Cowlitz Fm [holotype UCMP 33891]

10065 **cheloma, Cymia (Cymia):** Woodring Paratype
Woodring, 1959, pp. 223-224
Panama; N side Transisthmian Highway, knoll ca. 30 m N of highway, 1.2 km NW of Sabanita SU loc. 2611 = USGS loc. 16912
Middle Miocene, lower Gatun Fm

6166 **chiricahuana, Holospira:** Pilsbry Paratypes
Pilsbry, 1905, p. 219
Fort Bowie, Arizona; Chiricahua Mts.

6155 **chiricahuana, Oreohelix (Radiocentrum):** Pilsbry Paratypes
Pilsbry, 1905, p. 283
Chiricahua Mts., Arizona; Cave Creek Canyon

5523 **civitella, Odostomia (Evalea):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 32
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

6152 **clappi, Oreohelix:** Ferriss Paratypes
Ferriss, 1904, p. 53
Chiricahua Mts., Arizona; Cave Creek Canyon

6194 **clappi, Punctum:** Pilsbry Paratypes
Pilsbry, 1898, p. 133
Seattle, Wash.

797 **clarki, Ancistrolepis:** Tegland Paratype
Tegland, 1933, p. 3, pl. 12, fig. 17
Twin, Wash.; sea cliffs W of Twin River, for a distance of 3/4 mile
SU loc. NP 120
Oligocene, Twin River Fm

5948 **clarki, Epitonium:** Oldroyd Holotype
Oldroyd, T. S., 1921a, p. 115, pl. 5, fig. 13
Los Angeles Co., Calif.; Santa Monica
Pleistocene, upper San Pedro Fm

5518 **clarki, Epitonium:** Oldroyd Paratype
Oldroyd, T. S., 1921a, p. 115
Los Angeles Co., Calif.; Santa Monica
Pleistocene, upper San Pedro Fm

7219 **clarki, Turritella:** Dickerson Plastoholotype
Dickerson, 1914, p. 142, pl. 13, fig. 8. Also *in* Merriam, 1941, p. 128, pl. 39, fig. 6 (as *Mesalia*)
Contra Costa Co., Calif.; Stewartville UCMP loc. 1540
"Eocene," Martinez Fm [holotype UCMP 11936]

9724 **clarki, Typhis (Typhisopsis):** Keen and Campbell Holotype
Keen and Campbell, 1964, p. 48, figs. 15, 19. Also *in* Keen, 1971, p. 540, fig. 1050
Panama Bay; Venado Island, intertidally at -3.0′ tide

9725 **clarki, Typhis (Typhisopsis):** Keen and Campbell Paratype
Keen and Campbell, 1964, p. 48, fig. 23
Panama Bay; Venado Island, intertidally at -3.0′ tide

8354 **clarkiana, Bathytoma:** Rivers Plastosyntypes
8354a Rivers, 1913, p. 29, illust. opp. p. 29
San Pedro, Calif.
Upper Pleistocene

8257 **clavella, Balcis (Balcis):** Berry Paratype
Berry, 1954b, p. 259
Santa Monica, Calif; Long Wharf Canyon
Upper Pleistocene

6193 **clementina, Pupa:** Sterki Syntype
Sterki, 1890, p. 44
San Clemente Island, Calif.

10299 **cocosensis, Vertigo:** Dall Paratype
Dall, 1900a, p. 98
Cocos Island, Costa Rica

9721 **coei, Crepidula:** Berry Holotype
Berry, 1950, p. 35. Illustrated *in* McLean, 1969, pp. 35-36, fig. 18.3
Orange Co., Calif.; SE of Seal Beach

5510 **collisella, Turbonilla (Pyrgolampros):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 25
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

111 **collomi, Thais (Nucella):** Carson Holotype
Carson, 1926, p. 57, pl. 4, fig. 2
Santa Barbara Co., Calif.; 1/2 mile N of Schuman in R.R. cut, Santa Maria district
Lower Pliocene, Fernando Fm

137 **collomi, Thais (Nucella):** Carson Paratype
Carson, 1926, p. 57, pl. 4, fig. 1
Santa Barbara Co., Calif.; 1/2 mile N of Schuman in R.R. cut, Santa Maria district
Lower Pliocene, Fernando Fm

5831 **columbiana, Fluminicola:** Pilsbry Paratypes
Pilsbry, 1899a, p. 125. [species attributed to Hemphill by some authors, but Pilsbry is correct]
Columbia River, near Wallula, Wash.

5806 **columbiana, Physa:** Hemphill Syntypes
5807 Hemphill, 1890, p. 27
Astoria, Ore.; Columbia River

5829 **compacta, Cochliopa:** Pilsbry Paratypes
Pilsbry, 1910, p. 99
San Luis Potosi, Mexico; Choy River at cave 3 miles S of Las Palmas

400 **compressus, Gyrodes:** Waring Holotype
Waring, 1917, p. 67, pl. 9, fig. 6
Calabasas sheet, Calif.; near Ventura-Los Angeles Co. line, N of Simi fault
Upper Cretaceous, Chico Fm

7538 **conchita, Balcis:** Keen Holotype
Keen, 1943, p. 43, pl. 4, fig. 5
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

9715 **concreta, "Acmaea":** Berry Holotype
Berry, 1963, p. 142. [= *Collisella stanfordiana* (Berry, 1957), *fide* Keen, 1971, p. 325]
Baja California, Mexico; Punta San Felipe

6245 **consors, Helminthoglypta dupetithouarsi:** Berry Paratype
Berry, 1938a, p. 18
Monterey Co., Calif.; S slope San Juan grade, 8 miles NE of Salinas

8347 **constantiae, Diodora:** Kanakoff Paratypes
Kanakoff, 1953, pp. 67-70
Wilmington, Calif.; E bank Bermont Ave., 450′ S of SE cor. Sepulveda Blvd.
Upper Pleistocene, Palos Verdes Sand

644 **contignata, Ficus (Trophosycon) ocoyana:** Grant and Gale Paratype
Grant and Gale, 1931, p. 749, pl. 30, fig. 1
"Middle California" [central Calif., perhaps vicinity of Coalinga]
Lower Pliocene, Jacalitos Fm

5815 **cooperi, Lymnaea:** Hannibal Holotype
Hannibal, 1912b, p. 143, pl. 6, fig. 13a. Also *in* Taylor and Smith, 1971, p. 312, figs. 36, 37 (as *Fossaria*)
Santa Cruz Mts., Calif.; spring at Wright's [NW 1/4 Sec. 23, T 9 S, R 1 W, in Santa Clara Co., *fide* Taylor and Smith]

5814 **cooperi, Lymnaea:** Hannibal Paratype
Hannibal, 1912b, p. 143, pl. 6, fig. 13b. Also *in* Taylor and Smith, 1971, p. 312, fig. 40 (as *Fossaria*)
Santa Cruz Mts., Calif.; spring at Wright's, Santa Clara Co.

426 **cooperi, Pleurotoma (Dolichotoma):** Arnold Plastoholotype
Arnold, 1903, p. 203, pl. 7, fig. 3. Also *in* Grant and Gale, 1931, p. 499, pl. 25, fig. 3 (as *Surculites (Megasurcula) carpenterianus* var. *cooperi*)
Off San Pedro, Calif.; Deadman Island
Pleistocene, upper San Pedro Fm [holotype USNM; plastoholotype never received at SU]

5830 **coquillensis, Goniobasis:** Henderson Paratypes
Henderson, 1935, p. 2
Coquille River drainage, Ore.

464 **cordillerana, Heliosoma:** Hannibal Holotype
Hannibal, 1912b, p. 161, pl. 6, fig. 16; pl. 8, fig. 34. Also *in* Taylor and Smith, 1971, figs. 57, 58, 60, 61 (as *Vorticifex*)
Nevada; hill near Hawthorne, Belmont stage road
Eocene [late Miocene to early Pliocene, Esmeralda Fm, *fide* Taylor and Smith, 1971, p. 313]

247 **cornwalli, Thais:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 162, pl. 31, fig. 1
Vancouver Island, British Columbia, Canada; Jordan River, sea cliffs at mouth of Fossil Creek, 2 miles W of Sherringham Point SU loc. NP 130
Oligocene, Sooke Fm

8645 **coronadoensis, Macrarene:** Stohler Paratype
Stohler, 1959, p. 439
Gulf of California: Coronado Islands, North Island, 150′

9744 **cortezi, Crassispira (Striospira):** Shasky and Campbell Holotype
Shasky and Campbell, 1964, p. 119, pl. 22, fig. 16
Sonora, Mexico; NW of Bahia Saladita, Guaymas, 10-15 m

9830 **cortezi, Sinum:** Burch and Burch Paratype
Burch and Burch, 1964, pp. 109-110
Off West Mexico; between Mazatlán and Altata, 15 fms. Taken by shrimp trawlers

10288 **corteziana, Tegula (Agathistoma):** McLean Paratypes
McLean, 1970c, p. 119
Sonora, Mexico; S side Cabo Tepoca, 30° 16′ N, 112° 30′ W, mid intertidal LACM sta. 67-19

5824 **costata, Parapholyx:** Stearns Paratypes
Stearns, 1901, p. 291 [species not of Hemphill as cited by some authors, *fide* Henderson, 1929, p. 81]
The Dalles, Ore.; Columbia River

6515 **cowlitzensis, Turbella:** Effinger Paratypes
Effinger, 1938, p. 379
Lewis Co., Wash.; on Cowlitz River, Sec. 25, T 11 N, R 2 W
Lower Oligocene, Gries Ranch Fm

139 **crassa, Cancellaria:** Waring Holotype
Waring, 1917, p. 66, pl. 9, fig. 5. [Renamed *Cancellaria simiana* by Hanna, 1924, p. 160]
Near Ventura-Los Angeles Co. line, in Chico area of Bell's Canyon, N of Simi fault; Calabasas sheet
Cretaceous, upper Chico Fm

8350 **crassa, Cancellaria:** Nomland Plastoholotype
Nomland, 1917a, p. 237, pl. 12, figs. 7, 7a
Fresno Co., Calif.; near Coalinga, N bank of Waltham Creek
Middle Pliocene, Etchegoin Fm [holotype UCMP 11098]

9745 **crebriforma, Clathurella (Lioglyphostoma):** Shasky and Campbell Holotype
Shasky and Campbell, 1964, p. 119, pl. 22, fig. 20. Also *in* Keen, 1971, p. 761, fig. 1843
Sonora, Mexico; NW of Bahia Saladita, Guaymas, 7-10 m

7855 **crispatissima, Ocenebra:** Berry Holotype
Berry, 1953b, p. 414, pl. 28, fig. 6
Santa Catalina Island, Calif.; off Isthmus Cove, 33 fms

8097 **crockeri, Strombinoturris:** Hertlein and Strong Paratype
Hertlein and Strong, 1951b, p. 84
Gulf of California; Arena Bank, 33-35 fms

6511 **crooki, Molopophorus:** Clark Paratype
Clark, 1938, p. 715
Napa Qd, Calif.; Brink Ranch, 2 miles S of Putah Creek
Upper Eocene, Markley Fm

6163 **crotalina, Helminthoglypta:** Berry Paratypes
Berry, 1928, p. 276
Mojave Desert, Calif.; N end Granite Mts., Sidewinder Mine

8671 **cruenta, Tricolia affinis:** Robertson Paratype
Robertson, 1958, p. 267
Sao Paulo, Brazil; Bahia de Flamengo, Ubatuba

6205 **cucullinus, Bulimulus (Naesiotus):** Dall Paratypes
Dall, 1917c, p. 377
Galapagos; Hood Island, 380' elev., under stones

6179 **cuestana, Epiphragmophora dupetithouarsi:** Edson Paratypes
6180 Edson, 1912, p. 37
Santa Lucia Mts., Calif.; Cuesta Pass

9502 **cunninghamae, Trialatella:** Berry Holotype
Berry, 1964, p. 149. Illustrated *in* Keen, 1971, p. 529, fig. 1019 (as *Aspella*)
Sonora, Mexico; Puerto San Carlos, 15-35 fms

427 **curta, Pleurotoma (Borsonia) bartschi:** Arnold Plastoholotype
Arnold, 1903, p. 201, pl. 5, fig. 7
Los Angeles Co., Calif.; Deadman Island
Pleistocene, San Pedro Fm [holotype USNM; plastoholotype never received at SU]

9719 **cymatilis, Olivella (Dactylidiella):** Berry Holotype
Berry, 1963, p. 146. Illustrated *in* Keen, 1971, p. 629, fig. 1388
Baja California, Mexico; Magdalena Bay

6159 **dakani, Oreohelix hendersoni:** Henderson Paratypes
Henderson, 1913, p. 38
Colorado; 2 miles up Elk Creek from Newcastle

8655 **danai, Terebra (Strioterebrum):** Berry Holotype
Berry, 1958b, p. 96. Illustrated *in* McLean, 1969, p. 52, fig. 28.3
San Pedro, Calif.

6148 **danielsi, Ashmunella:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915b, p. 34
Socorro Co., New Mexico; Cave Spring Canyon, R 19 W, lat. 33° 27'

7982 **daulechica, Strombina:** Marks Paratypes
Marks, 1951, p. 112
SW Ecuador; Daule Basin, near Jerusalém
Middle Miocene, Daule Fm

9961 **decorata, Puncturella:** Cowan and McLean Paratype
Cowan and McLean, 1968, p. 105
Off W coast Queen Charlotte Islands, British Columbia; 53° 21.3′ N, 133° 04.1′ W, 193 m

8753 **decoris, Phyllonotus peratus:** Keen Holotype
Keen, 1960, p. 107, pl. 10, figs. 4, 5
W Mexico coast near the Guatemalan border, 15 fms

9180 **delaguerrae, Turritella schencki:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 184, pl. 23, fig. 5
Santa Barbara Co., Calif.; W of San Marcos Pass
Eocene, "Coldwater" Ss

9181 **delaguerrae, Turritella schencki:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 184, pl. 23, fig. 6
Santa Barbara Co., Calif.; W of San Marcos Pass
Eocene, "Coldwater" Ss

7988 **delgada, Fusiturricula:** Marks Paratypes
Marks, 1951, p. 127
SW Ecuador; near Las Masas, Progreso Basin
Lower Miocene, Subibaja Fm

8031 **delmontensis, Balcis:** Smith and Gordon Paratype
Smith and Gordon, 1948, p. 219
Monterey Bay, Calif.; off Del Monte, 10 fms

8473 **delorae, Ceratostoma:** Hall Holotype
Hall, 1958, p. 57, pl. 10, figs. 1-3. Also *in* Hall, 1959, p. 430, pl. 63, figs. 8-10
Alameda Co., Calif.; NW 1/4 Sec. 11, T 5 S, R 1 E, Alameda Creek SU loc. 3245
Middle Miocene, Oursan Ss

5870 **depressa, Polygyra columbiana:** Pilsbry and Henderson Holotype
Pilsbry and Henderson, 1936, p. 134, pl. 7, fig. 2
The Dalles, Ore. [retained at Univ. Colorado Museum Zoological Coll. as holotype 22519 of *Polygyra mullani depressa* "Hemphill"]

5854 **depressum, Helisoma occidentale:** Baker Paratypes
Baker, 1934a, p. 140
Klamath Lake, Ore.

10286 **deroyae, Fissurella (Cremides):** McLean Paratype
McLean, 1970c, p. 118
Galápagos; Santa Cruz Island, Academy Bay, 0° 45′ S, 90° 20′ W, on surf exposed rocks at low tide

10333 **deroyi, Naesiotus:** Smith Paratype
Smith, 1972, pp. 9-12
Galápagos; NW side Isla Santa Cruz, 870′ elev., on thorn bushes

7907 **devexa, Episcynia:** Keen Holotype
Keen, 1946, p. 9, pl. 1, figs. 1-4
Santa Barbara Co., Calif.; Santa Cruz Island, Scorpion Harbor, 2-3 fms

5823 **diagonalis, Parapholyx effusa:** Henderson Paratypes
Henderson, 1929, p. 82
Crater Lake, Ore.

10292 **diantha, Tricolia:** McLean Paratypes
McLean, 1970c, pp. 125-126
Galápagos; Albemarle (Isabela) Island, E of S end, 0° 55′ S, 90° 30′ W, 60 fms, R/V *Velero III* bottom sample 450 (not live taken)

6509 **dickersoni, Elimia:** Clark Paratype
Clark, 1938, p. 707
Napa Qd, Calif.; Pleasant Creek, 1-2 miles S of Putah Creek
Upper Eocene, Markley Fm

163 **dickersoni, Sinum:** Waring Holotype
Waring, 1917, p. 86, pl. 14, fig. 10
Ventura Co., Calif.; Martinez area, Simi Hills
Lower Eocene, Martinez Fm

5952 **diegensis, Clathrodrillia:** Oldroyd Paratypes
Oldroyd, T. S., 1921a, p. 115
San Diego Co., Calif.; Pacific Beach
Upper Pleistocene

9751 **diegensis, Macrarene:** McLean Paratypes
McLean, 1964, p. 131
San Diego Co., Calif.; Sec. 8, T 19 S, R 2 W
Pliocene, San Diego Fm

6432 **diegensis, Olivella boetica:** Oldroyd Holotype
Oldroyd, T. S., 1921b, p. 118, pl. 5, fig. 2
San Diego, Calif.

8355 **dineana, Lymnaea:** Taylor Paratypes
Taylor, 1957, p. 659, text-fig. 1, figs. 1-3
Navajo Co., Arizona; White Cone Peak, Sec. 12, T 25 N, R 21 E
Middle Pliocene, Bidahochi Fm

9513 **directa, Mitra:** Berry Holotype
Berry, 1960, p. 120. Illustrated *in* Keen, 1971, p. 644, fig. 1436 (as *Subcancilla*)
Sonora, Mexico; off Cabo Haro, Guaymas, 30-50 fms

6149 **dispar, Ashmunella danielsi:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915b, p. 41
Socorro Co., New Mexico; Little Whitewater Canyon, Mogollon Mts.

7104 **diversilineata, Turritella:** Merriam Plastoholotype
Merriam, J. C., 1897, p. 65. Illustrated *in* Clark, 1918, p. 170, pl. 22, fig. 5. Also *in* Merriam, C. W., 1941, p. 103, pl. 20, fig. 1
Vancouver Island, British Columbia, Canada; Carmanah Point
Oligocene, Blakeley Fm [Sooke Fm] [holotype UCMP 11224]

9993 **dorothyae, Terebra:** Bratcher and Burch Paratype
Bratcher and Burch, 1970a, p. 297
Off San Jose Point, Guatemala; on black sands, 7-11 fms

458 **drakei, Pachychilus:** Hannibal Holotype
Hannibal, 1912b, p. 183, pl. 8, fig. 26. Also *in* Taylor and Smith, 1971, figs. 41, 42
Wash.; Olequa Creek, below Little Falls
Eocene [late Eocene, Cowlitz Fm, *fide* Taylor and Smith, 1971, p. 311]

7534 **durhami, Ferminoscala:** Keen Holotype
Keen, 1943, p. 46, pl. 4, fig. 31
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

9204 **durhami, Trichotropis (?):** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 188, pl. 25, fig. 4
Santa Barbara Co., Calif.; Nojoqui Creek, 1200′ above Gaviota Canyon SU loc. 2908
Eocene-Oligocene, Gaviota Fm

9205 **durhami, Trichotropis (?):** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 188, pl. 25, fig. 5
Santa Barbara Co., Calif.; Gaviota Pass UCMP loc. B-7001
Eocene-Oligocene, Gaviota Fm

9206 **durhami, Trichotropis (?):** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 188, pl. 25, fig. 3
Santa Barbara Co., Calif.; near Las Cruces UCMP loc. B-6999
Eocene-Oligocene, Gaviota Fm

8261 **ebriconus, Balcis (Vitreolina):** Berry Paratype
Berry, 1954b, p. 265
San Pedro, Calif.; Hilltop Quarry
Pleistocene, Lomita

79 **egberti, Phalium (Bezoardica):** Schenck Holotype
Schenck, 1926, p. 80, pl. 13, fig. 7
Port Discovery, Wash.; sea cliffs 1/4 mile N of old Woodman Wharf
SU loc. NP 148
Oligocene, Lincoln Fm ?

80 **egberti, Phalium (Bezoardica):** Schenck Paratype
Schenck, 1926, p. 80
Port Discovery, Wash.; sea cliffs 1/4 mile N of old Woodman Wharf
SU loc. NP 148
Oligocene, Lincoln Fm ?

6203 **elaeodes, Bulimulus (Naesiotus):** Dall Paratypes
Dall, 1917c, p. 376
Galápagos; Albemarle Island, Banks Bay, at 1500-2300′ elev.

9936 **eleanorae, Lucapinella:** McLean Paratype
McLean, 1967, p. 350
Jalisco, Mexico; off La Cruz, N shore of Banderas Bay, 20° 44′ N, 105° 29′ W, from cobble bottom, 10 fms

7540 **electilis, Moniliopsis:** Keen Holotype
Keen, 1943, p. 49, pl. 4, fig. 15
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

6200 **elegans, Helix intercisa:** Hemphill Paratypes
Hemphill, 1891, p. 330
San Clemente Island, Calif.

109 **elodiae, Cancellaria:** Carson Holotype
Carson, 1926, p. 49, pl. 1, fig. 1
Santa Barbara Co., Calif.; Fugler's Point
Lower Pliocene, Fernando Fm

5848 **elrodi, Stagnicola:** Baker and Henderson Paratypes
Baker and Henderson, 1933, p. 30
Montana; W shore of Flathead Lake

310 **elsmerensis, Cantharus:** Carson Holotype
Carson, 1925, p. 32, pl. 1, fig. 4
Ventura Co., Calif.; Holser Canyon, Piru Valley
Lower Pliocene, Fernando Fm

311 **elsmerensis, Cantharus:** Carson Paratype
Carson, 1925, p. 32
Ventura Co., Calif.; Elsmere Canyon, near the forks
Lower Pliocene, Fernando Fm

5909 **empyrosia, Drillia:** Dall Holotype
Dall, 1899a, p. 127. Illustrated *in* Dall, 1902, p. 516, pl. 39, fig. 5
San Pedro, Calif.; 20-50 fms

7857 **encopendema, Turveria:** Berry Holotype
Berry, 1956b, p. 356, fig. 2. Also *in* Keen, 1971, p. 451, fig. 762
Sonora, Mexico; Cholla Cove, Bahia de Adair

8599 **englerti, Pisania:** Hertlein Paratype
Hertlein, 1960, p. 19
Easter Island

5512 **epiphanea, Turbonilla (Mormula):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 28
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

7133 **equistriata, Turritella inezana:** Merriam Plastoholotype
Merriam, 1941, p. 109, pl. 25, fig. 10
Ventura Co., Calif.; probably Ojai Valley
Lower Miocene, Vaqueros Fm [holotype UCMP 33985]

8701 **eremum, Calliostoma (Leiotrochus):** Woodring Paratype
Woodring, 1957, p. 63
Panama Canal Zone; 1 mile N of Gatun Lake SU loc. 2653
Miocene, Gatun Fm

6738 **eritrichius, Mesodon (megasoma,** subsp.?): Berry Paratypes
Berry, 1939, p. 56
Butte Co., Calif.; Table Bluff Light

9732 **erythrostigma, Siphonochelus (Siphonochelus):**
Keen and Campbell Holotype
Keen and Campbell, 1964, p. 51, pl. 10, figs. 27, 31, 35
Queensland, Australia; near Brisbane, Moreton Bay, 12 miles off Moreton Lighthouse, approx. 51 m

6144 **esuritor, Ashmunella:** Pilsbry Paratypes
Pilsbry, 1905, p. 249
Chiricahua Mts., Arizona

7074 **etheringtoni, Turritella uvasana:** Merriam Plastoholotype
Merriam, 1941, p. 94, pl. 15, fig. 14
Ventura Co., Calif.; Simi Valley UCMP loc. 7003
Eocene, "Domengine Fm" [holotype UCMP 33875]

8061 **euglyptus, Cyclostremiscus:** Aguayo and Borro Paratype
Aguayo and Borro, 1946a, p. 9
Cuba; Barranco E of Rio Canimar, Matanzas
Upper Miocene, Yumuri Fm

6739 **euthales, Mesodon megasoma:** Berry Paratype
Berry, 1939, p. 60
Del Norte Co., Calif.; Chaffay Ranch, 7 miles above mouth of Klamath River

194 **evoluta, Tornatina:** Waring Holotype
Waring, 1917, p. 99, pl. 15, fig. 8
Ventura Co., Calif.; McCray Wells
Upper Eocene, Tejon Fm

8640 **eyerdami, Beringius:** Smith Paratype
Smith, 1959, p. 5
Off Cape Flattery, Wash.; about 40 miles offshore, 100 fms

8032 **fackenthallae, Turbonilla (Turbonilla):** Smith and Gordon Paratype
Smith and Gordon, 1948, p. 220
Monterey Bay, Calif.; off Del Monte, 20-30 fms

594 **fax (?), Galeodea:** Tegland Paratype
Tegland, 1931, p. 412, pl. 59, fig. 5
Townsend's Bay, Wash.; sea cliffs between Classen's wharf and ship canal estuary SU loc. NP 125
Lower Oligocene

595 **fax (?), Galeodea:** Tegland Paratype
Tegland, 1931, p. 412, pl. 59, fig. 4
Townsend's Bay, Wash.; sea cliffs between Classen's Wharf and ship canal estuary SU loc. NP 125
Lower Oligocene

10044 **fayae, Anachis (Costoanachis):** Keen Paratype
Keen, 1971, p. 579, fig. 1178
Sonora, Mexico; Guaymas

10044a **fayae, Anachis (Costoanachis):** Keen Paratypes
Keen, 1971, p. 579
Sonora, Mexico; Guaymas

9726 **fayae, Pterotyphis (Tripterotyphis):** Keen and Campbell Paratype
Keen and Campbell, 1964, p. 54, pl. 11, fig. 40. Also *in* Keen, 1971, p. 542, fig. 1057
Jalisco, Mexico; Barra de Navidad

9726a **fayae, Pterotyphis (Tripterotyphis):** Keen and Campbell Paratypes
9726b Keen and Campbell, 1964, p. 54
Jalisco, Mexico; Barra de Navidad

9726c **fayae, Pterotyphis (Tripterotyphis):** Keen and Campbell Plastoholotype
Keen and Campbell, 1964, p. 54, pl. 11, fig. 44
Jalisco, Mexico; Barra de Navidad [holotype Santa Barbara Mus. Nat. Hist. 15999]

10289 **felipensis, Tegula (Agathistoma):** McLean Paratypes
McLean, 1970c, p. 121
Baja California del Norte, Mexico; Punta San Felipe, 31° 02′ N, 114° 49′ W, among small rocks at low tide

6199 **feralis, Helix:** Hemphill Paratypes
Hemphill, 1901, p. 121
San Nicholas Island, Calif.

106 **fergusoni, Cancellaria:** Carson Holotype
Carson, 1926, p. 53, pl. 1, fig. 8
Ventura Co., Calif.; Barlow's Ranch
Pliocene, upper San Pedro Fm

136 **fergusoni, Cancellaria:** Carson Paratype
Carson, 1926, p. 53, pl. 1, fig. 7
Santa Barbara Co., Calif.; Fugler's Point
Lower Pliocene, Fernando Fm

6143 **ferrissi, Ashmunella:** Pilsbry Paratypes
Pilsbry, 1905, p. 247
Chiricahua Mts., Arizona; Cave Creek Canyon

8102 **ferrissi, Holospira:** Pilsbry Paratypes
Pilsbry, 1905, p. 215
Huachuca Mts., Arizona; Manilla mine

6170 **ferrissi, Sonorella:** Pilsbry Paratypes
Pilsbry *in* Pilsbry and Ferriss, 1915a, p. 368
Dragoon Mts., Arizona

8623 **filiareginae, Vexillum regina:** Cate Holotype
Cate, J., 1961, p. 80, pl. 18, figs. 6a, 6b; pl. 19, fig. 6; pl. 20, fig. 1
Philippine Islands; Cape Melville, Balabac

8653 **fitchi, Terebra (Strioterebrum):** Berry Holotype
Berry, 1958a, p. 89. [= *Terebra tiarella* Deshayes, *fide* Keen, 1971, p. 684]
Baja California, Mexico; Vahia Santa Maria, Isla Magdalena

5524 **fitella, Odostomia (Evalea):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 33
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

5827 **flammulina, Chilina:** Marshall Paratypes
Marshall, 1924, p. 3
Chubut, Argentina; Rio Fitaleufu, 43° 9′ S, 71° 35′ W

8652 **fletcherae, Olivella:** Berry Holotype
Berry, 1958a, p. 85. Illustrated *in* Keen, 1971, p. 628, fig. 1378
Sonora, Mexico; Cholla Cove, Bahia de Adair

8610 **floresi, Craginia:** Alencaster de Cserna Paratypes
Alencaster de Cserna, 1956, p. 33
Mexico; San Juan Raya
Lower Cretaceous, San Juan Raya Fm

7790 **floridanus, Microcochus:** Rehder Paratypes
Rehder, 1943, p. 193
Missouri Key, Fla.

5949 **fossilis, Conus californicus:** Oldroyd Holotype
Oldroyd, T. S., 1921a, p. 116, pl. 5, fig. 9
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, San Pedro Fm

6173 **fossor, Holospira ferrissi:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915a, p. 387
Mule Mt., Arizona; 2 miles E of Warren

6150 **fragilis, Ashmunella tetrodon:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1917, p. 89
Black Range, New Mexico; Cave Creek, near Hillsboro

6309 **fraseri, Tritonalia:** Oldroyd Holotype
Oldroyd, I. S., 1920, p. 135, pl. 4, figs. 1, 2. Also *in* Oldroyd, I. S., 1927, p. 25, pl. 30, figs. 11, 11a
Vancouver Island, British Columbia, Canada; Brandon Island, Departure Bay, Nanaimo

6310 **fraseri, Tritonalia:** Oldroyd Paratype
Oldroyd, I. S., 1920, p. 135
Vancouver Island, British Columbia, Canada; Nanaimo, Brandon Island, Departure Bay

7207 **freya, Turritella:** Nomland Plastoholotype
Nomland, 1917b, p. 312, pl. 19, fig. 2. Also *in* Merriam, 1941, p. 124, pl. 37, fig. 14
Fresno Co., Calif.; NE of Coalinga UCMP loc. 2283
Miocene, Santa Margarita Fm [holotype UCMP 11313]

9988 **frisbeyae, Vermicularia:** McLean Paratype
McLean, 1970a, p. 311
Colima, Mexico; Manzanillo, 19° 03′ N, 104° 20′ W, off the lighthouse, 30-40 fms

7961 **frizzelli, Cancellaria (Bivetiella):** Marks Paratype
Marks, 1949, p. 462
Ecuador; near Jerusalém, Guayas Province
Middle Miocene, Daule Fm

6434 **fucana, Olivella biplicata:** Oldroyd Holotype
Oldroyd, T. S., 1921, p. 118, pl. 5, fig. 4. Also *in* Oldroyd, I. S., 1927, pl. 26, figs. 23, 23a
Straits of Juan da Fuca, near Cape Flattery, Wash.

8254 **galapagensis, Cypraea (Trivia):** Melvill Syntypes
Melvill, 1900, p. 208, text figs.
Galápagos Islands; Albemarle Island

10287 **galapagensis, Mirachelus:** McLean Paratype
McLean, 1970c, p. 118
Galápagos; Isabela Island, off Canal Bolivar, near Tagus Cove, 0° 16′ S, 91° 22′ W, 40-55 fms

6580 **galeana, Mitromorpha:** Berry Paratypes
Berry, 1941, p. 12
San Pedro, Calif.; Hilltop Quarry
Lower Pleistocene, Lomita Fm

9718 **gatesi, Solenosteira:** Berry Holotype
Berry, 1963, p. 144. Illustrated *in* Keen, 1917, p. 563, fig. 1120, left
Sinaloa, Mexico; NW of Mazatlán, 15 fms

8751 **ghanaense, Dendropoma:** Keen and Morton Holotype
Keen and Morton, 1960, p. 48, pl. 4, figs. 7, 8
Ghana, West Africa; about 10 miles W of Takoradi

7550 **gluma, Volvulella:** Keen Holotype
Keen, 1943, p. 54, pl. 4, fig. 10
Kern Co., Calif.; Caliente Qd, Barker's Ranch, 1000′ S, 600′ W of NE cor Sec. 5, T 29 S, R 29 E SU loc. 2641
Miocene, Temblor Fm, Round Mountain Silt or uppermost Olcese Sand

7536 **gnomon, Hastula:** Keen Holotype
Keen, 1943, p. 47, pl. 4, fig. 11
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt (lowermost part)

5516 **gomphina, Odostomia (Chrysallida):** Oldroyd Paratype
Oldroyd, T. S., 1924, p. 29
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

9508 **goodmani, "Acmaea":** Berry Holotype
Berry, 1960, p. 117. [= *Collisella stanfordiana* (Berry, 1957), *fide* Keen, 1971, p. 325]
Baja California, Mexico; 1 mile N of Puertecitos

9985 **gordanum, Calliostoma:** McLean Paratype
McLean, 1970b, p. 422-423
Baja California, Mexico; Gorda Bank, 70 fms

6267 **gouldi, Turbonilla (Pyrgolampros):** Dall and Bartsch Paratypes
Dall and Bartsch, 1909, p. 66
San Pedro, Calif.

5008 **gracilior, Daphnella aspera:** Hemphill in Tryon Lectotype
Hemphill *in* Tryon, 1884, p. 317, pl. 25, fig. 62. Lectotype designated by Grant and Gale, 1931, p. 597, pl. 25, fig. 22 [as *Mangelia (Mitromorpha) gracilior* (Hemphill *in* Tryon)]
Monterey, Calif.

8081 **gracilis, Decipifus:** McLean Holotype
McLean, 1959, p. 10, pl. 4, fig. 1. Also *in* Keen, 1971, p. 587, fig. 1222
Sonora, Mexico; Bocochibampo Bay, Guaymas

8082 **gracilis, Decipifus:** McLean Paratype
McLean, 1959, p. 10. Also *in* Keen, 1971, p. 587, fig. 1222
Sonora, Mexico; Bocochibampo Bay, Guaymas

9925 **gravinaensis, Purpurina:** Smith Plastoholotype
Smith, 1927, p. 109, pl. 101, fig. 6
SE Alaska; Gravina Island
Upper Triassic [holotype USNM 74196]

6198 **grippi, Epiphragmophora tudiculata:** Pilsbry Paratypes
Pilsbry, 1913, p. 49
Santee, Calif.; 18 miles from San Diego

6251 **grippi, Leptothyra:** Dall Paratype
Dall, 1911, p. 25
San Diego, Calif.; 100-150 fms, in harbor

7788 **grippi, Melanella (Balcis):** Bartsch Paratypes
Bartsch, 1917, p. 327
San Pedro, Calif.

6519 **gruveli, Marginella:** Bavay Paratypes
Bavay *in* Dautzenburg, 1912, p. 24
Angola, West Africa; Bai de Mossamedes, 15-20 m

8508 **guadalupeana, Astraea:** Berry Holotype
Berry, 1957, p. 77 [= *Astraea (Pomaulax) gibberosa* (Dillwyn, 1817), *fide* Keen, 1971, p. 355]
Baja California, Mexico; S end Guadalupe Island, 26.5 fms

9837 **guadalupensis, Haliotis fulgens:** Talmadge Paratype
Talmadge, 1964, p. 375
Baja California, Mexico; Morro Sur, Guadalupe Island

10300 **guadelupiana, Epiphragmophora:** Dall Paratype ?
Dall, 1900a, p. 101
Mexico; Guadalupe Island

7989 **guayasensis, Megasurcula:** Marks Paratype
Marks, 1951, p. 132
SW Ecuador; S of Las Masas
Lower Miocene, Subibaja Fm

9986 **guttata, Arene:** McLean Paratypes
McLean, 1970a, p. 310-311
Galápagos; Santa Cruz Island, Academy Bay, under rocks in tide pools

6156 **hachetana, Oreohelix (Radiocentrum):** Pilsbry Paratypes
Pilsbry, 1915, p. 330
New Mexico; summit of Hacheta Grande Mt.

6255 **halia, Melanella (Balcis):** Bartsch Paratype
Bartsch, 1917, p. 322
Baja California, Mexico; Point Abreojos

110 **hamlini, Cancellaria:** Carson Holotype
Carson, 1926, p. 51, pl. 1, fig. 6
Los Angeles Co., Calif.; Elsmere Canyon
Lower Pliocene, Fernando Fm

135 **hamlini, Cancellaria:** Carson Paratype
Carson, 1926, p. 51, pl. 1, fig. 4
Los Angeles Co., Calif.; Elsmere Canyon
Lower Pliocene, Fernando Fm

9995 **hancocki, Terebra:** Bratcher and Burch Paratype
Bratcher and Burch, 1970a, p. 299
Santa Elena Bay, Ecuador; off La Libertad, 2° 08′ 20″ S, 81° 0′ 15″ W, 8-10 fms, on rocks with gorgonids

6157 **handi, Oreohelix:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1918. p. 94
Lincoln Co., Nevada; Charleston Mt., 30 miles N of Las Vegas

5846 **hannai, Lanx:** Walker Holotype
Walker, 1925, p. 6, pl. 3, figs. 1, 3
Shasta Co., Calif.; Baird, McCloud River

5847 **hannai, Lanx:** Walker Paratypes
Walker, 1925, p. 6
Shasta Co., Calif.; Baird, McCloud River

8034 **hannai, Rissoina:** Smith and Gordon Paratypes
Smith and Gordon, 1948, p. 226
Carmel Bay, Calif.; 25 fms

69 **hannibali, Acmaea:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 171, pl. 38, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; Port San Juan, sea cliffs 1/4 mile E of Providence Cove SU loc. NP 133
Oligocene, Sooke Fm, basal ss and cgl

5131 **hannibali, Calliostoma:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 608, pl. 21, fig. 9
Baja California, Mexico; San Ignacio Arroyo, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

129 **hannibali, Chrysodomus:** Hertlein Holotype
Hertlein, 1925b, p. 42, pl. 3, fig. 4
Montesano, Wash.; 8 miles up Sylvia Creek SU loc. 152 = NP 220
Miocene, Montesano Fm

240 **hannibali, Fusinus:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 158, pl. 30, fig. 2
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

241 **hannibali, Fusinus:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 158, pl. 30, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

157 **hannibali, Lyria:** Waring Syntype
Waring, 1917, p. 84, pl. 12, fig. 3
Ventura Co., Calif.; Simi Hills, Martinez area, Calabasas sheet
Lower Eocene, Martinez Fm

158 **hannibali, Lyria:** Waring Syntype
Waring, 1917, p. 84, pl. 12, fig. 2
Ventura Co., Calif.; Simi Hills, Martinez area, Calabasas sheet
Lower Eocene, Martinez Fm

6183 **hapla, Polygyra:** Berry Paratypes
Berry, 1933, p. 14
Butte Co., Calif.; Butte Creek Canyon, near Chico

5146 **hartmanni, Macron:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 629, pl. 18, fig. 2; pl. 21, fig. 5
Baja California, Mexico; San Ignacio Arroyo, 8 km W of San Ignacio SU loc. 66
Miocene, Isidro Fm

5147 **hartmanni, Macron:** Hertlein and Jordan Paratypes
5148 Hertlein and Jordan, 1927, p. 269
5149 Baja California, Mexico; San Ignacio Arroyo, 8 km SW of San
5150 Ignacio SU loc. 66
5151 Miocene, Isidro Fm

7984 **haughti, Phos:** Marks Paratypes
Marks, 1951, p. 114
Ecuador; Daule Basin, near Jerusalém
Middle Miocene, Daule Fm

6520 **haullevillei, Clathurella:** Dautzenberg Paratypes
Dautzenberg, 1912, p. 14
West Africa; Guinea coast, off wharf at Tamara

113 **hawleyi, Chrysodomus:** Carson Holotype
Carson, 1926, p. 55, pl. 2, fig. 3
4 miles W of Santa Barbara, Calif.
Upper Pliocene, San Pedro Fm [Santa Barbara Fm]

5813 **heathi, Doryssa:** Pilsbry Paratype
Pilsbry *in* Baker, 1914, p. 653
Rio Jary, Brazil; Sao Antonio do Cachoeira

5378 **hecoxi, Fusus:** Arnold Paratype
Arnold, 1908a, p. 371
Santa Cruz Co., Calif.; 5.5 miles above town of Boulder Creek
Oligocene, San Lorenzo Fm

5139 **heimi, Cymia:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 622, pl. 18, fig. 5
Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

5140 **heimi, Cymia:** Hertlein and Jordan Paratypes
5141 Hertlein and Jordan, 1927, p. 622
5142 Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

10047 **helenae, Nassarina (Cigclirina):** Keen Holotype
Keen, 1971, p. 594, fig. 1247
Sonora, Mexico; off Guaymas, 45 m

10297 **helleri, Endodonta:** Dall Paratype
Dall, 1900a, p. 93
Galápagos; Isabela Island, Iguana Cove, 2000′ elev.

5835 **hemphilli, Goniobasis:** Henderson Paratypes
Henderson, 1935, p. 96
Portland, Ore.

5855 **hemphilli, Helisoma:** Baker and Henderson Holotype
Baker and Henderson *in* Baker, Frank, 1934a, p. 141
San Francisco, Calif.; Mountain Lake

5856 **hemphilli, Helisoma:** Baker and Henderson Paratypes
Baker and Henderson *in* Baker, Frank, 1934a, p. 141
San Francisco, Calif.; Mountain Lake

6253 **hemphilli, Melanella (Melanella):** Bartsch Paratypes
Bartsch, 1917, p. 313
Baja California, Mexico; Point Abreojos

5775 **hemphilli, Stagnicola:** Henderson ex Baker Ms Holotype
Henderson, 1934b, pl. 14, fig. 7, right. Described *in* Baker, 1934b, p. 19
Utah Co., Utah; near Salt Lake City

5775a **hemphilli, Stagnicola:** Henderson ex Baker Ms Paratype
5775b Henderson, 1934b, pl. 14, fig. 7, left
5775c Utah Co., Utah; near Salt Lake City

6261 **hemphilli, Strombiformis:** Bartsch Paratypes
Bartsch, 1917, p. 344
Baja California, Mexico; Point Abreojos

7760 **hemphilli, Tegula:** Oldroyd Paratypes
Oldroyd, T. S., 1921a, p. 115
San Diego, Calif.; Pacific Beach

6177 **hendersoni: Polygyra mullani:** Pilsbry Paratypes
Pilsbry, 1928, p. 178
The Dalles, Ore.

8033 **hertleini, Rissoella:** Smith and Gordon Paratype
Smith and Gordon, 1948, p. 225
Monterey Bay, Calif.; off Cabrillo Point, 10 fms

9996 **hertleini, Terebra:** Bratcher and Burch Paratype
Bratcher and Burch, 1970b, pp. 1-2
Galápagos; Santa Cruz Island, Academy Bay, 3.5-5.5 fms

9708 **hesperina: Blasicrura coxeni:** Schilder and Summers Paratype
Shilder and Summers, 1963, p. 68
Talesea, New Britain

6141 **heterodonta, Ashmunella levettei:** Pilsbry Paratypes
Pilsbry, 1905, p. 241
Huachuca Mts., Arizona

8047 **hewitti, Ampullella:** Hanna and Hertlein Paratypes
Hanna and Hertlein, 1949, p. 393
Kern Co., Calif.; Sec. 18, T 29 S, R 20 E CAS loc. 32388A
Middle Eocene, Domengine Fm

8092 **hilli, Crockerella:** Hertlein and Strong Paratype
Hertlein and Strong, 1951a, p. 79
Gulf of California; Santa Inez Bay, 26° 52′ N, 111° 53′ W, 4-13 fms

5511 **himerta, Turbonilla (Pyrgiscus):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 27
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

6262 **hipolitensis, Niso:** Bartsch Paratypes
6263 Bartsch, 1917, p. 350
San Diego, Calif. (type 6262); Baja California, Mexico, San Hipolito Point (type 6263)

8256 **hoffmeyeri, Terebra (Strioterebrum):** Abbott Paratypes
Abbott, 1952, p. 78
Philippines; Luzon Island, Pasay Beach, Manila Bay

8063 **hoffi, Cyclostremiscus (Bathyspira):** Aguayo and Borro Paratype
Aguayo and Borro, 1946b, p. 44
Cuba; Barranco E of Rio Canimar, Matanzas
Upper Miocene, Yumuri Fm

6216 **holguinense, Opisthosiphon aguilerianum:** Aguayo Paratypes
Aguayo, 1932a, p. 93
Oriente, Cuba; Cerro San Juan, Sao Arriba, Holguin

531 **hooveri, Mangilia:** Arnold Paratype
Arnold, 1903, p. 212
Los Angeles Co., Calif.; San Pedro
Pleistocene, upper San Pedro Fm

8693 **howardae, Nassarius:** Chace Paratypes
Chace, 1958b, p. 333
Baja California, Mexico; Almejas Beach, 5 miles N of San Felipe

6040 **huachucana, "Pyramidula" strigosa:** Pilsbry Paratypes
Pilsbry, 1902, p. 511
Huachuca Mts., Arizona

6244 **humboldtica, Helminthoglypta arrosa:** Berry Paratypes
Berry, 1938a, p. 17
Humboldt Co., Calif.; near Bridge Creek Camp, S of Scotia

8707 **hyptius, Solariorbis (Haplorbis) hyptius:** Woodring Paratypes
Woodring, 1957, p. 75
Panama Canal Zone; R.R. 3500′ SE of Gatun Station
Miocene, middle Gatun Fm

6249 **idae, Mitra:** Melvill Paratypes
Melvill, 1893, p. 140
San Diego Co., Calif.; Point Loma

5517 **idae, Turbonilla (Pyrgolampros):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 26
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

7861 **idahoensis, Lymnaea:** Henderson Paratypes
Henderson, 1931, p. 75
Idaho; Little Salmon River, 16 miles N of New Meadows, on rocks in a mountain stream

8357 **imminens, Pyrgulopsis:** Taylor Paratypes
Taylor, 1950, p. 28
Imperial Co., Calif.; shore of Salton Sea, by Fish Springs
Upper Pleistocene

5776 **impedita, Stagnicola:** Henderson ex Baker Ms Holotype
Henderson, 1934b, pl. 14, fig. 3 left. Described *in* Baker, 1934b, p. 20
Cache Co., Utah; near Logan

5776a **impedita, Stagnicola:** Henderson ex Baker Ms Paratypes
5776b Henderson, 1934b, pl. 14, fig. 3, right. Also *in* Baker, 1934b, p. 20
5776c Cache Co., Utah; near Logan

6922 **imperialis, Chrysodomus:** Dall Paratype
Dall, 1909a, p. 42, pl. 18, fig. 1
Santa Cruz Qd, Calif.; near headwaters of Alpine Creek Arnold's loc. 6 = C-306
Pliocene, Purisima Fm

5191 **imperialis, Rapana:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, pp. 631-632, pl. 20, fig. 1
Baja California, Mexico; San Ramon River, La Purisima cliffs SU loc. 57
Lower Miocene, Isidro Fm

9727 **imperialis, Typhis (Typhina):** Keen and Campbell Paratype
Keen and Campbell, 1964, p. 46, fig. 4
Off Tosa, Japan; approx. 200 m

9728 **imperialis, Typhis (Typhina):** Keen and Campbell Plastoholotype
Keen and Campbell, 1964, p. 46, figs. 1-3
Off Tosa, Japan; 200 m [holotype in Kyoto, Japan, private coll. of Mr. Akimbumi Teramachi]

8260 **incallida, Balcis (Vitreolina):** Berry Paratype
Berry, 1954b, p. 264
San Pedro, Calif.; Hilltop quarry
Lower Pleistocene, Lomita

9512 **incompta, Coralliophila:** Berry Holotype
Berry, 1960, p. 119
Gulf of California; Angel de la Guarda Island, 20 miles off Puerto Refugio

6424 **indisputabilis, Alectrion mendicus:** Oldroyd "Holotype"
Oldroyd, I. S., 1927, pl. 26, fig. 4, no description. [= a variant of *Alectrion mendicus, teste* Keen, 1976]
San Diego, Calif.

6147 **inermis, Ashmunella tetrodon:** Pilsbry and Ferriss Paratype
Pilsbry and Ferriss, 1915b, p. 33
Socorro Co., New Mexico; Mogollon Mts., Dry Creek Canyon

7226 **infera, Turritella uvasana:** Merriam Plastoholotype
Merriam, 1941, p. 90, pl. 40, fig. 4
Ventura Co., Calif.; Simi Valley, Las Llajas Canyon UCMP loc. A-994
Eocene, Llajas Fm [holotype UCMP 33993]

7849 **infima, Assiminea:** Berry Holotype
Berry, 1947a, p. 5, text fig. 1
Inyo Co., Calif.; Death Valley, Badwater, elev. -279.6'

7849a **infima, Assiminea:** Berry Paratypes
Berry, 1947a, p. 5
Inyo Co., Calif.; Death Valley, Badwater, elev. -279.6'

8356 **infirma, Baroginella:** Laseron Paratypes
Laseron, 1957, p. 305
Torres Strait, Australia; Murray Island, 5-8 fms

6213 **inglesi, Helminthoglypta:** Berry Paratype
Berry, 1938b, p. 43
Kern Co., Calif.; Horse Meadows, trail to Sunday Peak

10279 **insalli, Terebra (Triplostephanus):** Bratcher and Burch Paratype
Bratcher and Burch, 1967, p. 7
Red Sea, coast of Israel; Eilat, Gulf of Aqaba (Akabar)

10326 **iota, Turritella:** Popenoe Plastoholotype
Popenoe, 1937, p. 401, pl. 49, fig. 8
Orange Co., Calif.; Corona sheet CIT loc. 984
Cretaceous, Turonian [holotype UCLA 40673]

6214 **isabella, Helminthoglypta:** Berry Paratypes
Berry, 1938b, p. 42
Kern Co., Calif.; 2 miles E of Isabella

7542 **ischnon, Olivella:** Keen Holotype
Keen, 1943, p. 50, pl. 4, figs. 3, 4
Kern Co., Calif.; Caliente Qd, near Barker's Ranch, SE 1/4 Sec. 5, T 29 S, R 29 E SU loc. 2641
Miocene, Temblor Fm, basal Round Mountain Silt or uppermost Olcese Sand

5521 **ithea, Odostomia (Evalea):** Oldroyd Paratype
Oldroyd, T. S., 1924, p. 31
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

6044 **jacksonensis, Lymnaea:** Baker Paratypes
Baker, 1907, p. 52
Jackson Lake, Wyoming

8106 **jacoquea, Turritella (?):** Jenkins Plastosyntypes
Jenkins, 1913, p. 451, pl. 20, fig. 7. Also *in* Maury, 1934, p. 150, pl. 14, fig. 4 [as *Cerithium* (?)]
Brazil; Jacoca, 4 km SW of Ceará-Mirim, Rio Grande do Norte
Eocene? or Upper Cretaceous

9997 **jacquelinae, Terebra:** Bratcher and Burch Paratype
Bratcher and Burch, 1970b, pp. 2-5
Galápagos; Santa Cruz Island, Academy Bay, ca. 10 fms

6568 **jaegeri, Oreohelix handi:** Berry Paratypes
Berry, 1931c, p. 118
Charleston Mts., Nevada; ridge W of Griffith's Hotel, 7500′ elev.

10294 **jaliscoensis, Calliclava:** McLean and Poorman Paratype
McLean and Poorman, 1917, p. 90
Jalisco, Mexico; Tenacatita Bay, 19° 17′ N, 104° 50′ W, 20-40 fms

6552 **janesburgensis, Turricula:** Stanton Plastoholotype
Stanton, 1920, p. 45, pl. 9, figs. 2a, 2b
North Dakota; Cannonball River near Janesburg
Cretaceous, Cannonball Fm [holotype USNM 32447]

5809 **jaryensis, Doryssa transversa:** Pilsbry Paratype
Pilsbry *in* Baker, 1914, p. 649
Rio Jary, Brazil; Sao Antonio da Cachoeira

8502 **jayana, Cancellaria (Narona):** Keen Holotype
Keen, 1958a, p. 249, pl. 30, fig. 5. Also *in* Keen, 1971, p. 651, fig. 1461
Panama Bay; 1 mile off Canal entrance, 10 fms

8503 **jayana, Cancellaria (Narona):** Keen Paratype
Keen, 1958a, p. 249
Panama Bay; 1 mile off Canal entrance, 10 fms

8255 **jekylli, Entodina:** Baker Paratype
Baker, 1914, p. 630
Brazil; Camp 39, M. & M. R.R., 284 km above Porto Velho

130 **jordani, Buccinum:** Hertlein Holotype
Hertlein, 1925b, p. 41, pl. 3, fig. 3
Montesano, Wash.; 8 miles up Sylvia Creek SU loc. 152 = NP 220
Miocene, Montesano Fm

10042 **judithae, Liocerithium:** Keen Holotype
Keen, 1971, p. 411, fig. 517
Gulf of California; Angel de la Guarda Island

7099 **juliana, Turritella variata:** Merriam Plastoholotype
Merriam, 1941, p. 99, pl. 19, fig. 10
Santa Ynez Mts., Calif.; San Julian Ranch UCMP loc. A-312
Lower Oligocene, Gaviota Fm [holotype UCMP 33912]

497 **keaseyense, Epitonium (Boreoscala):** Durham Holotype
Durham, 1937, p. 498, pl. 57, fig. 17
Ore.; 3/4 mile W of Strassel SU loc. NP 292
Oligocene, Keasey Fm

6516 **keenae, "Alvania" (Willettia):** Gordon Holotype
Gordon, 1939, p. 31
San Mateo Co., Calif.; Moss Beach, among boulders

7915 **keenae, Ocenebra:** Bormann Holotype
Bormann, 1946, p. 40, pl. 4, fig. 17
Los Angeles Co., Calif.; White's Point

7916 **keenae, Ocenebra:** Bormann Paratype
Bormann, 1946, p. 40, pl. 4, fig. 18
Los Angeles Co., Calif.; White's Point

8035 **keenae, Rissoina:** Smith and Gordon Paratype
Smith and Gordon, 1948, p. 227
Monterey Bay, Calif.; off Point Pinos, 5-15 fms

10061 **keenae, Septa (Monoplex) parthenopea:** Beu Paratype
Beu, 1970, p. 233, pl. 2, figs. 6, 8
Mazatlán, Mexico; taken by shrimp dredger

10062 **keenae, Septa (Monoplex) parthenopea:** Beu Paratype
Beu, 1970, p. 233, pl. 2, fig. 9
Sonora, Mexico; off Guaymas, taken by shrimp boats

10063 **keenae, Septa (Monoplex) parthenopea:** Beu Paratype
Beu, 1970, p. 233, pl. 3, fig. 17
Galápagos; Albemarle Island, Tagus Cove

6268 **kincaidi, Turbonilla (Strioturbonilla):** Bartsch Paratypes
Bartsch, 1921, p. 33
Puget Sound, Wash.; Dogfish Bay

5849 **klamathensis, Lanx (Walkerola):** Hannibal Holotype
Hannibal, 1912b, p. 149, pl. 8, fig. 25a
Upper Klamath Lake, Ore.; Government Irrigation Dam

5850 **klamathensis, Lanx (Walkerola):** Hannibal Paratype
Hannibal, 1912b, p. 149, pl. 8, fig. 25b
Upper Klamath Lake, Ore.; Government Irrigation Dam

9922 **klamathensis, Worthenia:** Smith Plastoholotype
Smith, 1927, p. 108, pl. 96, fig. 3
Shasta Co., Calif.; N fork Squaw Creek, 3 miles N of Kellys Ranch
Upper Triassic, Hosselkus Ls [holotype USNM 74161]

6714 **knechti, Margarita optabilis:** Arnold Paratypes
6715 Arnold, 1903, p. 332
San Pedro, Calif.
Pleistocene, lower San Pedro Fm

8659 **kochi, Calliostoma dubium:** Pallary Paratypes
Pallary, 1902b, p. 26
Tanger, Morocco [Tangier]

8674 **kurodai, Bittium:** Makiyama Paratype
Makiyama, 1927, p. 66
Japan; Honohasi, Shizuoka Prefecture
Pliocene, Dainiti

8677 **kurodai, Nassarius (Hinia):** Makiyama Paratype
Makiyama, 1927, p. 121
Shizuoka Prefecture, Japan; Dainiti
Pliocene, Dainiti

5364 **lahondaensis, Chlorostoma stantoni:** Arnold Holotype
Arnold, 1908a, p. 388, pl. 36, fig. 2. Also *in* Arnold, 1909, illust. 2, fig. 63
San Mateo Co., Calif.; Pescadero Creek just above mouth of Jones Gulch, 3 miles S of La Honda
Upper Miocene, lower Purisima Fm [Pliocene] [Arnold's specimen 1079]

5365 **lahondaensis, Chlorostoma stantoni:** Arnold — Paratype
Arnold, 1908a, p. 388
San Mateo Co., Calif.; Pescadero Creek just above mouth of Jones Gulch
Upper Miocene, lower Purisima Fm [Pliocene]

6229 **lalage, Mitrella:** Pilsbry and Lowe — Paratypes
Pilsbry and Lowe, 1932a, p. 70
Mazatlán, Mexico

7548 **lampada, Typhis (Talityphis):** Keen — Holotype
Keen, 1943, p. 53, pl. 3, figs. 14, 19, 23
Kern Co., Calif.; Caliente Qd, center SW 1/4 Sec. 6, T 29 S, R 30 E, in small gully SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

7549 **lampada, Typhis (Talityphis):** Keen — Paratype
Keen, 1943, p. 53
Kern Co., Calif.; Caliente Qd, center SW 1/4 Sec. 6, T 29 S, R 30 E, in small gully SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

5851 **lancides, Fisherola:** Hannibal — Holotype
Hannibal, 1912b, p. 152, pl. 8, fig. 35a. Also *in* Taylor and Smith, 1971, fig. 34
Snake River, Wash.

5852 **lancides, Fisherola:** Hannibal — Paratype
Hannibal, 1912b, p. 152
Snake River, Wash.

798 **landesi, Ancistrolepis:** Tegland — Holotype
Tegland, 1933, p. 132, pl. 13, fig. 2
Puget Sound, Wash.; Bainbridge Island, beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Upper Oligocene, Blakeley Fm

7985 **landesi, Tritiaria (Antillophos):** Marks — Paratypes
Marks, 1951, p. 115
SW Ecuador; Las Masas area, NE Progreso Basin
Lower Miocene, Subibaja Fm

7804 **langi, Homorus (Subulona):** Pilsbry — Paratypes
Pilsbry, 1919, p. 115
Zambi, Belgian Congo, Africa

200 **lawsoni, Pachychilus:** Hannibal — Holotype
Hannibal, 1912b, p. 183, pl. 8, fig. 23. Also *in* Taylor and Smith, 1971, figs. 43, 44 (as *Lymnaea*)
Alameda Co., Calif.; Berkeley Hills, near Bald Peak
Miocene, Contra Costa Lake beds

7545 **lens, Teinostoma (Teinostoma?):** Keen — Holotype
Keen, 1943, p. 51, pl. 4, figs. 7-9
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

5450 **leonina, Monadenia fidelis:** Berry — Paratype
Berry, 1937, p. 30
Siskiyou Co., Calif.; Beaver Creek, 1 mile above mouth

6574 **lepisma, Acmaea:** Berry — Holotype
Berry, 1940b, p. 155, pl. 17, figs. 3, 4
San Pedro, Calif.; Hilltop Quarry
Lower Pleistocene

6574a **lepisma, Acmaea:** Berry — Paratypes
Berry, 1940b, p. 155
San Pedro, Calif.; Hilltop Quarry
Lower Pleistocene

6227 **leucocyma: Drillia:** Dall Paratypes
Dall, 1883, p. 328
Key West, Fla.

8654 **leucostephes, Hertleinella:** Berry Holotype
Berry, 1958b, p. 95. Illustrated *in* Keen, 1971, p. 530, fig. 1023 left
Baja California, Mexico; E side Cedros Island

10220 **levis, Clivuloturris:** Hickman Holotype
Hickman, 1976a, p. 78-79, pl. 6, figs. 10, 11
W. central Wash. SU loc. NP 50
Oligocene, Lincoln Creek Fm

10221 **levis, Clivuloturris:** Hickman Paratype
Hickman, 1976a, pp. 78-79, pl. 6, fig. 6
W central Wash. SU loc. NP 50
Oligocene, Lincoln Creek Fm

10222 **levis, Clivuloturris:** Hickman Paratype
Hickman, 1976a, pp. 78-79
W central Wash. SU loc. NP 50
Oligocene, Lincoln Creek Fm

114 **lewisii, Gyrineum:** Carson Holotype
Carson, 1926, p. 53, pl. 2, fig. 1. Also *in* Smith, 1970, p. 504, pl. 47, fig. 8 [as *Mediargo mediocris* (Dall)]
Santa Barbara Co. Calif.; Santa Maria District, Fugler's Point
Lower Pliocene, Fernando Fm

138 **lewisii, Gyrineum:** Carson Paratype
Carson, 1926, p. 53, pl. 2, fig. 2. Also *in* Smith, 1970, p. 504, pl. 47, fig. 4 [as *Mediargo mediocris* (Dall)]
Santa Barbara Co., Calif.; Santa Maria District, Fugler's Point
Lower Pliocene, Fernando Fm

6228 **limonitella, Drillia:** Dall Paratypes
Dall, 1884, p. 329
Cedar Keys, Fla.

8713 **listrota, Turritella:** Woodring Paratype
Woodring, 1959, p. 160
Canal Zone; Barro Colorado Island
Upper Oligocene, Bohio Fm

6551 **lloydi, Turris:** Stanton Plastoholotype
Stanton, 1920, p. 45, pl. 8, fig. 16
North Dakota; Cannonball River, 7 miles S of Leith
Cretaceous, Cannonball Fm [holotype USNM 32445]

7532 **loismartinae, Cylichna?:** Keen Holotype
Keen, 1943, p. 44, pl. 4, figs. 16, 18
Kern Co., Calif.; Caliente Qd, near Kern River, center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

8065 **lombardii, Allogena:** Smith Paratypes
Smith, 1943, p. 545
Idaho Co., Idaho; Meadow Creek, 1.5 miles S of Selway Falls

7101 **lorenzana, Turritella:** Wagner and Schilling Plastoholotype
Wagner and Schilling, 1923, p. 257, pl. 50, fig. 11. Also *in* Merriam, 1941, p. 99, pl. 19, fig. 12
Kern Co., Calif.; near San Emigdio Canyon UCMP loc. 3217
Oligocene, Pleito Fm [holotype UCMP 11424]

6936 **louderbacki, Turris:** Dickerson Plastosyntype
Dickerson, 1914, p. 147, pl. 16, fig. 9b
Contra Costa Co., Calif.; Mt. Diablo Qd, 1 mile S of Stewartville UCMP loc. 1540
Eocene, Martinez Fm [syntype UCMP 11698]

7806 **lowei, Subulina:** Pilsbry Paratypes
Pilsbry, 1919, p. 141
Africa; Belgian Congo

9501 **lunaris, Lunaia:** Berry Holotype
Berry, 1964, p. 148. Illustrated *in* Keen, 1971, p. 477, fig. 869 [as *Natica (Lunaia)*]
Sonora, Mexico

6207 **lycodus, Bulimulus (Naesiotus):** Dall Paratypes
Dall, 1917c, p. 379
Galápagos; Indefatigable Island

7869 **lyra, Scissurella:** Berry Paratype
Berry, 1947b, p. 268
San Pedro, Calif.; near Second and Pacific Streets
Lower Pleistocene, Lomita

152 **maccreadyi, Turritella:** Waring Holotype
Waring, 1914, p. 783. Illustrated *in* Waring, 1917, p. 87, pl. 12, fig. 10
Ventura Co., Calif.; Martinez area, Simi Hills, 3 miles NE of Simi Peak
Lower Eocene, Martinez Fm [Paleocene]

5184 **maccreadyi, Turritella:** Waring Paratype
Waring, 1914, p. 783
Ventura Co., Calif.; Martinez area, Simi Hills, 3 miles NE of Simi Peak
Lower Eocene, Martinez Fm [Paleocene]

7866 **macfarlandi, Antiplanes:** Berry Paratype
Berry, 1947b, p. 262
San Pedro, Calif.; Hilltop Quarry
Pleistocene, Lomita Fm

6525 **macgintyi, Murex:** Smith Paratype
Smith, 1938, p. 88
Florida; Clewiston, Lake Okeechobee
Pliocene

10280 **macleani, Coralliophila:** Shasky Paratype
Shasky, 1970, pp. 189-190
Sonora, Mexico; Guaymas, Saladita Bay, 27° 53′ 15″ N, 110° 59′ W, 3-4 m on bases of white gorgonid sea whips

10045 **macleani, Decipifus:** Keen Paratypes
Keen, 1971, p. 588
Baja California del Norte, Mexico; Puertecitos, intertidal

6256 **macra, Melanella (Balcis):** Bartsch Paratypes
Bartsch, 1917, p. 326
Vancouver Island, British Columbia, Canada; Nanaimo, False Narrows

8511 **macrospira, Hanetia:** Berry Holotype
Berry, 1957, p. 79. Illustrated *in* Keen, 1971, p. 563, fig. 1121 (as *Solenosteira*)
Baja California, Mexico; about 8 miles N of San Felipe

6161 **maculata, Oreohelix:** Henderson Paratypes
Henderson, 1921, p. 15
Northern Wyoming; White Creek Canyon

10283 **maesae, Maesiella:** McLean and Poorman Paratype
McLean and Poorman, 1971, pp. 101-102
Sonora, Mexico; Guaymas, 1 mile S of Puerto San Carlos, 17 fms

6168 **magazinensis, Polygyra edentata:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1907, p. 545
Logan Co., Ark.; Magazine Mt.

5773 **magister, Stagnicola palustris:** Henderson ex Baker Ms Holotype
Henderson, 1934b, pl. 14, fig. 1 left. Described *in* Baker, 1934b, p. 17
Modoc Co., Calif.; E shore Rhett (Tule) Lake

5773a **magister, Stagnicola palustris:** Henderson ex Baker MS Paratype
Henderson, 1934b, pl. 14, fig. 1, right. Baker, 1934b, p. 17
Modoc Co., Calif.; E shore, Rhett (Tule) Lake

5440 **magna, Lirularia:** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 36
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

8755 **mamillatum, Stephopoma:** Morton and Keen Paratype
Morton and Keen, 1960, p. 28, pl. 1, fig. 2
West Africa, off Gorée, Senegal; 27 fms

5522 **manca, Odostomia (Evalea):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 32
Los Angeles, Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

8752 **marchadi, Dendropoma:** Keen and Morton Paratypes
Keen and Morton, 1960, p. 37, pl. 2, fig. 3
Senegal, West Africa; Gorée

7190 **margaritana, Turritella:** Nomland Plastoholotype
Nomland, 1917b, p. 312, pl. 20, fig. 5. Also *in* Merriam, 1941, p. 120, pl. 34, fig. 10
San Luis Obispo Co., Calif.; UCMP loc. 1706
Upper Miocene, Santa Margarita Fm [holotype UCMP 11312]

6230 **mariamadrae, Tegula mariana:** Pilsbry and Lowe Paratypes
Pilsbry and Lowe, 1932a, p. 85
Gulf of California; Tres Marias Islands, Isla Maria Madre

8666 **mariposa, Monadenia (Corynadenia) hillebrandi:** Smith Paratype
Smith, 1957, p. 24
Mariposa Co., Calif.; McLean Cave

7547 **mariposa, Turbonilla (Pyrgolampros):** Keen Holotype
Keen, 1943, p. 52, pl. 4, fig. 19
Kern Co., Calif.; Caliente Qd, small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

7547a **mariposa, Turbonilla (Pyrgolampros):** Keen Paratype
Keen, 1943, p. 52, pl. 4, fig. 25
Kern Co., Calif.; Caliente Qd, small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

6510 **markleyensis, Pseudoliva:** Clark Paratype
Clark, 1938, p. 710
Napa Qd, Calif.; Brink Ranch, 2 miles S of Putah Creek
Upper Eocene, Markley Fm

8096 **marksi, Strombina:** Hertlein and Strong Paratype
Hertlein and Strong, 1951a, p. 84
Gulf of California; near Arena Bank, 23° 29′ 30″ N, 109° 25′ 30″ W, 45 fms

6554 **marmarotis, Monadenia:** Berry Paratypes
Berry, 1940a, p. 3
Siskiyou Co., Calif.; Marble Valley, near Ranger Station

7990 **masasensis, Conus (Leptoconus):** Marks Paratypes
Marks, 1951, p. 139
Guayas Province, Ecuador; near Las Masas
Lower Miocene, Subibaja Fm

5395 **mateoensis, Patella:** Arnold Paratypes
5396 Arnold, 1908a, p. 362
5397 San Mateo Co., Calif.; ridge between San Lorenzo River and Pesca-
5398 dero Creek
5399 Eocene, Martinez Fm ?

5400 **mateoensis, Patella:** Arnold Paratypes
5401 Arnold, 1908a, p. 362
5402 San Mateo Co., Calif.; ridge between San Lorenzo River and Pesca-
5403 dero Creek
Eocene, Martinez Fm ?

10278a **matthewsi, Ancilla:** Burch and Burch Paratype
Burch, J. Q., and Burch, R. L., 1967a, pp. 81-82
Off Fortaleza, Ceara, Brazil; from digestive tract of toad fish *Amphichthys cryptocentrus* (Val., 1837)

9856 **matthewsi, Marginella (Prunum):** van Mol and Tursch Holotype
van Mol and Tursch, 1967, pp. 196-197, fig. 1
Off Fortaleza, Ceará, Brazil; from stomachs of fishes known locally as "pacamao", 20 fms

9738 **mauryi, Epitonium (Epitonium):** Tursch and Pierret Holotype
Tursch and Pierret, 1964, p. 36, fig. 5
Rio de Janeiro, Brazil; off Punta de Juatinga 23° 22′ S, 48° 28′ W, 50 m

9742 **mcleani, Calliostoma:** Shasky and Campbell Holotype
Shasky and Campbell, 1964, p. 117, pl. 22, figs. 21, 24. Also *in* Keen, 1971, p. 334, fig. 86
Sonora, Mexico; Guaymas, NW of Bahia Saladita, 2-15 m

6167 **media, Holospira bilamellata:** Pilsbry Paratypes
Pilsbry, 1915, p. 339
Hacheta Grande Mts., New Mexico; Sheridan Canyon

10041 **medialis, Episcynia:** Keen Holotype
Keen, 1971, p. 381, fig. 352
Guaymas, Mexico; off Cabo Haro, 18 m

7802 **medjensis, Limicolaria laeta:** Pilsbry Paratypes
Pilsbry, 1919, p. 97
Africa; Medje, Belgian Congo

7031 **meganosensis, Turritella:** Clark and Woodford Plastoholotype
Clark and Woodford, 1927, p. 119, pl. 21, fig. 2. Also *in* Merriam, 1941, p. 75, pl. 8, fig. 3
Contra Costa Co., Calif.; Mt. Diablo area UCMP loc. 3159
Eocene, Meganos Fm [holotype UCMP 12445]

6565 **melanopylon, Micrarionta (Eremarionta):** Berry Paratypes
Berry, 1930c, p. 187
San Bernardino Co., Calif.; W side Black Canyon, 9 miles N of Hinkley

6151 **mendax, Ashmunella:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1917, p. 92
New Mexico; Gallina Canyon, Black Range

9750 **mendella, Tegula (Agathistoma):** McLean Paratype
McLean, 1964, p. 131
San Diego Co., Calif.; Mission Bay, depths to 10′

8591 **mendozana, Hanetia:** Berry Holotype
Berry, 1959, p. 111 [= *Solenosteira mendozana* (Berry), *fide* Keen, 1971, p. 563]
Baja California, Mexico; Magdalena Bay, 10-25 fms

10281 **mendozana, Strombina (Cotonopsis):** Shasky Paratype
Shasky, 1970, p. 194
Gulf of Fonseca, El Salvador; 15° 57′ N, 95° 32′ W, 33-73 m

5525 **menzola, Odostomia (Amaura):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 33
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

496 **merriami, Drillia:** Arnold Plastoholotype
Arnold, 1903, p. 207, pl. 8, fig. 7
Los Angeles Co., Calif.; Deadman Island
Pleistocene, lower San Pedro Fm [holotype USNM]

10298 **mertensi, Leptinaria:** Dall Paratype
Dall, 1900a, p. 97
Cocos Island, Costa Rica

6433 **mexicana, Olivella boetica:** Oldroyd Holotype
Oldroyd, T. S., 1921b, p. 118, pl. 5, fig. 3. Also *in* Oldroyd, I. S., 1927, p. 163, pl. 26, figs. 21, 21a
Baja California, Mexico; Scammons Lagoon

6566 **micrometalleus, Micrarionta (Eremarionta):** Berry Paratypes
Berry, 1930c, p. 189
Kern Co., Calif.; 3.5 miles S of Petrified Forest, Elpaso Range

8079 **micromphalus, Menetus?:** Taylor Paratype
Taylor, 1954, p. 74, pl. 20, figs. 7-9
San Bernardino Co., Calif.; W end Barstow Hills in "Lake Bed Horizon", canyon next S from Pirie Canyon, middle of SE 1/4 Sec. 15, T 11 N, R 2 W
Upper Miocene, Barstow Fm ?

8080 **micromphalus, Menetus?:** Taylor Paratype
Taylor, 1954, p. 74
San Bernardino Co., Calif.; W end Barstow Hills, middle of SE 1/4 Sec. 15, T 11 N, R 2 W
Upper Miocene, Barstow Fm ? [also = paratype of *Planorbis mojavensis* Hannibal, 1912b, p. 157]

6164 **millepalmarum, Micrarionta (Erenarionta):** Berry Paratypes
Berry, 1930b, p. 543, as *mille-palmarum*
Riverside, Calif.; Thousand Palms

8588 **milleri, Lucapinella:** Berry Holotype
Berry, 1959, p. 109
Baja California, Mexico; Puertecitos

7578 **milleri, Trigonostoma:** Burch Paratype
Burch, 1949, p. 3. Illustrated *in* Keen, 1971, p. 656, fig. 1480
Costa Rica; Tambor, near Puntarenas

6171 **millestriata, Holospira:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915a, p. 380
Dragoon Mts., Arizona

8714 **mimeticum, Cerithium (Thericium):** Woodring Paratypes
Woodring, 1959, p. 171
Panama Canal Zone; Barro Colorado Island
Upper Oligocene, upper Bohio Fm

165 **miranda, Cyclostrema:** Bartsch Paratypes
Bartsch, 1911a, p. 230
San Pedro, Calif. [Moore, 1969, pp. 169-170 points out that the locality is erroneous and that the specimens are *Tornus subcarinatus* (Montagu, 1803), a European taxon]

8105 **mirimense, Cerithium (?):** Jenkins Syntypes
Jenkins, 1913, p. 450, pl. 20, fig. 8. Also *in* Maury, 1934, p. 150, pl. 14, fig. 3
Rio Grande de Norte, Brazil; near Itapasaroca
"Eocene" [specimens missing, 1936]

8660 **miscowichi, Ocinebra:** Pallary Paratype
Pallary, 1906, p. 3
Mogador, Morocco

6219 **mitchelli, Acmaea striata:** Oldroyd Paratypes
Oldroyd, 1933, p. 205
Philippine Islands; southern Luzon

6220 **mitchelli, Nerita:** Oldroyd Paratypes
Oldroyd, I. S., 1933, p. 205
Philippine Islands
8621 **mitriformis, Arielia:** Shasky Holotype
Shasky, 1961, p. 20, pl. 4, figs. 7-9. Also *in* Keen, 1971, p. 741, fig. 1769 (as *Mitrolumna*)
Gulf of California; off Isla Espiritu Santo, 40-90 fms
5777 **modoci, Fluminicola:** Hannibal Holotype
Hannibal, 1912b, p. 187, pl. 8, fig. 30. Also *in* Taylor and Smith, 1971, figs. 16, 21 [as *Lithoglyphus turbiniformis* (Tryon, 1865)]
S end of Goose Lake, Calif.; Fletcher's Spring
5777a **modoci, Fluminicola:** Hannibal Paratype
Hannibal, 1912b, p. 187
S end of Goose Lake, Calif.; Fletcher's Spring
8077 **mohaveana, Lymnaea:** Taylor Holotype
Taylor, 1954, p. 73, pl. 20, figs. 1, 2
San Bernardino Co., Calif.; "Lake bed horizon" in canyon next S from Pirie Canyon, W end of Barstow Hills, middle of SE 1/4 Sec. 15, T 11 N, R 2 W
Upper Miocene, Barstow Fm
8078 **mohaveana, Lymnaea:** Taylor Paratype
Taylor, 1954, p. 73
San Bernardino Co., Calif.; W end Barstow Hills, middle of SE 1/4 Sec. 15, T 11 N, R 2 W
Upper Miocene, Barstow Fm
5460 **mojavensis, Planorbis:** Hannibal Paratype
Hannibal, 1912b, p. 157
San Bernardino Co., Calif.; near Barstow, Mojave Desert
Upper Miocene, Barstow Fm [= paratype 8080 *Menetus* (?) *micromphalus* Taylor, 1954]
6210 **monotaenius, Bulimulus (Naesiotus) nux:** Dall and Ochsner Paratypes
Dall and Ochsner, 1928, p. 157
Galápagos; Charles Island
5158 **montereyana, Turritella:** Wiedey Syntype
Wiedey, 1928, p. 123, pl. 21, fig. 2
Monterey Co., Calif.; Bryson Qd, 1.5 miles S of San Antonio River SU loc. 447
Middle Miocene, Monterey Fm
6451 **montereyensis, Astraea inaequalis:** Oldroyd Holotype
Oldroyd, I. S., 1927, p. 165, pl. 108, figs. 5, 6
Monterey, Calif.
6265 **montereyensis, Odostomia (Chrysallida):** Dall and Bartsch Paratype
Dall and Bartsch, 1907, p. 516
Monterey, Calif.; 12 fms
8030 **montereyensis, Retusa (Sulcularia):** Smith and Gordon Paratype
Smith and Gordon, 1948, p. 217
Monterey Bay, Calif.; off Del Monte, 8-15 fms
615 **morani, Astraea:** Loel and Corey Holotype
Loel and Corey, 1932, p. 271, pl. 64, figs. 6a, 6b
San Luis Obispo Co., Calif.; Corral de Piedra Creek
Lower Miocene, Vaqueros Fm
2 **morani, Zalophancylus:** Hannibal Holotype
See Chordata
9503 **mousleyi, Melampus:** Berry Holotype
Berry, 1964, p. 152. Illustrated *in* Keen, 1971, pp. 844-846, fig. 2399
Sonora, Mexico; Cholla Cove, Bahia Adair, upper estero

10064 **mucronata, Primovula:** Azuma and Cate Paratype
Azuma and Cate, 1971, p. 264
Kirimeaski, Kii, Japan; 25 fms

269 **muirensis, Antiplanes:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 157, pl. 30, fig. 6
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

270 **muirensis, Antiplanes:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 157, pl. 30, fig. 4
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

6172 **mularis, Holospira arizonensis:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915a, p. 386
Mule Mts., Arizona; Escabrosa Ridge

7047 **mulleri, Turritella andersoni:** Merriam Plastoholotype
Merriam, 1941, p. 80, pl. 11, fig. 2
Ventura Co., Calif.; 1.5 miles W of Vickers Hot Springs UCMP loc. A-1414
Middle Eocene [holotype UCMP 15297]

7860 **murrha, Agaronia:** Berry Paratype
Berry, 1953b, p. 417
Corinto, Nicaragua

6224 **mutata, Cerithidea:** Pilsbry and Vanatta Syntypes
Pilsbry and Vanatta, 1902, p. 558
Galápagos; Albemarle Island, Tagus Cove

6146 **mutator, Ashmunella tetrodon:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915b, p. 31
Socorro Co., New Mexico; Mogollon Mts., Dry Creek Canyon

8589 **myrae, Nomaeopelta:** Berry Holotype
Berry, 1959, p. 109. Illustrated *in* Keen, 1971, p. 327, fig. 56b
Sinaloa, Mexico; Mazatlán, Las Gaviotas Beach

8529 **myrae, Trivia (Pusula):** Campbell Holotype
Campbell, 1961b, p. 25, pl. 5, figs. 1-3. Also *in* Keen, 1971, p. 487, fig. 907
Baja California, Mexico; off Loreto, 25 fms

9991 **myrakeenae, Aspella (? Dermomurex):** Emerson and D'Attilio Paratype
Emerson and D'Attilio, 1970, pp. 89-92
Nayarit, Mexico; Banderas Bay, intertidal under rocks 22° 44′ N, 105° 29′ W

8756
8756a **myrakeenae, Stephopoma:** Olsson and McGinty Paratypes
Olsson and McGinty, 1958, p. 35
Panama; Atlantic coast, near Bocas del Toro

8678 **nakamurai, Thais:** Makiyama Paratype
Makiyama, 1927, p. 128
Shizuoka Prefecture, Japan; Dainiti
Pliocene, Dainiti

8675 **nakamurai, Uromitra:** Makiyama Paratype
Makiyama, 1927, p. 78
Shizuoka Prefecture, Japan; Tennoyama
Pliocene, Dainiti

5508 **nanella, Marginella jewettii:** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 24
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

379 **nanus, Strombus raninus:** Bales Paratypes
Bales, 1942, p. 19
Lake Worth, Fla.

8108 **natalensis, Turritella:** Jenkins Syntypes
Jenkins, 1913, p. 451, pl. 20, figs. 6, 6a
Brazil; Rio Grande do Norte, near Itapasaroca
Eocene? [Cretaceous, *fide* Maury, 1934, pp. 126, 143]

8346 **natlandi, Hemitoma:** Durham Plastoholotype
Durham, 1950, p. 132, pl. 28, figs. 7, 8
Gulf of California; Coronado Island UCMP loc. A-3548
Pleistocene [holotype UCMP 30474]

793 **nelsonensis, Patella (?):** Trechmann Paratype
Trechmann, 1918, p. 185
New Zealand; Nelson District, Eighty-Eight Valley
Triassic, Kaihiku

7065 **neopleura, Turritella uvasana:** Merriam Plastoholotype
Merriam, 1941, p. 93, pl. 15, fig. 6
Kern Co., Calif.; Tejon Qd, Liveoak Canyon UCMP loc. 7182
Eocene, Tejon Fm [holotype UCMP 33873]

6201 **nepos, Helix intercisa:** Hemphill Paratypes
Hemphill, 1891, p. 330
San Clemente Island, Calif.

6202 **nevadensis, Oreohelix:** Berry Paratypes
Berry, 1932, p. 60
White Pine Co., Nevada; Shell Creek Mts., Cleve Creek, elev. 8100′

5843 **nevadensis, Parapholyx effusa:** Henderson Holotype
Henderson, 1934a, p. 91, pl. 9, fig. 6, second from left
Winnemucca Lake, Nevada

5842 **nevadensis, Parapholyx effusa:** Henderson Paratypes
5844 Henderson, 1934a, p. 91, pl. 9, fig. 6 except second from left
Winnemucca Lake, Nevada

273 **newcombei, Cerithidea:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 163, pl. 31, figs. 4a, 4b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Sooke SU loc. NP 129
Oligocene, Sooke Fm

274 **newcombei, Cerithidea:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 163, pl. 31, fig. 5
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Sooke SU loc. NP 129
Oligocene, Sooke Fm

6241 **newcombiana, Paludinella:** Hemphill Syntypes
Hemphill, 1876, p. 49
Humboldt Bay, Calif.

108 **newhallensis, Cancellaria:** Carson Holotype
Carson, 1926, p. 56, pl. 3, fig. 3
Los Angeles Co., Calif.; Elsmere Canyon
Lower Pliocene

5409 **newsomi, Pleurotoma:** Arnold Plastoholotype
Arnold, 1908a, p. 368, pl. 33, fig. 2
Santa Cruz Co., Calif.; Boulder Creek, 2.25 miles N of Eagle Rock
Oligocene, San Lorenzo Fm [holotype USNM]

8571 **ninfae, Terebra (Strioterebrum):** Campbell Paratype
Campbell, 1961b, p. 27
Chiapas, Mexico; about 30 miles N of Guatemalan border

7799 **nipponensis, Cylichna:** Nomura and Hatai Paratype
Nomura and Hatai, 1940, p. 72
Aomori-Ken, NE Honsyu, Japan; off Kyuroku-Shima

9731 **nipponensis, Siphonochelus (Siphonochelus):** Keen and Campbell Plastoholotype
Keen and Campbell, 1964, p. 50, pl. 10, fig. 25
Off Tosa, Japan, 200+ m [holotype in Kyoto, Japan, private collection of Mr. Akibumi Teramachi]

9730 **nipponensis, Siphonochelus (Siphonochelus):** Keen and Campbell Paratype
Keen and Campbell, 1964, p. 50
Off Tosa, Japan; 200+ m

5950 **nodosus, Vermetus:** Oldroyd Holotype
See Pelecypoda

7182 **nova, Turritella:** Nomland Plastoholotype
Nomland, 1916b, p. 208, pl. 11, fig. 3. Also *in* Merriam, 1941, p. 119, pl. 34, fig. 7 (as *Turritella cooperi nova*)
Fresno Co., Calif.; Waltham Canyon UCMP loc. 2533
Pliocene, Jacalitos Fm [holotype UCMP 12060]

6160 **obscura, Oreohelix cooperi:** Henderson Paratypes
Henderson, 1918, p. 46
White Creek Canyon, Wyoming

8259 **obstipa, Balcis (Vitreolina):** Berry Paratype
Berry, 1954b, p. 262
San Pedro, Calif.; Hilltop Quarry
Lower Pleistocene, Lomita Fm.

6248 **occidentalis, Eulimella:** Hemphill Paratypes
Hemphill, 1894, p. 395
San Diego, Calif.

5817 **occidentalis, Limnaea stagnalis:** Hemphill Paratypes
Hemphill, 1890, p. 26
Whatcom Co., Wash.; Whatcom Lake, Bellingham

5448 **ochromphalus, Monadenia fidelis:** Berry Paratypes
5449 Berry, 1937, p. 28
Siskiyou Co., Calif.; Etna Creek, 2.5 miles above Etna

6208 **ochsneri, Helicina (Idesa):** Dall Paratypes
Dall, 1917c, p. 382
Galápagos; Albemarle Island, Cowley Mt.

7157 **ocoyana, Turritella:** Conrad Plastoneotype
Conrad, 1855, p. 329, pl. 8, figs. 73a, 73b. Neotype designated by Merriam, 1941, p. 112, pl. 29, fig. 5
Kern Co., Calif.; Poso Creek, Kern River region UCMP loc. 2713
Middle Miocene, Temblor Fm [neotype UCMP 31641]

8717 **oeciscus, Hemisinus (Longiverena):** Woodring Paratype
Woodring, 1959, p. 157
Panama Canal Zone; Barro Colorado Island
Upper Oligocene, upper Bohio Fm

5892 **oldroydae, Chilina:** Marshall Paratype
Marshall, 1924, p. 4
Chubut Province, Argentina; Lake Fetalafquen, Andes

6264 **oldroydae, Diastoma:** Bartsch Paratype
Bartsch, 1911b, p. 583
San Pedro, Calif.

6410a **oldroydi, Acteocina:** Dall Paratypes
6410c Dall, 1925, p. 25
Vancouver Island, British Columbia, Canada; Nanaimo, Departure Bay

6410b **oldroydi, Acteocina:** Dall Paratype
Dall, 1925, p. 25. Also *in* Oldroyd, 1927, p. 28, pl. 2, fig. 4
Vancouver Island, British Columbia, Canada; Nanaimo, Departure Bay

6455 **oldroydi, Coralliophila:** Oldroyd Holotype
Oldroyd, I. S., 1929, p. 98, pl. 5, figs. 1, 2. Also *in* McLean, 1969, p. 44, fig. 23.4 (as *Latiaxis*)
Catalina Island, Calif.; off Isthmus, Bird Rock

6456 **oldroydi, Coralliophila:** Oldroyd Paratype
Oldroyd, I. S., 1929, p. 98, pl. 5, fig. 4
Catalina Island, Calif.; off Isthmus, Bird Rock

6457 **oldroydi, Coralliophila:** Oldroyd Paratype
Oldroyd, I. S., 1929, p. 98, pl. 5, fig. 3 [not fig. 4 as stated]
Galapagos; Indefatigable Island

429 **oldroydi, Mangilia:** Arnold Holotype
Arnold, 1903, p. 213, pl. 6, fig. 16
Los Angeles Co., Calif.; Deadman Island
Pleistocene, lower San Pedro Fm

6252 **oldroydi, Melanella (Melanella):** Bartsch Paratypes
Bartsch, 1917, p. 309
San Pedro, Calif.

104 **oldroydia, Cancellaria:** Carson Holotype
Carson, 1926, p. 51, pl. 1, fig. 5
San Mateo Co., Calif.; near mouth of Purisima Creek

6447 **oldroydii, Sigaretus:** Dall Holotype
Dall, 1897c, p. 85. Illustrated *in* Dall, 1921, pl. 14, figs. 1, 3 (as *Eunaticina*). Also in Oldroyd, I. S., 1927, pl. 92, figs. 11, 11a
Off Catalina Island, Calif.; in deep water

459 **olequaensis, Ambloxus:** Hannibal Holotype
Hannibal, 1912b, p. 178, pl. 8, fig. 27. Also *in* Taylor and Smith, 1971, figs. 22, 23 (as *Juga*)
Wash.; Olequa Creek, 2 miles N of Little Falls
Eocene [Late Eocene, Cowlitz Fm, *fide* Taylor and Smith, 1971, p. 311]

5828 **olivacea, Chilina:** Marshall Paratypes
Marshall, 1924, p. 4
Chubut, Argentina; 43° 20′ S, 71° 30′ W, Rio Corcovado

7624 **olympicensis, Perse:** Durham Paratype
Durham, 1944, p. 174
Jeferson Co., Wash.; Point Nill, Port Discovery SU loc. NP 151
Lower Oligocene, Quimper Ss

8351 **olympicensis, Turritella:** Durham Plastoholotype
Durham, 1944, p. 163, pl. 17, fig. 1
Jefferson Co., Wash.; UCMP loc. A-3702
Lower Oligocene, Quimper Ss [holotype UCMP 35318]

6269 **onealensis, Cerithiopsis:** Bartsch Paratypes
Bartsch, 1921, p. 35
Puget Sound, Wash.; off O'Neal Island, 20 fms

8058 **onoyamai, Bittium:** Oinomikado and Ikebe Paratypes
Oinomikado and Ikebe, 1939, p. 105
Toyama Prefecture, Japan; Tagawa, Konade-mura, Nishi Tonami-gun
Upper Pliocene, Tagawa beds

10203 **oregonensis, Comitas (Boreocomitas):** Hickman Paratype
Hickman, 1976, p. 43, pl. 2, fig. 14
Ore. SU loc. H 40
Oligocene, Keasey Fm, upper mbr

6184 **oria, Polygyra columbiana:** Berry Paratypes
Berry, 1933, p. 15
Eldorado Co., Calif.; S fork American River Canyon near Riverton

6215 **orina, Helminthoglypta:** Berry Paratypes
Berry, 1938b, p. 41
Kern Co., Calif.; near summit of Breckinridge Mt.

6181 **orotis, Vitrea:** Berry Paratype
Berry, 1930a, p. 113
San Diego Co., Calif.; Palomar Mts., E of Palomar P.O., 5000′ elev.

7859 **orthosymmetra, Turritella:** Berry Paratype
Berry, 1953b, p. 412
Santa Catalina Island, Calif.; off Pebbly Beach, 50 fms

8095 **osborni, Aesopus:** Hertlein and Strong Paratypes
Hertlein and Strong, 1951a, p. 83
Off Port Guatulco, Mexico; 15° 44′ 28″ N, 96° 07′ 51″ W, 7 fms

10325 **ossa, Turritella:** Popenoe Plastoholotype
Popenoe, 1937, p. 401, pl. 49, fig. 6
Santa Ana Mts., Calif.; CIT loc. 1066
Cretaceous, Campanian [holotype UCLA 40674]

7848 **ovuliformis, Pedicularia californica:** Berry Holotype
Berry, 1946c, p. 3, fig. 1
Santa Catalina Island, Calif.; Farnsworth Bank, 42 m

7848a **ovuliformis, Pedicularia californica:** Berry Paratype
Berry, 1946c, p. 3
Santa Catalina Island, Calif.; Farnsworth Bank, 42 m

10060 **oweni, Haliotis corrugata:** Talmadge Paratype
Talmadge, 1966, p. 1
Guadalupe Island, off Baja California, Mexico; 20′

6192 **ozarkensis, Omphalina fuliginosa:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1907, p. 562
Logan Co., Ark.; Petit Jean Mts.

8073 **pachyostracon, Craterarion:** Taylor Holotype
Taylor, 1954, p. 75, pl. 20, figs. 18-20
San Bernardino Co., Calif.; canyon S of Pirie Canyon, SE 1/4 Sec. 15, T 11 N, R 2 W
Upper Miocene, Barstow Fm

8074 **pachyostracon, Craterarion:** Taylor Paratypes
Taylor, 1954, p. 75
San Bernardino Co., Calif.; canyon S of Pirie Canyon, SE 1/4 Sec. 15, T 11 N, R 2 W
Upper Miocene, Barstow Fm

10332 **packardi, Ampullina:** Popenoe Plastoholotype
Popenoe, 1937, p. 399, pl. 49, figs. 4, 5
Santa Ana Mts., Calif.; CIT loc. 1054
Cretaceous, Campanian [holotype UCLA 40667]

7000 **packardi, Turritella:** Merriam Plastoholotype
Merriam, 1941, p. 66, pl. 3, fig. 6
Orange Co., Calif.; Santa Ana Mts. UCMP loc. A-810
Upper Cretaceous, "Chico" Fm [holotype UCMP 15362]

107 **palmeri, Cancellaria:** Carson Holotype
Carson, 1926, p. 55, pl. 2, fig. 4
Santa Cruz Co., Calif.; bluffs above beach E of hotel at Capitola
Lower Pliocene, Purisima Fm

7780 **paparyensis, Segmentina:** Baker Paratype
Baker, Fred, 1914, p. 662
Brazil; mouth of main affluent of Papary Lake

7797 **pareximia, Actaeopyramis:** Nomura Paratypes
Nomura, 1936, p. 19
NE Honsyu, Japan; Siogama Bay

10293 **parkeri, Turritella:** McLean Paratypes
McLean, 1970c, p. 127
Baja California, Mexico; Bahia de la Paz, W of Espiritu Santo Island, 24° 24.3' - 24° 25.6' N,
110° 23.7' - 110° 25.5' W, 45-65 fms

8514 **parthenia, Pleuroliria:** Berry Holotype
Berry, 1957, p. 81. Illustrated *in* Keen, 1958b, p. 477, fig. 912
Gulf of Nicoya, Costa Rica; off Isla Tortugas, 10 fms

6438 **parva, Olivella biplicata:** Oldroyd Holotype
Oldroyd, T. S., 1921, p. 119, pl. 5, fig. 7
Baja California, Mexico; Point Abreojos

5387 **Patella** n. sp. **b:** Arnold Syntypes
Arnold, 1908a, p. 362
San Mateo Co., Calif.; ridge between San Lorenzo River and Pescadero Creek
Eocene, Martinez Fm ?

8682 **paucilirata, Siphonalia:** Makiyama Paratype
Makiyama, 1941, p. 88
Chiba-ken, Japan; coast at Sasage
Lower Pleistocene, Kanozan Fm

5509 **pecora, Turbonilla (Strioturbonilla):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 24
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pablo Fm

5506 **pedroensis, Acteocina:** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 23
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

7196 **pedroensis, Turritella:** Applin Plastoholotype
Applin MS *in* Merriam, 1941, p. 121, pl. 35, fig. 5
Los Angeles Co., Calif.; Timms Point, San Pedro UCMP loc. 7102
Pleistocene [holotype UCMP 15236]

509 **pembertoni, Ataphrus:** Hall and Ambrose Holotype
Hall and Ambrose, 1916, p. 70. Illustrated *in* Wiedey, 1929b, pl. 1, fig. 7
Alameda Co., Calif.; Tesla Qd, Jordan Ranch, Arroyo del Valle
Upper Cretaceous, lower Chico Fm

6254 **peninsularis, Melanella (Balcis):** Bartsch Paratypes
Bartsch, 1917, p. 320
Baja California, Mexico; San Hipolite Point and Pt. Abreojos

10058 **pentedesmium, Cirsotrema:** Berry Holotype
Berry, 1963, p. 143. Illustrated *in* Keen, 1971, p. 428, fig. 634 left [as *Epitonium (Cirsotrema) vulpinum* (Hinds, 1844)]
Guaymas, Mexico; San Carlos, 15-30 fms

7981 **pequenita, Strombina:** Marks Paratype
Marks, 1951, p. 111
SW Ecuador; Zacachun corehole, 80-90'
Lower Miocene, upper Subibaja Fm

8353 **perangulatus, Murex:** Nomland Plastoholotype
Nomland, 1916b, p. 206, pl. 11, figs. 1a, 1b
Fresno Co., Calif.; Coalinga-Priest Valley Road
Lower Pliocene [holotype UCMP 10257]

10048 **perata, Nassarina (Cigclirina):** Keen Paratype
Keen, 1971, p. 594, fig. 1248
Chiapas, Mexico; Puerto Videra, 37-45 m

6209 **perchloris, Bulimulus (Naesiotus) nux:** Dall and Ochsner Paratypes
Dall and Ochsner, 1928, p. 156
Galápagos; Charles Island

6195 **percostata, Polygyra dorfeuilliana:** Pilsbry Paratypes
Pilsbry, 1899b, p. 37
Arkansas; Red River, near Texarkana

8716 **pericallum, Bittium:** Woodring Paratype
Woodring, 1959, p. 179
Panama Canal Zone; Mount Hope Cemetery area
Middle Miocene, upper Gatun Fm

5386 **perissolaxoides, Pleurotoma:** Arnold Paratype
Arnold, 1908a, p. 368
Santa Cruz Co., Calif.; San Lorenzo River, 3.75 miles above Boulder Creek
Oligocene, San Lorenzo Fm

8496 **perplexa, Aspella:** Keen Holotype
Keen, 1958a, p. 248, pl. 30, fig. 11. Also *in* Keen, 1971, p. 527, fig. 1014 left [as *Aspella (Dermomurex) indentata* (Carpenter, 1857)]
Perlas Islands, Panama

60 **perrini, Acanthina:** Trask Holotype
Trask, 1922, p. 157, pl. 8, figs. 1a, 1b
6 miles S of Livermore, Calif.
Miocene, Briones Fm

213 **perrini, Acanthina:** Trask Paratype
Trask, 1922, p. 157
6 miles S of Livermore, Calif.
Miocene, Briones Fm

102 **perrini, Cancellaria:** Carson Holotype
Carson, 1926, p. 56, pl. 3, fig. 4
Santa Barbara Co., Calif.; Santa Maria District, Fugler's Point
Lower Pliocene, Fernando Fm

103 **perrini, Cancellaria:** Carson Paratype
Carson, 1926, p. 56
Los Angeles Co., Calif.; Elsmere Canyon
Lower Pliocene, Fernando Fm

103a **perrini, Cancellaria:** Carson Paratype
Carson, 1926, p. 56
Santa Barbara Co., Calif.; Santa Maria District, Fugler's Point
Lower Pliocene, Fernando Fm

7763 **perrini, Fissurella:** Arnold Paratype
Arnold, 1908a, p. 362
San Mateo Co., Calif.; ridge between headwaters of San Lorenzo River and Pescadero Creek, Santa Cruz Qd SU loc. 2694
"Eocene, Martinez Fm"

277 **perrini, Rapana:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 161, pl. 31, fig. 7
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

6996 **perrini, Turritella chicoensis:** Merriam Plastoholotype
Merriam, 1941, p. 66, pl. 2, fig. 3
Corona Qd, Calif.; near Santiago Canyon UCMP loc. 2154
Upper Cretaceous, "Chico" Fm [holotype UCMP 15366]

6204 **perrus, Bulimulus (Naesiotus):** Dall Paratypes
Dall, 1917c, p. 376
Galápagos; Narborough Island, 2000-4500′ elev.

8498 **personatum, Crucibulum:** Keen Holotype
Keen, 1958a, p. 247, pl. 30, figs. 6, 8. Also *in* Keen, 1971, p. 463, fig. 824
Pacific coast of Panama

8499 **personatum, Crucibulum:** Keen Paratype
Keen, 1958a, p. 247, pl. 30, fig. 7
Pacific coast of Panama

418 **pertumida, Turritella inezana:** Wiedey Paratype
Wiedey, 1928, p. 119, pl. 12, fig. 6
San Luis Obispo Co., Calif.; Canal de Pietro, or Corral de Piedra, 5 miles E of San Luis Obispo
Miocene, Vaqueros Fm [= hypotype 418, *Turritella inezana* Waring, 1915, fig. 28]

7130 **pervulgata, Turritella inezana:** Merriam Plastoholotype
Merriam, 1941, p. 108, pl. 25, fig. 11
Ventura Co., Calif.; Ojai Valley UCMP loc. A-330
Lower Miocene, Vaqueros Fm [holotype UCMP 31686]

5896 **pescaderoensis, Turritella:** Arnold Holotype
Arnold, 1908a, p. 358, pl. 31, fig. 7. Also *in* Merriam, 1941, p. 66, pl. 2, fig. 5
San Mateo Co., Calif.; 2.5 miles N of Bolsa Point, 1 mile S of Arroyo de los Frijoles
Upper Cretaceous, Chico Fm

5891 **pescaderoensis, Turritella:** Arnold Paratype
Arnold, 1908a, p. 358
San Mateo Co., Calif.; 2.5 miles N of Bolsa Point, 1 mile S of Arroyo de los Frijoles
Upper Cretaceous, Chico Fm

6575 **petrothauma, Astraea (Pomaulax):** Berry Paratype
Berry, 1940b, p. 156
San Pedro, Calif.; Hilltop Quarry
Lower Pleistocene

6211 **phlegonis, Bulimulus (Naesiotus) ustulatus:** Dall and Ochsner Paratypes
Dall and Ochsner, 1928, p. 160
Galápagos; Charles Island, 1650′ elev.

460 **physispira, Brannerillus:** Hannibal Holotype
Hannibal, 1912b, p. 191, pl. 8, fig. 28. Also *in* Taylor and Smith, 1971, figs. 49, 53
Kettleman Hills, Calif.; gulch S of Medallion One Canyon, E flank of Hills
Pliocene [Upper Pliocene, Tulare Fm, basal part, *fide* Taylor and Smith, 1971, p. 313]

5821 **picta, Cochliopa:** Pilsbry Paratypes
Pilsbry, 1910, p. 100
San Luis Potosi, Mexico; Coy River, near Tampamolon

10290 **picta, Tegula (Agathistoma):** McLean Paratype
McLean, 1970c, p. 121-122
W of Manta, Ecuador; 0° 56′ 43″ S, 80° 44′ 43″ W, on exposed reef at low tide R/V *Velero III* Sta. 403-35

6153 **pilsbryi, Oreohelix:** Ferriss Paratypes
Ferriss, 1917, p. 102
Black Range, New Mexico; Chloride (Mineral Creek)

153 **plectatus, Ficus:** Waring Holotype
Waring, 1917, p. 83, pl. 12, fig. 8
Ventura Co., Calif.; Martinez area, Simi Hills
Lower Eocene, Martinez Fm [Paleocene]

481 **pleistocenensis, Eupleura muriciformis:** Arnold Holotype
Arnold, 1903, p. 249, pl. 9, fig. 16
Los Angeles Co., Calif.; San Pedro, lumber yard
Pleistocene, upper San Pedro Fm

5420 **portolaensis, Fusus:** Arnold Paratype
Arnold, 1908a, p. 385. Illustrated *in* Arnold, 1909, Illust. 2, fig. 68
San Mateo Co., Calif.; 1/2 mile SW of Portola on Sausal Creek
Upper Miocene, Purisima Fm [Arnold's specimen 1080]

537 **praecursor, Columbella solidula:** Arnold Plastoholotype
Arnold, 1903, p. 236, pl. 10, fig. 4
Los Angeles Co., Calif.; San Pedro, lumber yard
Pleistocene, upper San Pedro Fm [holotype USNM]

9735 **precursor, Typhis (Talityphis):** Keen and Campbell Plastoholotype
Keen and Campbell, 1964, p. 49, pl. 9, figs. 14, 18
Atlántico, Colombia; 6 km W of Puerto Columbia UC loc. S-8012
Upper Oligocene, Las Perdices Shale [Holotype UCMP No. 15083]

7986 **predistortus, Cantharus (Triumphis):** Marks Paratype
Marks, 1951, p. 117
SW Ecuador; Daule Basin
Middle Miocene, Daule Fm

7784 **profundorum, Oreohelix yavapai:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1911, p. 182
Grand Canyon, Arizona; Specimen Cove, Bass Trail

6182 **pronotis, Monadenia fidelis:** Berry Paratypes
Berry, 1931a, p. 122
Del Norte Co., Calif.; Point St. George, near Crescent City

10067a **protera, Hanetia dalli:** Woodring Paratypes
10067b Woodring, 1964, p. 257
10067c Panamá; Transisthmian Highway, 9° 21′ + 335 m N, 79° 49′ W
SU loc. 2611 = USGS loc. 16912
Middle Miocene, Gatun Fm, lower part

8669 **pterocladica, Tricolia affinis:** Robertson Paratypes
Robertson, 1958, p. 264
Boynton Beach, Fla.

9722 **puertoricensis, Typhis (Talityphis):** Warmke Holotype
Warmke, 1964, p. 1, pl. 1, figs. 3, 4
Puerto Rico; off Punta Cadena, N of Mayaguez, 33 fms

7868 **punctocostata, Puncturella:** Berry Holotype
Berry, 1947b, p. 265, pl. 26, figs. 7-9
San Pedro, Calif.; near Second and Pacific Streets
Lower Pleistocene, Lomita Fm

7868a **punctocostata, Puncturella:** Berry Paratype
Berry, 1947b, p. 265
San Pedro, Calif.; near Second and Pacific Streets
Lower Pleistocene, Lomita Fm

7867 **punctulum, Mistostigma:** Berry Holotype
Berry, 1947b, p. 264, pl. 27, fig. 5
Santa Barbara, Calif.; Bath House Cliff
Upper Pliocene, Santa Barbara Fm

7867a **punctulum, Mistostigma:** Berry Paratype
Berry, 1947b, p. 264
Santa Barbara, Calif.; Bath House Cliff
Upper Pliocene, Santa Barbara Fm

8587 **pusilla, Diodora:** Berry Holotype
Berry, 1959, p. 109. Illustrated *in* Keen, 1971, p. 316, fig. 22
Guerrero, Mexico; off Acapulco, 6-10 fms

8605 **pycna, Olivella:** Berry Holotype
Berry, 1935, p. 262, fig. 1
Marin Co., Calif.; Bolinas Bay, 3-4 fms

5447 **pycna, Olivella:** Berry Paratype
Berry, 1935, p. 262
Marin Co.. Calif.; Bolinas Bay, 3-4 fms

9175 **quadrangulata, Nerita:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 183, pl. 23, fig. 1
Santa Barbara Co., Calif.; N of Gaviota Pass UCMP loc. B-6962
Eocene-Oligocene, Refugian stage, Gaviota Fm

9175a **quadrangulata, Nerita:** Weaver and Kleinpell Paratypes
9175b Weaver and Kleinpell, 1963, p. 183
9175c Santa Barbara Co., Calif.; N of Gaviota Pass UCMP loc. B-6962
Eocene-Oligocene, Refugian stage, Gaviota Fm

7625 **quimperensis, Perse olympicensis:** Durham Paratype
Durham, 1944, p. 175, pl. 16, fig. 6
Jefferson Co., Wash.; Point Nill, Port Discovery SU loc. NP 151
Oligocene, Quimper Ss

6591 **ralphi, Puncturella:** Berry Holotype
Berry, 1947b, p. 267, pl. 26, figs. 4-6
San Pedro, Calif.; near Second and Pacific Streets
Pleistocene, Lomita Fm

5579 **redondoensis, Pseudomelatoma semiinflata:** Burch Paratype
Burch, T., 1938, p. 21
Redondo Beach, Calif.; 25 fms

498 **refulleri, Epitonium (Boreoscale) condoni:** Durham Holotype
Durham, 1937, p. 497, pl. 57. fig. 3
Washington-Columbia Co., line, Nehalem River, near Vernonia, Ore. SU loc. NP 1
Oligocene, Keasey Fm

5811 **regina, Doryssa rex:** Pilsbry Paratype
Pilsbry in Baker, Fred, 1914, p. 651
Rio Jary, Brazil; Sao Antonio do Cachoeira

8567 **rejecta, Oliva:** Burch and Burch Paratype
Burch and Burch, 1962, p. 166
Baja California, Mexico; La Paz, on tide flats

428 **renaudi, Drillia:** Arnold Plastoholotype
Arnold, 1903, p. 208, pl. 8, fig. 5
Los Angeles Co., Calif.; Deadman Island
Pleistocene, lower San Pedro Fm [holotype USNM]

7006 **renodata, Turritella pachecoensis:** Merriam Plastoholotype
Merriam, 1941, p. 69, pl. 4, fig. 8
Simi Valley, Calif.; SE 1/4 Sec. 23, T 2 N, R 18 W UCMP loc. 3777
Paleocene, Martinez Fm [holotype UCMP 15315]

161 **reticulata, Pseudoliva:** Waring Holotype
Waring, 1914, p. 783. Also *in* Waring, 1917, p. 86, pl. 12, fig. 4 (as *Pseudoliva howardi* Dickerson)
Ventura Co., Calif.; Martinez area of Simi Hills
Lower Eocene, Martinez Fm [Paleocene]

146 **reversa, Turritella:** Waring Holotype
Waring, 1917, p. 88, pl. 12, fig. 15. Also *in* Merriam, 1941, p. 74, pl. 7, fig. 7
Ventura Co., Calif.; Calabasas sheet, Simi Hills
Eocene, Martinez Fm [Paleocene]

596 **rex, Galeodea:** Tegland Paratype
Tegland, 1931, p. 413, pl. 62, figs. 2, 3
Bainbridge Island, Wash.; Puget Sound, beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Oligocene, Blakeley Fm

597 **rex, Galeodea:** Tegland Paratype
Tegland, 1931, p. 413, pl. 62, fig. 5
Bainbridge Island, Wash.; Puget Sound, beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Oligocene, Blakeley Fm

598 **rex, Galeodea:** Tegland Paratype
Tegland, 1931, p. 413, pl. 62, fig. 4
Bainbridge Island, Wash.; Puget Sound, beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Oligocene, Blakeley Fm

7803 **rhodacme, Achatina schweinfurthi:** Pilsbry Paratype
Pilsbry, 1919, p. 74
Africa; Stanleyville, Belgian Congo

8712 **rhytodes, Turritella gatunensis:** Woodring Paratypes
Woodring, 1957, p. 109
Canal Zone; W side Rio Chagres, NW of Gatun Dam
Miocene, middle Gatun Fm

8094 **ritteri, Anachis:** Hertlein and Strong Paratypes
Hertlein and Strong, 1951a, p. 82
Off Port Guatulco, Mexico; 15° 44′ 28″ N, 96° 07′ 51″ W, 7 fms

6247 **ritteri, Trivia:** Raymond Paratypes
Raymond, 1903, p. 85
Off San Pedro, Calif.; 50 fms

147 **robustus, Gyrodes:** Waring Syntype
Waring, 1917, p. 84, pl. 13, fig. 11
Ventura Co., Calif.; Martinez area, Simi Hills
Lower Eocene, Martinez Fm [Paleocene]

148 **robustus, Gyrodes:** Waring Syntype
Waring, 1917, p. 84, pl. 13, fig. 12
Ventura Co., Calif.; Martinez area, Simi Hills
Lower Eocene, Martinez Fm [Paleocene]

6185 **rochai, Bulimulus (Rhinus):** Baker Paratypes
Baker, 1914, p. 636
Ceará, Brazil; Ceará-Mirim

7991 **roigi, Conus (Leptoconus):** Marks Paratype
Marks, 1951, p. 140
Ecuador; near Las Masas, Guayas Province
Lower Miocene, Subibaja Fm

6176 **rooseveltiana, Sonorella:** Berry Paratypes
Berry, 1917a, p. 14
Gila Co., Arizona; Roosevelt

6949 **rosea, Nucella (?):** Dall Paratype
Dall, 1872, p. 270
Simeonoff Island, Shumagin group, Alaska

6225 **roseobasis, Drillia:** Pilsbry and Vanatta Syntype
Pilsbry and Vanatta, 1902, p. 558
Galápagos; Albemarle Island, Tagus Cove

7531 **rotundomontana, Chrysallida:** Keen Holotype
Keen, 1943, p. 43, pl. 4, fig. 28
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

402 **rotundus, Pugnellus:** Waring Holotype
Waring, 1917, p. 67, pl. 9, fig. 10
near Ventura-Los Angeles Co. line, Calif.; Calabasas sheet, S of Santa Monica Mts.
Upper Cretaceous, Chico Fm

646 **ruginodosa, Ficus (Trophosycon) ocoyana:** Grant and Gale Paratype
Grant and Gale, 1931, p. 746, pl. 30, fig. 5
Los Angeles Co., Calif.; Elsmere Canyon
Lower Pliocene

8644 **rupicollina, Astraea (Uvanilla):** Stohler Paratype
Stohler, 1959, p. 434
Baja California, Mexico; 8 miles SE of South Coronado Island, 70′

6212 **saccharodytes, Helminthoglypta proles:** Berry Paratypes
Berry, 1938b, p. 46
Tulare Co., Calif.; Sugar Loaf Mt., 6000′ elev.

6197 **salmonensis, Helicodiscus fimbriatus:** Hemphill Paratypes
Hemphill *in* Binney, 1890, p. 220
Salmon River, Idaho

8665 **salmonensis, Monadenia fidelis:** Talmadge Paratype
Talmadge, 1954, p. 54
Siskiyou Co., Calif.; Wooley Creek, Salmon River

451 **sanctaeclarae, Carinifex:** Hannibal Holotype
Hannibal, 1909, p. 40. Illustrated *in* Hannibal, 1912b, p. 163, pl. 6, fig. 14a (as *Pompholyx*). Also *in* Taylor and Smith, 1971, figs. 54-56, 59 (as *Helisoma*)
Santa Clara Co., Santa Cruz Mts., Calif.; Los Gatos, near ls quarry
Pliocene, Santa Clara Lake Beds

796 **sanctaecrucis, Fusus:** Arnold Holotype
Arnold, 1908a, p. 372, pl. 33, fig. 3. Also *in* Arnold, 1909, fig. 19, and *in* Tegland, 1933, p. 166, pl. 12, fig. 2 (as *Fusinus*)
Santa Cruz Co., Calif.; Bear Creek, 4 miles above San Lorenzo River
Oligocene, San Lorenzo Fm

5418 **sanctaecrucis, Fusus:** Arnold Paratypes
5419 Arnold, 1908a, p. 372
Santa Cruz Co., Calif.; Bear Creek, 4 miles above San Lorenzo River
Oligocene, San Lorenzo Fm

101 **sanctaemariae, Cancellaria:** Carson Holotype
Carson, 1926, p. 57, pl. 3, fig. 5, as *sanctae-mariae*
Santa Barbara Co., Calif.; Santa Maria District, Fugler's Point
Lower Pliocene, Fernando Fm

6625 **sanctijosephi, Lymnaea cubensis:** Hannibal Holotype
Hannibal *in* Keep, 1911, p. 309, pl. 3, fig. 6, as *sancti-josephi.* Also *in* Taylor and Smith, 1971, fig. 35 [as *Bakerilymnaea bulimoides* (Lea, 1841)]
Santa Clara Co., Calif.; Calabasas Slough between Alviso and Lawrence

5527 **sanesia, Odostomia (Amaura):** Oldroyd Paratype
Oldroyd, T. S., 1924, p. 34
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

6191 **sanmarcosensis, Bulimulus:** Pilsbry and Lowe Paratypes
Pilsbry and Lowe, 1932b, p. 49
Gulf of California; San Marcos Island

9190 **sanmarcosensis, Turritella variata:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 185, pl. 24, fig. 4
Santa Barbara Co., Calif.; Camino Cielo UCMP loc. B-6940
Eocene, "Coldwater" Fm

9191 **sanmarcosensis, Turritella variata:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 185, pl. 24, fig. 2
Santa Barbara Co., Calif.; Camino Cielo UCMP loc. B-6940
Eocene, "Coldwater" Fm

9192 **sanmarcosensis, Turritella variata:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 185, pl. 24, fig. 3
Santa Barbara Co., Calif.; Camino Cielo UCMP loc. B-6940
Eocene, "Coldwater" Fm

5369 **santacruzana, Agasoma:** Arnold Holotype
Arnold, 1908a, p. 379, pl. 34, fig. 7. Also *in* Arnold, 1909, Illus. 2, fig. 44.
San Mateo Co., Calif.; 1/2 mile NNE of N end of Searsville Lake, on hill N of road
Lower Miocene, Vaqueros Fm [Arnold's specimen 1072]

5422 **santacruzana, Turcicula:** Arnold Paratypes
Arnold, 1908a, p. 373
Santa Cruz Co., Calif.; San Lorenzo River, 3 miles above Boulder Creek
Oligocene, San Lorenzo Fm

7126 **santana, Turritella inezana:** Loel and Corey Plastoholotype
Loel and Corey, 1932, p. 259, pl. 59, fig. 13
Orange Co., Calif.; Santa Ana Mts., W end Plano Trabuco UCMP loc. 6128
Lower Miocene, Vaqueros Fm [holotype UCMP 31691]

7962 **santiagensis, Cancellaria (Bivetiella):** Marks Paratype
Marks, 1949, p. 462
Ecuador; Esmeraldas Province, Angostura Cave, Santiago River
Lower Miocene, Angostura Fm

10335 **scalesiana, Naesiotus:** Smith Paratype
Smith, A. G., 1972, pp. 17-19
Galápagos; Isla Santa Cruz, Harneman Farm, *Scalesia* Zone CAS loc. 40021

5729
5730 **scalpta, Streptacis:** Knight Paratypes
Knight, 1931, p. 12
St. Louis Co., Missouri; St. Louis
Pennsylvanian, Harriet Fm, top of Labette Shale

7544 **scandix, Syrnola,** Keen Holotype
Keen, 1943, p. 50, pl. 4, fig. 29
Kern Co., Calif.; Caliente Qd, small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

7544a **scandix, Syrnola:** Keen Paratype
Keen, 1943, p. 50, pl. 4, fig. 24
Kern Co., Calif.; Caliente Qd, small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

7544b **scandix, Syrnola:** Keen Paratype
Keen, 1943, p. 50, pl. 4, fig. 30
Kern Co., Calif.; Caliente Qd, small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

5519 **scelera, Odostomia (Chrysallida):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 30
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

6576 **schencki, Actaeon (Microglyphis):** Berry Paratype
Berry, 1941, pp. 3-4
Los Angeles Co., Calif.; San Pedro, Hilltop Quarry
Lower Pleistocene, Lomita

9237 **schencki, Conus:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 194, pl. 27, fig. 8
Santa Barbara Co., Calif.; Canada de Santa Anita SU loc. 2091
Eocene, middle Gaviota Fm

9238 **schencki, Conus:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 194, pl. 27, fig. 9
Santa Barbara Co., Calif.; Canada de Santa Anita SU loc. 2091
Eocene, middle Gaviota Fm

7783 **schencki, Epitonium (Boreoscala) keaseyense:** Durham Holotype
Durham, 1937, p. 498, pl. 57, fig. 14
Washington Co., Ore.; 3 miles S of Timber, Sec. 3, T 2 N, R 5 W
Oligocene, Keasey Fm

9210 **schencki, Galeodea:** Weaver and Kleinpell Holotype
Weaver and Kleinpell, 1963, p. 189, pl. 25, fig. 16
Santa Barbara Co., Calif.; Lompoc Qd, Nojoqui Creek UCMP loc. B-6933
Eocene-Oligocene, Sacate-Gaviota Fm

9211 **schencki, Galeodea:** Weaver and Kleinpell Paratype
Weaver and Kleinpell, 1963, p. 189, pl. 25, fig. 15
Santa Barbara Co., Calif.; Lompoc Qd, Nojoqui Creek UCMP loc. B-6933
Eocene-Oligocene, Sacate-Gaviota Fm

9723 **schencki, Laevityphis (Laevityphis):** Keen and Campbell Holotype
Keen and Campbell, 1964, p. 53, pl. 9, figs. 16, 20
Atlantico, Colombia; Puerto Colombia
Upper Oligocene, Las Perdices Fm

7623 **schencki, Olequahia:** Durham Holotype
Durham, 1944, p. 168, pl. 15, fig. 15
Washington Co., Ore.; Sec. 8, T 3 N, R 4 W
Oligocene, Keasey Fm

5711 **schencki, Pleurotomaria (Entemnotrochus?):** Hickman Holotype
Hickman, 1976a, p. 1095, pl. 1, figs. 1, 2, 11
Polk Co., Ore.; Dallas Qd, nr line between Secs. 11 & 12, T 8 S, R 6 W; Oregon Portland Cement Company Quarry, 1-1/2 mi SW of Dallas SU loc. 1111
Eocene, Yamhill Fm, Rickreall Ls mbr

7043 **schencki, Turritella:** Merriam Plastoholotype
Merriam, 1941, p. 81, pl. 10, fig. 10
Kern Co., Calif.; Tecuya Creek UCMP loc. A-1399
Upper Eocene, Tejon Fm [holotype UCMP 33945]

6983
6983a **schencki, Turritella:** Merriam Paratypes
Merriam, 1941, p. 81
Kern Co., Calif.; Tecuya Creek UCMP loc. A-1399
Upper Eocene, Tejon Fm

7779 **schereri, Helicina:** Baker Paratypes
Baker, Fred, 1914, p. 625
Ceará-Mirim, Brazil

8628 **schilderiana, Cypraea tigris:** Cate Paratype
Cate, 1961, p. 108
Oahu, Hawaii; Koko Head

6556 **scottiana, Monadenia fidelis:** Berry Paratypes
Berry, 1940a, p. 11
Siskiyou Co., Calif.; Kelsey Creek, Scott River

8345 **scrippsae, Hemitoma:** Durham Plastoholotype
Durham, 1950, p. 133, pl. 28, figs. 9, 14
Gulf of California; Carmen Island, Marquer Bay UCMP loc. A-3520
Upper Pliocene, Marquer Fm [holotype UCMP 30363]

7040 **scrippsensis, Turritella:** Hanna Plastoholotype
Hanna, 1927, p. 308, pl. 49, fig. 10. Also *in* Merriam, 1941, p. 81, pl. 9, fig. 15
San Diego Co., Calif.; La Jolla Qd UCMP loc. 5085
Eocene, Rose Canyon Fm [holotype UCMP 30904]

7038 **secondaria, Turritella andersoni lawsoni:** Merriam Plastoholotype
Merriam, 1941, p. 78, pl. 9, fig. 9
Ventura Co., Calif.; Llajas Canyon, Simi Valley UCMP loc. 7004
Eocene, "Domengine" Fm [holotype UCMP 33998]

8692 **seftoni, Ocenebra:** Chace Paratype
Chace, 1958a, p. 331
Baja California, Mexico; Guadalupe Island, Melpomene Cove, 40 fms

8513 **semiusta, Mitra:** Berry Holotype
Berry, 1957, p. 80
Santa Barbara Co., Calif.; off Point Conception, 15 m

8519 **sericeus, Capulus:** Burch and Burch Holotype
Burch and Burch, 1961, p. 19, pl. 2, figs. 1, 2. Also *in* Keen, 1971, p. 467, fig. 832
Sonora, Mexico; off Cabo Haro, Guaymas, 100 fms

6266 **serrae, Turbonilla (Strioturbonilla):** Dall and Bartsch Paratype
Dall and Bartsch, 1907, p. 497
Monterey, Calif.; 12 fms

9514 **sharonae, Lamellaria:** Willett Paratype
Willett, 1939, p. 123
Anaheim Bay, Calif.

8590 **shaskyi, Cantharus:** Berry Holotype
Berry, 1959, p. 111
Sonora, Mexico; probably S of Guaymas, from shrimp boats

6175 **shasta, Polygyra columbiana:** Berry Paratype
Berry, 1921, p. 37
Shasta Co., Calif.; La Moine

7798 **shataii, Menestho (Menestho):** Nomura Paratypes
Nomura, 1936, p. 36, as *s-hataii*
NE Honsyu, Japan; Siogama Bay

9921 **sheehani, Patella:** Smith Plastoholotype
Smith, 1927, p. 108, pl. 96, figs. 28, 29
Shasta Co., Calif.; N fork Squaw Creek, 3 miles N of Kellys Ranch
Upper Triassic, Hosselkus Ls [holotype USNM 74175]

5845 **shepardi, Zonites:** Hemphill Syntypes
Hemphill *in* Binney, 1892, p. 167
Santa Catalina Island, Calif.; Avalon

6233 **shepardiana, Graphis:** Dall Paratypes
Dall, 1919b, p. 342
San Pedro, Calif.; foot of Ash Street

112 **shumanensis, Thais (Nucella):** Carson Holotype
Carson, 1926, p. 56, pl. 3, fig. 1
Ventura Co. Calif.; Santa Maria District 1/2 mile N of Schuman, in R.R. cut
Lower Pliocene, Fernando Fm

141 **shumanensis, Thais (Nucella):** Carson Paratype
Carson, 1926, p. 56, pl. 3, fig. 2
Ventura Co., Calif.; Santa Maria District, 1/2 mile N of Schuman
Lower Pliocene, Fernando Fm

9992 **shyana, Terebra:** Bratcher and Burch Paratype
Bratcher and Burch, 1970a, p. 295
Colima, Mexico; off Manzanillo, 17-40 fms

10278 **shyorum, Epitonium (Epitonium):** DuShane and McLean Paratype
DuShane and McLean, 1968, p. 2
Colima, Mexico; Manzanillo, 12-13 fms

6174 **sierrana, Polygyra:** Berry Paratype
Berry, 1921, p. 36
Siskiyou Co., Calif.; 2 miles N of Weed

140 **simiensis, Turritella:** Waring Holotype
Waring, 1917, p. 88, pl. 14, fig. 15. Also *in* Merriam, 1941, p. 67, pl. 5, fig. 4 (as *T. pachecoensis* Stanton)
Ventura Co., Calif.; Martinez area, Simi Hills
Eocene, Martinez Fm [Paleocene]

6523 **sirius, Siphonaria:** Pilsbry Paratypes
Pilsbry, 1894, p. 9
Sagami, Japan

6054 **skogsbergi, Turbonilla (Pyrgolampros):** Strong Holotype
Strong, 1937, p. 54, pl. 4, fig. 3a
Monterey Bay, Calif.; 5 miles N of Monterey, 28 fms

6055 **skogsbergi, Turbonilla (Pyrgolampros):** Strong Paratype
Strong, 1937, p. 54, pl. 4, fig. 3b
Monterey Bay, Calif.; 5 miles N of Monterey, 28 fms

6558 **smithiana, Monadenia fidelis:** Berry Paratype
Berry, 1940a, p. 14
Del Norte Co., Calif.; 3 miles below Hiouchi, N side Smith River

10295 **snodgrassi, Bulimulus:** Dall Paratype
Dall, 1900a, p. 90
Galápagos; Hood Island

6223 **snodgrassi, Chlorostoma:** Pilsbry and Vanatta Syntypes
Pilsbry and Vanatta, 1902, p. 557
Galápagos; Albemarle Island, Iguana Cove

8100 **socorroensis, Latirus:** Hertlein and Strong Paratype
Hertlein and Strong, 1951b, p. 76
Clarion Island, off West Mexico

9510 **sonorana, Bursa californica:** Berry Holotype
Berry, 1960, p. 118. Illustrated *in* Keen, 1971, p. 509, fig. 967
Sonora, Mexico; near Guaymas, from shrimp boats

67 **sookensis, Acmaea mitra:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 171, pl. 35, figs. 2a, 2b
Vancouver Island, British Columbia, Canada: sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

252 **sookensis, Calyptraea:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 168, pl. 36, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

253 **sookensis, Calyptraea:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 168, pl. 36, fig. 2
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creek, Sooke SU loc. NP 129
Oligocene, Sooke Fm

260 **sookensis, Crepidula:** Clark and Arnold Holotype
Clark and Arnld, 1923, p. 166, pl. 35, figs. 5a, 5b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, Sooke SU loc. NP 129
Oligocene, Sooke Fm

261 **sookensis, Crepidula:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 166, pl. 32, figs. 2a, 2b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, Sooke SU loc. NP 129
Oligocene, Sooke Fm

232 **sookensis, Gadinia reticulata:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 157, pl. 35, fig. 3
Vancouver Island, British Columbia, Canada; Jordan River, sea cliffs at mouth of Fossil Creek, 2 miles W of Sherringham Point SU loc. NP 130
Oligocene, Sooke Fm

233 **sookensis, Gadinia reticulata:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 157, pl. 35, fig. 4
Vancouver Island, British Columbia, Canada; Jordan River, sea cliffs at mouth of Fossil Creek, 2 miles W of Sherringham Point SU loc. NP 130
Oligocene, Sooke Fm

71 **sookensis, Goniobasis:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 164, pl. 32, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Kirby Creeks, Sooke
Oligocene, Sooke Fm

271 **sookensis, Littorina:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 165, pl. 37, figs. 4a, 4b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

245 **sookensis, Polinices (Ampullina?):** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 170, pl. 33, figs. 4a, 4b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

5347 **sorenseni, Haliotis:** Bartsch Paratype
Bartsch, 1940, p. 50
Santa Barbara Co., Calif.; just S of Point Conception, 10 fms

8048 **spectabilis, Coronaria:** Trechmann Paratypes
8049 Trechmann, 1918, p. 187
New Zealand; Otago, Nugget Point (type 8048); Wairoa Gorge, Nelson (type 8049)
Triassic, Karnic

8667 **spelaea, ?Vitrea subrupicola:** Dall Paralectotypes
Dall, 1895, pp. 27-28. Paralectotypes designated by Smith, 1957, p. 30 [referred to *Pristiloma subrupicola spelaeum* (Dall)]
Calaveras Co., Calif.; Cave City

8702 **spermatia, Teinostoma (Idioraphe):** Woodring Paratypes
Woodring, 1957, p. 69
Canal Zone; 3500′ SE of Gatun R.R. station
Miocene, Gatun Fm

9743 **sphoni, Mitra (Strigatella):** Shasky and Campbell Holotype
Shasky and Campbell, 1964, p. 118, pl. 22, figs. 13, 14. Also *in* Keen, 1971, p. 642, fig. 1428
Sonora, Mexico; NW of Bahia Saladita, Guaymas, 2-15 m

8569 **sphoni, Olivella (Olivella):** Burch and Campbell Paratype
Burch and Campbell, 1963, p. 124
Guaymas, Mexico; Bocochibampo Bay, 20 m

8668 **spirellum, Speleodiscoides:** Smith Paratypes
Smith, 1957, p. 34
Amador Co., Cali.; Violin Cave, S fork Dry Creek

197 **spissa, Olivella:** Waring Holotype
Waring, 1917, p. 85, pl. 12, fig. 7
Ventura Co., Calif.; Simi Hills
Eocene, Martinez Fm [Paleocene]

7862 **squamulifer, Trophon:** Gabb Plastoholotype
Gabb, 1866, p. 44. Illustrated *in* Bormann, 1946, pl. 4, fig. 13 (as *Ocenebra*)
Santa Barbara, Calif.
Pleistocene, Santa Barbara Fm [holotype UCMP 15459]

425 **stanfordensis, Agasoma:** Arnold Holotype
Arnold, 1908a, p. 384, pl. 35, fig. 5
Santa Clara Co., Calif.; Tusk Gully, 2.5 miles S of Mayfield
Upper Miocene [Arnold's specimen 1087]

5380 **stanfordensis, Fusus (Priscofusus?):** Arnold Holotype
Arnold, 1908a, p. 383, pl. 35, fig. 7. Also *in* Arnold, 1909, Illus. 2, fig. 55
Santa Clara Co., Calif.; near Frenchman's Tower, on hill between Tusk Gully and Madera Creek, 2.5 miles SSW of Mayfield
Upper Miocene, Temblor Fm [Arnold's specimen 1081]

8507 **stanfordiana, "Acmaea":** Berry Holotype
Berry, 1957, p. 76. Illustrated *in* Keen, 1971, p. 325, fig. 51 (as *Collisella*)
Sonora, Mexico; Pelican Point

5371 **stantoni, Chrysodomus:** Arnold Paratype
Arnold, 1908a, p. 386, pl. 37, fig. 4. Also *in* Arnold, 1909, Illus. 2, fig. 65
San Mateo Co., Calif.; 7/8 mile E of Año Nuevo Point
Pliocene, upper Purisima Fm [Arnold's specimen 1088]

5372 **stantoni, Chrysodomus:** Arnold Paratype
Arnold, 1908a, p. 386
San Mateo Co., Calif.; 7/8 mile E of Año Nuevo Point
Pliocene, upper Purisima Fm

5812 **starksi, Doryssa:** Pilsbry Paratype
Pilsbry *in* Baker, Fred, 1914, p. 652
Rio Iriri, Brazil

5133 **starri, Crassispira:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 626, pl. 21, fig. 7
Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

6242 **stearnsi, Ocinebra:** Hemphill Paratypes
Hemphill, 1911, p. 100
Monterey, Calif.

8705 **stemonium, Teinostoma (Pseudorotella):** Woodring Paratypes
Woodring, 1957, p. 71
Canal Zone; highway 1.6 km NE of boundary SU loc. 2656
Miocene, Gatun Fm

8709 **stenopa, Natica (Naticarius):** Woodring Paratype
Woodring, 1957, p. 85
Canal Zone; Mount Hope, W side of Panama R.R.
Miocene, upper Gatun Fm

403 **stephensae, Amphithalamus:** Bartsch Paratypes
Bartsch, 1927, p. 27
Baja California, Mexico; Magdalena Bay

8570 **steveni, Olivella (Olivella):** Burch and Campbell Paratype
Burch and Campbell, 1963, p. 125
Baja California, Mexico; 2 miles S of Aguachale

7983 **stevensoni, Anachis (Costoanachis):** Marks Paratypes
Marks, 1951, p. 112
Ecuador; Zacachun corehole, 80-90′ depth, Progreso area
Lower Miocene, Subibaja Fm

7081 **stewarti, Turritella uvasana:** Merriam Plastoholotype
Merriam, 1941, p. 95, pl. 16, fig. 7
Cowlitz Co., Wash.; Coal Creek UCMP loc. 7167
Eocene, Cowlitz Fm [holotype UCMP 33888]

6461 **stimpsoni, Truncatella:** Stearns Paratypes
Stearns, 1872, p. 249
San Diego, Calif.; False Bay [Mission Bay]

8663 **stocki, Nassarius:** Kanakoff Paratypes
Kanakoff, 1956, p. 110
Los Angeles Co., Calif.; 1/2 mile S of Humphreys R.R. station
Pliocene, Pico Fm

532 **stokesi, Paludestrina:** Arnold Paratype
Arnold, 1903, p. 305
Los Angeles Co., Calif.; San Pedro
Pleistocene, upper San Pedro Fm

9498 **striata, Kogomea:** Laseron Paratypes
Laseron, 1957, p. 294
Queensland, Australia; Swain Reef, Michmaelmas Cay

7980 **striatocostata, Strombina:** Marks Paratypes
Marks, 1951, p. 110
SW Ecuador; Daule Basin, near Pedro Carbo
Middle Miocene, Daule Fm

8091 **strohbeeni, Cymatosyrinx:** Hertlein and Strong Paratype
Hertlein and Strong, 1951b, p. 77
Baja California, Mexico; off Cape San Lucas

6271 **strongi, Odostomia (Evalea):** Bartsch Paratypes
Bartsch, 1927, p. 19
Santa Catalina Island, Calif.; Isthmus Cove

8706 **strongylus, Solariorbis (Solariorbis):** Woodring Paratypes
Woodring, 1957, p. 75
Canal Zone; highway 1.6 km NE of boundary SU loc. 2656
Miocene, lower Gatun Fm

9920 **stuarti, Patella:** Smith Plastoholotype
Smith, 1927, p. 108, pl. 91, fig. 18
Shasta Co., Calif.; Bear Cove, Brock Mt., between Squaw Creek and Pit River
Upper Triassic, Hosselkus Ls [holotype USNM 74149]

9717 **subactum, Crucibulum:** Berry Holotype
Berry, 1963, p. 144. Illustrated *in* Keen, 1971, p. 465, fig. 831
Sinaloa, Mexico; off Teacapan, 25-35 fms

7796 **subcinctella, Syrnola (Syrnola):** Nomura Paratypes
Nomura, 1936, p. 15
NE Honsyu, Japan; Siogama Bay

7858 **succinea, Lacuna:** Berry Holotype
Berry, 1953b, p. 411, fig. 4
San Pedro, Calif.

7858a **succinea, Lacuna:** Berry Paratype
Berry, 1953b, p. 141
San Pedro, Calif.

6189 **suprapunctatus, Drymaeus linostoma:** Baker Paratype
Baker, Fred, 1914, p. 638
Matto Grosso, Brazil, Madeira-Mamoré R.R., 284 km above Porto Velho

7966 **sursalta, Cancellaria (Cancellaria):** Marks Paratype
Marks, 1949, p. 461
Ecuador; Guayas Province, Zacachun corehole, 140′-150′ depth
Lower Miocene

6187 **suturalis, Bulimulus (Rhinus) rochai:** Baker Paratypes
Baker, Fred, 1914, p. 637
Ceará-Mirim, Ceará, Brazil

6186 **taipuensis, Bulimulus (Rhinus) rochai:** Baker Paratype
Baker, 1914, p. 636
Taipú, Brazil; 46 km from Natal

5810 **tapajozensis, Doryssa transversa:** Pilsbry Paratype
Pilsbry *in* Baker, Fred, 1914, p. 649
Rio Tapajoz, Brazil

6257 **taravali, Melanella (Balcis):** Bartsch Paratypes
Bartsch, 1917, p. 328
Baja California, Mexico; Point Abreojos

5910 **taylori, Tegula pulligo:** Oldroyd Holotype
Oldroyd, I. S., 1925, p. 171, pl. 20, figs. 1, 2. Also *in* Oldroyd, I. S., 1927, p. 179, pl. 91, figs. 3, 6
Off N end Vancouver Island, British Columbia, Canada; Hope Island

5911 **taylori, Tegula pulligo:** Oldroyd Paratype
Oldroyd, I. S., 1925, p. 171
Off N end Vancouver Island, British Columbia, Canada; Hope Island

10277 **tehuanarum, Amaea (Scalina):** DuShane and McLean Paratype
DuShane and McLean, 1968, pp. 4-6
Gulf of Tehuantepec, Mexico; 15° 58′ N, 95° 00′ W, 33-38 fms

7052 **tejonensis, Turritella:** Merriam Plastoholotype
Merriam, 1941, p. 81, pl. 11, fig. 7
Kern Co., Calif.; Grapevine Canyon UCMP loc. 452
Eocene, Tejon Fm [holotype UCMP 15190]

7533 **temblorensis, Cylichna:** Keen Holotype
Keen, 1943, p. 44, pl. 4, figs. 13, 14
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

419 **temblorensis, Turritella:** Wiedey Paratype
Wiedey, 1928, p. 122, pl. 11, fig. 9
Los Angeles Co., Calif.; Santa Monica Mts., in small canyon trending W from head of Dry Canyon, at base of E-W divide, 2 miles S of Calabasas
Middle Miocene, Temblor Fm

8043 **tenuissima, Volvulella:** Willett Paratypes
Willett, 1944b, p. 71
Los Angeles Co., Calif.; off Redondo Beach, 75 fms

6041 **tenuistriata, Urocoptis:** Aguayo Paratypes
Aguayo, 1932b, p. 96
Madruga, Havana, Cuba

9729 **teramachii, Typhis (Typhina)** Keen and Campbell Plastoholotype
Keen and Campbell, 1964, p. 48, pl. 8, figs. 10-11
Off Kii, Japan, 100 m [holotype in private collection of Mr. Akibumi Teramachi, Kyoto, Japan]

8258 **tersa, Balcis (Balcis):** Berry Paratype
Berry, 1954b, p. 261
Los Angeles Co., Calif.; San Pedro, Hilltop Quarry
Lower Pleistocene, Lomita Fm.

5520 **tersa, Odostomia (Evalea):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 31
Los Angeles Co., Calif.; San Pedro, Nob Hill Cut
Pleistocene

510 **teslaensis, Cerithium ?:** Hanna Holotype
Hanna, 1924, p. 162. Illustrated *in* Wiedey, 1929b, p. 25, pl. 1, fig. 6 (as *Cerithium branneri* Hall and Ambrose) [Renamed by Hanna; originally described as *Cerithium branneri* Hall and Ambrose, 1916, p. 70]
Alameda Co., Calif.; 1 mile N 20° W of Tesla and Corral Hollow
Upper Cretaceous, middle Chico Fm

6145 **tetrodon, Ashmunella:** Pilsbry and Ferriss Paratypes
Pilsbry and Ferriss, 1915b, p. 15
Socorro Co., New Mexico; Mogollon Mts., Dry Creek Canyon

8672 **thalassicola, Tricolia:** Robertson Paratypes
Robertson, 1958, p. 271
Great Abaco Island, Bahamas; North Point, Elbow Cay

8750 **tholia, Dendropoma:** Keen and Morton Holotype
Keen and Morton, 1960, p. 41, pl. 3, figs. 4, 5
Mozambique, East Africa; Inhaca Island, Lorenzo Marques

8750a **tholia, Dendropoma:** Keen and Morton Paratypes
Keen and Morton, 1960, p. 41, pl. 3, fig. 6
Mozambique, East Africa; Inhaca Island, Lorenzo Marques

10068 **thompsoni, Eupleura:** Woodring Paratypes
10069 Woodring, 1959, pp. 218-220
Panama; Transisthmian Highway, 9° 21′ + 335 m N, 79° 49′ W SU loc. 2611 = USGS loc. 16912
Middle Miocene, Gatun Fm, lower middle part

5528 **timessa, Odostomia (Amaura):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 35
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

8658 **tingitana, Gibbula:** Pallary Paratypes
Pallary, 1902a, p. 315
Tanger, Morocco, on stones [Tangier]

8657 **tingitana, Nassa:** Pallary Paratype
Pallary, 1901, p. 226
Tanger, Morocco, 12-21 m [Tangier]

142 **titan, Trachytriton:** Waring Holotype
Waring, 1917, p. 87, pl. 14, fig. 18
Ventura Co., Calif.; Martinez area, Simi Hills, Calabasas sheet
Lower Eocene, Martinez Fm [Paleocene]

8099 **togatum, Epitonium (Cirsotrema):** Hertlein and Strong Paratype
Hertlein and Strong, 1951b, p. 89
Near Manzanillo, Mexico; 19° 04′ N, 104° 22′ W, 30 fms

6158 **tooelensis, Oreohelix strigosa depressa:** Henderson and Daniels Paratypes
Henderson and Daniels, 1916, p. 323
6 miles NE of Tooele, Utah

7166 **topangensis, Turritella ocoyana:** Merriam Plastoholotype
Merriam, 1941, p. 115, pl. 30, fig. 1
Santa Monica Mts., Calif.; Malibu Canyon, Mesa Peak UCMP loc. A-556
Miocene, Topanga Fm [holotype UCMP 31648]

8680 **totomiensis, Siphonalia tonohamaensis:** Makiyama Paratypes
Makiyama, 1941, p. 80
Shizuoka Prefecture, Japan; Ugari, near Fukuroi
Pliocene, Hosoya Fm

8673 **totomiensis, Thiara:** Makiyama Paratype
Makiyama, 1927, p. 66
Shizuoka Prefecture, Japan; Dainiti
Pliocene, Dainitian

8679 **totomiensis, Turris (Gemmula):** Makiyama Paratypes
Makiyama, 1931b, p. 46
Pliocene, Hosoya (Kakegawa)

5367 **trancosana, Thais:** Arnold Holotype
Arnold, 1908a, p. 388, pl. 36, fig. 3. Also *in* Arnold, 1909, Illus. 2, fig. 74
Santa Clara Co., Calif.; 2.5 miles SSW of Stanford University; ditch between Felt Lake and Los Trancos Creek
Upper Pliocene, Merced Fm [Arnold's specimen 1082]

9511 **tricoronis, Murex (Murex):** Berry Holotype
Berry, 1960, p. 119. Illustrated *in* Keen, 1971, p. 514, fig. 978
Baja California, Mexico; 1 mile off Cedros Village, Cedros Island; 40 fms

6578 **tridesmia, Clathurella (Glyphostoma):** Berry Paratypes
6578a Berry, 1941, p. 8
Los Angeles Co., Calif.; San Pedro, Hilltop Quarry
Lower Pleistocene, Lomita Fm

8703 **trochalum, Teinostoma (Idoraphe) angulatum:** Woodring Paratypes
Woodring, 1957, p. 70
Canal Zone; 1.6 km NE of boundary on highway SU loc. 2656
Miocene, Gatun Fm

5526 **trochilia, Odostomia (Amaura):** Oldroyd Paratypes
Oldroyd, T. S., 1924, p. 34
Los Angeles Co., Calif.; San Pedro, Nob Hill cut
Pleistocene, lower San Pedro Fm

10282 **tumida, Drillia (Drillia):** McLean and Poorman Paratype
McLean and Poorman, 1971, p. 97
Jalisco, Mexico; Banderas Bay, 20° 40′ N, 105° 25′ W, 20-40 fms

5901 **turneri, Viviparus (Callina):** Hannibal Syntype
Hannibal, 1912b, p. 193, pl. 8, fig. 31
Silver Peak Range, Nevada
"Eocene," Truckee beds [upper Miocene-lower Pliocene, Esmeralda Fm, *fide* Taylor and Smith, 1971, p. 311]

5902 **turneri, Viviparus (Callina):** Hannibal Paratype
Hannibal, 1912b, p. 193. Also *in* Taylor and Smith, 1971, figs. 28, 29 (as *Bellamya*)
Silver Peak Range, Nevada
"Eocene," Truckee beds [upper Miocene-lower Pliocene, Esmeralda Fm *fide* Taylor and Smith, 1971, p. 311]

7238 **Turritella** sp. B: Schenck and Keen Holotype
Schenck and Keen, 1940, pl. 27, figs. 5, 6
Ventura Co., Calif.; 1 mile SE of Matilija, on S wall of Kennedy Canyon, 1150′ contour, 1400′ due W of Ventura River
Eocene, "Coldwater" Fm

5903 **turveri, Haliotis fulgens:** Bartsch Paratype
Bartsch, 1942, p. 57
Baja California, Mexico; Magdalena Bay

8510 **tyrianthina, Acanthina:** Berry Holotype
Berry, 1957, p. 78. Illustrated *in* Keen, 1971, p. 552, fig. 1085
Baja California, Mexico; Magdalena Bay, Man-of-War Cove

9509 **tyrianthina, Neosimnia vidleri:** Berry Holotype
Berry, 1960, p. 118
Sonora, Mexico; Puerto Penasco, Cholla Cove

7756 **usanium, Serratocerithium:** Compton Holotype
Compton, 1944, p. 466, pl. 78, figs. 3, 6
Los Angeles Co., Calif.; ridge E of Santa Ynez Canyon, 4 miles E of road in canyon, along fire road just W of top of ridge. Santa Monica Mts. SU loc. 2691
Paleocene, Martinez Fm

7757 **usanium, Serratocerithium:** Compton Paratype
Compton, 1944, p. 466, pl. 78, fig. 5
Los Angeles Co., Calif.; Santa Monica Mts., ridge E of Santa Ynez Canyon, 4 miles E of road in canyon, along fire road just W of top of ridge
Paleocene, Martinez Fm

7757a **usanium, Serratocerithium:** Compton Paratype
Compton, 1944, p. 466
Los Angeles Co., Calif.; Santa Monica Mts., ridge E of Santa Ynez Canyon, 4 miles E of road in canyon, along fire road just W of top of ridge
Paleocene, Martinez Fm

254 **vancouverensis, Acmaea persona:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 172, pl. 35, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

5912a **vancouverensis, Acteon punctocoelata:** Oldroyd Syntype
Oldroyd, 1927, p. 25, pl. 1, fig. 19
Vancouver Island, British Columbia, Canada; Nanaimo, Departure Bay, off Brandon Island, 10-15 fms

5912b **vancouverensis, Acteon punctocoelata:** Oldroyd Syntype
Oldroyd, I. S., 1927, p. 25, pl. 1, fig. 20. Also *in* Oldroyd, I. S., 1924, pl. 1, fig. 9 (as *Acteon punctocoelata*)
Vancover Island, British Columbia, Canada; Nanaimo, Departure Bay, Brandon Island, 10-15 fms

284 **vancouverensis, Bursa:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 163, pl. 37, figs. 1a, 1b. Also *in* Smith, 1970, pl. 48, fig. 3 [as *Mediargo mathewsonii* (Gabb)]
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

244 **vancouverensis, Calyptraea (Galerus) mammillaris:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 167, pl. 36, figs. 3a, 3b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

279 **vancouverensis, Leptothyra:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 173, pl. 37, figs. 3a, 3b
Vancouver Island, British Columbia, Canada; Jordan River, sea cliffs at mouth of Fossil Creek, 2 miles W of Sherringham Point SU loc. NP 130
Oligocene, Sooke Fm

272 **vancouverensis, Megathura:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 173, pl. 34, figs. 3a, 3b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

293 **vancouverensis, Polinices (Neverita) recluziana:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 169, pl. 33, figs. 2a, 2b
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

5838 **vancouverensis, Stagnicola bulimoides:** Baker Holotype
Baker, 1939, p. 144
Vancouver Island, British Columbia, Canada; hospital at Nanaimo

5839 **vancouverensis, Stagnicola bulimoides:** Baker Paratypes
Baker, 1939, p. 144
Vancouver Island, British Columbia, Canada; hospital at Nanaimo

208 **vaquerosensis, Purpura:** Arnold Holotype
Arnold, 1907c, p. 427, pl. 52, figs. 1a, 1b
Monterey Co., Calif.; Lynch Mt.
Lower Miocene, Vaqueros Fm

8619 **velascoensis, Emarginula:** Shasky Holotype
Shasky, 1961, p. 18, pl. 4, figs. 1-3. Also *in* Keen, 1971, p. 310, fig. 7
Gulf of California; off Isla Monserrate, 40-80 fms

10291 **verrucosa, Tegula (Agathistoma):** McLean Paratype
McLean, 1970b, pp. 122-123
Canal Zone, Panama; Palo Seco, 8° 55′ N, 79° 34′ W, rocky intertidal

237 **victoriana, Acmaea:** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 172, pl. 34, figs. 1a, 1b
Vancouver Island, British Columbia, Canada; sea cliffs 1-1.5 miles W of Owens Point, Port San Juan SU loc. NP 134
Oligocene, Sooke Fm

238 **victoriana, Acmaea:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 172, pl. 34, figs. 2a, 2b
Vancouver Island, British Columbia, Canada; sea cliffs 1-1.5 miles W of Owens Point, Port San Juan SU loc. NP 134
Oligocene, Sooke Fm

239 **victoriana, Acmaea:** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 172, pl. 34, fig. 4
Vancouver Island, British Columbia, Canada; sea cliffs 1-1.5 miles W of Owens Point, Port San Juan SU loc. NP 134
Oligocene, Sooke Fm

9506 **viridicolor, Cypraea cernica:** Cate Holotype
Cate, 1962, pp. 175-177, pl. 40, fig. 1
Western Australia; Northwest Cape, Vlaming Head

8662 **vladimiri, Kelletia:** Kanakoff Paratypes
Kanakoff, 1954, pp. 114-117
Los Angeles Co., Calif.; 1/2 mile S of Humphreys R.R. station
Pliocene, Pico Fm

6169 **walcottiana, Sonorella:** Bartsch Paratypes
Bartsch, 1903, p. 103
San Diego Co., Calif.; Palm Springs [= *Sonorella wolcottiana*, Bartsch em.]

9720 **walkeri, Knefastia:** Berry Holotype
Berry, 1958a, p. 87. Illustrated *in* Keen, 1958b, p. 447, figs. 728a
Gulf of California; off Puerto Refugio, Angel de la Guarda Island

792 **wardi, Leucosyrinx clallamensis:** Tegland Paratype
Tegland, 1933, p. 124, pl. 10, fig. 8
Bainbridge Island, Wash.; beach between S side of entrance to Blakeley Harbor and Restoration Point SU loc. NP 103
Upper Oligocene, Blakeley Fm

8327 **warrenae, Megalacron tabarensis:** Clench and Turner Paratypes
Clench and Turner, 1964, p. 43
Off New Ireland, Tanga Group; Boang Island, Bismarck Archipelago

5818 **wasatchensis, Lymnaea stagnalis:** Baker Paratypes
Baker, Frank, 1911, p. 152
Near Salt Lake City, Utah

7785 **wasatchensis, Patula strigosa:** Hemphill Paratypes
Hemphill *in* Binney, 1886, p. 34
Wasatch Mts., near Ogden, Utah; among quartzite boulders, 4500′ elev.

462 **washingtonianus, Viviparus:** Hannibal Holotype
Hannibal, 1912b, p. 194, pl. 8, fig. 32. Also *in* Taylor and Smith, 1971, figs. 26, 30 (as *Bellamya*)
Wash.; Olequa Creek, 2 miles N of Little Falls
Eocene [Late Eocene, Cowlitz Fm, *fide* Taylor and Smith, 1971, p. 311]

6527 **watermani, Olivella:** McGinty Paratype
McGinty, 1940, p. 6
Off Palm Beach, Fla.; 80 fms

7530 **watsonae, Anachis:** Keen Holotype
Keen, 1943, p. 42, pl. 4, figs. 1, 2
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

8661 **weyersi, Cerithidea (Aphanistylus):** Dautzenberg Paratype
Dautzenberg, 1899, p. 8
W coast of Sumatra, near Indrapoera River

6512 **wheatlandensis, Siphonalia bicarinata:** Clark and Anderson Paratype
Clark and Anderson, 1938, p. 952
Yuba Co., Calif.; Dry Creek, 6 miles NE of Wheatland
Upper Eocene-Lower Oligocene, Wheatland Fm

7535 **whitei, Ferminoscala:** Keen Holotype
Keen, 1943, p. 46, pl. 4, figs. 32, 33
Kern Co., Calif.; Caliente Qd, in small gully near center SW 1/4 Sec. 6, T 29 S, R 30 E SU loc. 2121
Miocene, Temblor Fm, Round Mountain Silt

473 **whitei, Valvata:** Hannibal Holotype
Hannibal, 1910, p. 107. Illustrated *in* Taylor and Smith, 1971, figs. 45, 46, 50
Oregon, near Summer Lake
Quaternary, Upper Lahontan [Pliocene, probably Blancan, *fide* Taylor and Smith, 1971]

9710 **willetti, Antiplanes (Rectiplanes):** Berry Holotype
Berry, 1953b, p. 419, pl. 29, fig. 2
Alaska; Forrester Island, 50 fms

9989 **willetti, Turritella:** McLean Paratype
McLean, 1970a, p. 312
Colima, Mexico; Manzanillo, Santiago Bay, 19° 06′ N, 104° 23′ W, 7-12 fms

461 **williamsi, Pyrgulopsis:** Hannibal Holotype
Hannibal, 1912b, p. 189, pl. 8, fig. 29a. Also *in* Taylor and Smith, 1971, figs. 24, 25
San Joaquin Valley, Calif.; Lost Hills, Martin and Dudleys Oilwell [SE 1/4 Sec. 32, T 26 S, R 21 E]
Pliocene [San Joaquin Fm, *fide* Taylor and Smith, 1971, p. 312]

465 **williamsi, Pyrgulopsis:** Hannibal Paratype
Hannibal, 1912b, p. 189, pl. 8, fig. 29b
San Joaquin Valley, Calif.; Lost Hills, SE 1/4 Sec. 32, T 26 S, R 21 E
Pliocene [San Joaquin Fm, *fide* Taylor and Smith, 1971, p. 312]

466 **williamsi, Pyrgulopsis:** Hannibal Paratype
Hannibal, 1912b, p. 189, pl. 8, fig. 29c
San Joaquin Valley, Calif.; Lost Hills, SE 1/4 Sec. 32, T 26 S, R 21 E
Pliocene [San Joaquin Fm, *fide* Taylor and Smith, 1971, p. 312]

8604 **williamsi, Woodbridgea:** Berry Holotype
Berry, 1953b, p. 422, fig. 8
Baja California, Mexico; off Cedros Village, Cedros Island, 25 fms

7786 **winslowae, Arena:** Pilsbry and Lowe Paratypes
Pilsbry and Lowe, 1932a, p. 86
Taboga Island, Panama

5125 **wittichi, Thais:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 633, pl. 18, fig. 3
Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San Ignacio SU loc. 66
Miocene, Isidro Fm

5126 **wittichi, Thais:** Hertlein and Jordan Paratypes
5127 Hertlein and Jordan, 1927, p. 633
5128 Baja California, Mexico; Arroyo San Ignacio, 8 km SW of San
5129 Ignacio SU loc. 66
5130 Miocene, Isidro Fm

5894 **wittichi, Turritella:** Hertlein and Jordan Holotype
Hertlein and Jordan, 1927, p. 635, pl. 21, fig. 3. Also *in* Merriam, 1941, p. 114, pl. 29, fig. 1
Baja California, Mexico; on trail from Arroyo Mesquital to La Purisima, in *Turritella* bed above San Gregorio Lagoon SU loc. 59
Miocene, Isidro Fm

5135 **wittichi, Turritella:** Hertlein and Jordan Paratype
Hertlein and Jordan, 1927, p. 635
Baja California, Mexico; on trail from Arroyo Mesquital to La Purisima, in *Turritella* bed above San Gregorio Lagoon SU loc. 59
Miocene, Isidro Fm

6169 **wolcottiana, Sonorella:** Bartsch Paratypes
Bartsch, 1903, p. 103
San Diego Co., Calif.; Palm Springs [emended from *S. walcottiana*]

6579 **woodfordi, Mitromorpha barbarensis:** Berry Paratype
Berry, 1941, p. 10
Los Angeles Co., Calif.; San Pedro, Hilltop Quarry
Lower Pleistocene, Lomita Fm

8520 **xavieri, Colubraria:** Campbell Holotype
Campbell, 1961a, p. 141, pl. 10, figs. 7, 8. Also *in* Keen, 1971, p. 512, fig. 974
Sonora, Mexico; Guaymas, 2 miles W of Cabo Haro, 100 fms

8711 **xena, Neverita (Glossaulax) reclusiana:** Woodring Paratypes
Woodring, 1957, p. 92
Canal Zone; highway 1.7 km SW of Sabanita SU loc. 2611
Miocene, lower Gatun Fm

8676 **yokoyamai, Asthenotoma:** Makiyama Paratypes
Makiyama, 1927, p. 95
Shizuoka Prefecture, Japan; Dainiti
Pliocene, Dainiti Fm

5836 **yrekaensis, Goniobasis:** Henderson Paratypes
Henderson, 1935, p. 97
Shasta River, below Yreka, Calif.; 4 miles above river mouth

7807 **zambiensis, Thapsia:** Pilsbry Paratypes
Pilsbry, 1919, p. 237
Zambi, Belgian Congo

8262 **zeteki, Epitonium:** Dall Paratype
Dall, 1917b, p. 486. Illustrated *in* Keen, 1971, p. 428, fig. 632 left
Near Panama City, Panama

6572 **zizyphus, Clavus (Crassispira):** Berry Paratype
Berry, 1940b, p. 152
Los Angeles Co., Calif.; San Pedro, Hilltop Quarry
Lower Pleistocene

POLYPLACOPHORA (AMPHINEURA)

6236 **californiensis, Ischnochiton (Lepidozona):** Berry Paratype
Berry, 1931b, p. 255
San Diego Co., Calif.; near Scripps Institution, La Jolla

8650 **circumsenta, Stenoplax:** Berry Paratype
Berry, 1956a, p. 72
Baja California, Mexico; Scammon Lagoon, W of Isla Concha

8646 **crossota, Nuttallina:** Berry Paratype
Berry, 1956a, p. 71. Illustrated *in* Keen, 1958, p. 528, fig. 49
Sonora, Mexico; W end of Puerto Penasco

7847 **heathiana, Stenoplax (Stenoradsia):** Berry Holotype
Berry, 1946a, p. 161, pl. 4, fig. 8
Monterey Co., Calif.; Pacific Grove, shoreline

8649 **isoglypta, Stenoplax:** Berry Paratype
Berry, 1956a, p. 72
Isabel Island, Peru

7870 **keepiana, Lepidochitona:** Berry Paratype
Berry, 1948, p. 14

280 **lioplax, Oligochiton:** Berry Holotype
Orange Co., Calif.; Newport
Berry, 1922, p. 431, pl. 1, figs. 5, 6
Vancouver Island, British Columbia, Canada; sea cliffs between mouths of Muir and Coal Creeks, W of Otter Point, Sooke SU loc. NP 129
Oligocene, Sooke Fm

281 **lioplax, Oligochiton:** Berry Paratype
Berry, 1922, p. 431, pl. 1, figs. 3, 4
Vancouver Island, British Columbia, Canada; Sooke, sea cliffs between mouths of Coal and Muir Creeks, W of Otter Point SU loc. NP 129
Oligocene, Sooke Fm

6240 **oldroydi, Lepidopleurus (Leptochiton):** Dall Paratypes
Dall, 1919a, p. 500
San Pedro, Calif.

6239 **percrassus, Lepidopleurus (Oldroydia):** Dall Paratypes
Dall, 1894, p. 90
Santa Barbara Channel, off San Pedro, Calif.; 75 fms

6238 **semiliratus: Dendrochiton:** Berry Holotype
Berry, 1927, p. 160, pl. 13, figs. 1, 2
Vancouver Island, British Columbia, Canada; Nanaimo, Departure Bay

6273 **semiliratus, Dendrochiton:** Berry Paratype
Berry, 1927, p. 160
Vancouver Island, British Columbia, Canada; Nanaimo, Departure Bay

8647 **sonorana, Stenoplax (Maugerella) conspicua:** Berry Paratypes
Berry, 1956a, p. 73. Illustrated *in* Keen, 1958, p. 528, fig. 47
Sonora, Mexico; W end Puerto Penasco

8648 **subtilis, Lepidozona:** Berry Paratypes
Berry, 1956a, p. 74. Illustrated *in* Keen, 1958, p. 526, fig. 42
Sonora, Mexico; W end Puerto Penasco

6237 **willetti, Ischnochiton (Lepidozona):** Berry Paratypes
Berry, 1917b, p. 236
Forrester Island, Alaska

BRACHIOPODA

818 **adairensis, Productus (Marginifera):** Drake Syntype
Drake, 1898, p. 402, pl. 9, figs. 1, 3
Adair, Okla.; 5 miles SE, 7 miles E of town
Carboniferous, Boston Fm

819 **adairensis, Productus (Marginifera):** Drake Syntype
Drake, 1898, p. 402, pl. 9, fig. 2
Adair, Okla.; 5 miles SE, 7 miles E of town
Carboniferous, Boston Fm

815 **cherokeensis, Productus:** Drake Holotype
Drake, 1898, p. 404, pl. 9, figs. 4, 5
Adair, Okla.; 5 miles SE of town
Carboniferous, Boston Fm

9929 **hamiltonense, Dielasma:** Smith Plastoholotype
Smith, 1927, p. 123, pl. 102, figs. 14-16
Kupreanof Island, Alaska; Hamilton Bay
Upper Triassic [holotype USNM 74208]

7776 **hannibali, Discinisca cumingii:** Hertlein and Grant Holotype
Hertlein and Grant, 1944, p. 29, pl. 16, figs. 7, 8, 11
Oak Bay, Wash.; between Port Townsend and Port Ludlow SU loc. NP 128
Oligocene, Lincoln Fm

5860 **laevis, Rhynchonella wollossowitschii:** Diener Holotype
Diener, 1924, p. 14, pl. 1, figs. 12a-12d
New Siberian Islands; Koteleny Island, at head of Balyktach River
Upper Triassic, Noric

5857 **lata, Rhynchonella wollossowitschii:** Diener Holotype
Diener, 1924, p. 14, pl. 1, figs. 11a-11d
New Siberian Islands; Koteleny Island, head of Balyktach River
Upper Triassic, Noric

9926 **pittensis, Spiriferina:** Smith Plastoholotype
Smith, 1927, p. 124, pl. 95, fig. 10
Shasta Co., Calif.; Brock Mt.
Upper Triassic, Hosselkus Ls [holotype USNM 74156]

9928 **richardsoni, Rhynchonella:** Smith Plastoholotype
Smith, 1927, p. 123, pl. 96, figs. 19-21
Shasta Co., Calif.; old quarry SW end of Brock Mt. between Squaw Creek and Pit River
Upper Triassic, Hosselkus Ls [holotype USNM 74171]

144 **simiensis, Kingena:** Waring Holotype
Waring, 1917, p. 73, pl. 12, fig. 11
Ventura Co., Calif.; Simi Hills, Martinez area
Lower Eocene, Martinez Fm

5376 **smithi, Terebratalia:** Arnold Holotype
Arnold, 1903, p. 93, pl. 17, fig. 9
Los Angeles Co., Calif.; Deadman Island, off San Pedro
Pleistocene, San Pedro Fm

242 **sookensis, Terebratella (?):** Clark and Arnold Holotype
Clark and Arnold, 1923, p. 176, pl. 36, figs. 5a, 5b
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, at mouth of Fossil Creek SU loc. NP 130
Oligocene, Sooke Fm

243 **sookensis, Terebratella (?):** Clark and Arnold Paratype
Clark and Arnold, 1923, p. 176, pl. 36, fig. 4
Vancouver Island, British Columbia, Canada; Jordan River, 2 miles W of Sherringham Point, at mouth of Fossil Creek SU loc. NP 130
Oligocene, Sooke Fm

7778 **washingtonensis, Gryphus:** Hertlein and Grant Holotype
Hertlein and Grant, 1944, p. 93, pl. 16, figs. 13, 14, 16
Grays Harbor Co., Wash.; R.R. cuts E of Balch SU loc. NP 57
Eocene, Cowlitz Fm

5858 **wollossowitschii, Rhynchonella:** Diener Syntype
Diener, 1924, p. 14, pl. 1, figs. 10a-10d
New Siberian Islands; Koteleny Island, head of Balyktach River
Triassic

5859 **wollossowitschii, Rhynchonella:** Diener Syntype
Diener, 1924, p. 14, pl. 1, figs. 9a-9d
New Siberian Islands; Koteleny Island, head of Balyktach River
Triassic

9927 **yukonensis, Spiriferina:** Smith Plastoholotype
Smith, 1927, p. 124, pl. 101, figs. 13, 14
S bank Yukon River, opposite Nation River
Upper Triassic [holotype USNM 74202]

ARTHROPODA (EXCEPT OSTRACODA)

5169 **alaskensis, Portunites:** Rathbun Paratype
Rathbun, 1926, p. 72, pl. 22, fig. 3
Pacific Co., Wash.; N of Holcomb, bluffs along Willapa River SU loc. NP 253
Oligocene, Keasey Fm

5374 **antennatus, Archaeopus:** Rathbun Paratype
Rathbun, 1908, p. 347, pl. 47, figs. 4, 5, 6
San Mateo Co., Calif.; Bolsa Point, 1 mile N of Pigeon Point
Upper Cretaceous, Chico Fm

6628 **apollo, Cheirurus:** Billings Plastoholotype
Billings, 1860, p. 322, fig. 28. Also *in* Billings, 1865, fig. 397 (as "*n. sp.*")
Quebec, Canada; Pt. Lévis
Middle Ordovician, Beekmantown Fm [holotype Geol. Surv. Canada 5380]

5601 **bainbridgensis, Cancer:** Rathbun Holotype
Rathbun, 1926, p. 60, pl. 16, fig. 2
Bainbridge Island, Wash.; Bean Point SU loc. NP 205
Upper Oligocene, Blakeley Fm

5062 **bainbridgensis, Cancer:** Rathbun Paratype
Rathbun, 1926, p. 60, pl. 16, fig. 3
Bainbridge Island, Wash.; Bean Point SU loc. NP 205
Upper Oligocene, Blakeley Fm

777a **bairdensis, Proteus:** Wheeler Holotype
Wheeler, 1935, p. 49, pl. 6, figs. 1-3
Shasta Co., Calif.; Redding Qd, SW 1/4 SE 1/4 Sec. 14, T 34 N, R 4 W SU loc. 1041
Carboniferous, Baird Ls

777b **bairdensis, Proteus:** Wheeler Paratype
Wheeler, 1935, p. 49
Shasta Co., Calif.; Redding Qd, SW 1/4 SE 1/4 Sec. 14, T 34 N, R 4 W
Carboniferous, Baird Fm

5286 **bandonensis, Callianassa:** Rathbun Holotype
Rathbun, 1926, p. 118, pl. 27, figs. 5, 6
Coos Co., Ore.; S of mouth of Five Mile Creek, Bandon SU loc. NP 38
Oligocene

5287 **bandonensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 118, pl. 27, fig. 8
Coos Co., Ore.; S of mouth of Five Mile Creek, Bandon SU loc. NP 38
Oligocene

5287a **bandonensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 118, pl. 27, fig. 7
Coos Co., Ore.; S of mouth of Five Mile Creek, Bandon SU loc. NP 38
Oligocene

6612 **barrandei, Amphion:** Billings Plastosyntype
Billings, 1865, p. 288, fig. 277b
Newfoundland, Canada; Cow Head
Ordovician, Quebec group [syntype Geol. Surv. Canada 682b]

6613 **barrandei, Amphion:** Billings Plastosyntype
Billings, 1865, p. 288, fig. 277a
Newfoundland, Canada; Cow Head
Ordovician, Quebec group [syntype Geol. Surv. Canada 681b]

6987 **beattyana, Parapilekia:** Holliday Paratype
Holliday, 1942, p. 475, pl. 73, fig. 4
Nye Co., Nevada; Furnace Creek Qd, 1 mile SE of Beatty, gully in Meikeljohn Peak on road to Telluride Canyon SU loc. 2204
Lower Ordovician

8305 **bifida, Acanthopyge (Mephiarges):** Edgell Holotype
Edgell, 1955, p. 138, pl. 14, figs. 1, 3-8
New South Wales, Australia; Goodradigbee Valley, 4 miles SE of Burrinjuck Dam, 4 miles NNE of Wee Jasper Village
Middle Devonian, Wee Jasper Ls

5321 **brucei, Blepharipoda:** Rathbun Holotype
Rathbun, 1926, p. 126, pl. 28, fig. 11
Jefferson Co., Wash.; Classens Wharf, Townsend Bay SU loc. NP 125
Oligocene, Lincoln Fm

5321 **brucei, Blepharipoda:** Rathbun Paratype
Rathbun, 1926, p. 126, pl. 28, fig. 10
Jefferson Co., Wash.; Classens Wharf, Townsend Bay SU loc. NP 125
Oligocene, Lincoln Fm

5319 **brucei, Blepharipoda:** Rathbun Paratype
Rathbun, 1926, p. 126
Jefferson Co., Wash.; Classens Wharf, Townsend Bay SU loc. NP 125
Oligocene, Lincoln Fm

6619 **canadensis, Amphion:** Billings Plastosyntypes
6621 Billings, 1859, p. 381, figs. 12a, 12b
Quebec; Mingan Islands
Middle Ordovician, Chazyan, Mingan Fm [syntypes at Geol. Surv. Canada]

5176 **carmanahensis, Pilumnoplax:** Rathbun Holotype
Rathbun, 1926, p. 38, pl. 9, figs. 1-4
Vancouver Island, British Columbia, Canada; sea cliffs for a distance of 3 miles W of Carmanah Point SU loc. NP 141
Oligocene

6629 **cayleyi, Amphion:** Billings Plastoholotype
Billings, 1863, p. 239, fig. 277. Also *in* Billings, 1865, p. 413, fig. 398 (as *Amphion* sp?)
Quebec; Pt. Lévis
Middle Ordovician, Lévis Fm [holotype Geol. Surv. Canada 825]

5077 **conwayensis, Griffithides:** Wheeler Holotype
Wheeler, 1935, p. 53, pl. 6, figs. 4, 5
Conway Co., Ark.; near center NW 1/4 Sec. 17, T 5 N, R 16 W SU loc. 1040
Pennsylvanian, Atoka Fm [new name for *Phillipsia* (*Griffithides*) *ornata* Vogdes, 1895]

5175 **hannibalanus, Pilumnoplax:** Rathbun Holotype
Rathbun, 1926, p. 39, pl. 10, figs. 1, 2
Nehalem Bay, Ore.; cut on Tillamook branch of Southern Pacific R.R., 1 mile E of Wheeler SU loc. NP 229
Middle Oligocene?

5273 **hannibalanus, Pilumnoplax:** Rathbun Paratype
Rathbun, 1926, p. 39, pl. 10, fig. 3
W of Neah Bay, Wash.; sea cliffs at Koitlah Point SU loc. NP 167
Middle Oligocene?

5951 **idae, Mesorhoea:** Rathbun Paratype
Rathbun, 1926, p. 27
NE of San Pedro, Calif.; Nob Hill
Pleistocene, San Pedro Fm

6626 **julius, Amphion:** Billings Plastoholotype
Billings, 1865, p. 290, fig. 279
Newfoundland; Cow Head
Middle Ordovician, Quebec group [holotype Geol. Surv. Canada 680]

5258 **marcusana, Mursia:** Rathbun Paratype
Rathbun, 1926, p. 82, pl. 19, fig. 7
Puget Sound, Wash.; Alki Point, near Seattle SU loc. NP 48
Upper Oligocene, Blakeley Fm

6986 **marginatus, Ectenonotus:** Holliday Paratype
Holliday, 1942, p. 476, pl. 73, fig. 3
Nye Co., Nevada; Furnace Creek Qd, 1 mile SE of Beatty SU loc. 2205
Lower Ordovician

5070 **naselensis, Eumorphocorystes:** Rathbun Holotype
Rathbun, 1926, p. 100, pl. 24, figs. 9, 10
Pacific Co., Wash.; bluffs along Nasel River near mouth of Salmon Creek SU loc. NP 281
Oligocene, Lincoln Fm

6611 **nevadensis, Amphion:** Walcott Plastoholotype
Walcott, 1884, p. 94, pl. 12, fig. 13
Eureka district, Nevada
Ordovician, Pogonip Fm [holotype USNM 24645]

778 **nosoniensis, Griffithides:** Wheeler Holotype
Wheeler, 1935, p. 51, pl. 6, figs. 6, 7
Shasta Co., Calif.; Redding Qd, NE 1/4 SW 1/4 Sec. 24, T 34 N, R 4 W SU loc. 1034
Permian, Nosoni Fm

5077 **ornata, Phillipsia (Griffithides):** Vogdes Holotype
Vogdes, 1895, pp. 589-591, text fig. [renamed *Griffithides conwayensis* by Wheeler, 1935, p. 53]
Conway Co., Ark.; Sec. 17, T 5 N, R 16 W SU loc. 1040
Pennsylvanian, Atoka Fm

10301 **pleistocenica, Randallia:** Rathbun Paratype
Rathbun, 1926, p. 77
San Pedro, Calif.; Nob Hill
Pleistocene

5063 **porterensis, Callianassa:** Rathbun Holotype
Rathbun, 1926, p. 119, pl. 28, fig. 4
Wash.; bluff on Chehalis River below Porter SU loc. NP 53
Oligocene, Lincoln Fm

5064 **porterensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 119
Wash.; bluff on Chehalis River below Porter SU loc. NP 53
Oligocene, Lincoln Fm

5065a **porterensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 119, pl. 28, fig. 3 (as paratype C)
Yaquina Bay, Ore.; cut on C and E. R.R. between Rocky Point and Oysterville SU loc. NP 15
Oligocene, Lincoln Fm

5065b **porterensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 119, pl. 28, fig. 1 (as paratype D)
Yaquina Bay, Ore.; cut on C and E. R.R. between Rocky Point and Oysterville SU loc. NP 15
Oligocene, Lincoln Fm

6610 **salteri, Amphion:** Billings Plastoholotype
Billings, 1861, p. 322, fig. 6
Grenville Co., Ontario, Canada; "Philipsburg," Oxford Township
Lower Ordovician, Beekmantown Fm [holotype Geol. Surv. Canada 515]

5322 **triangulum, Portunites:** Rathbun Paratype
Rathbun, 1926, p. 68, pl. 17, figs. 3, 4
Lewis Co., Wash.; Chehalis River, near mouth of Lincoln Creek SU loc. NP 211
Oligocene, Lincoln Fm

5172a **twinensis, Callianassa:** Rathbun Holotype
Rathbun, 1926, p. 117, pl. 27, fig. 2
Clallam Co., Wash.; W of Twin River for a distance of 3/4 mile SU loc. NP 120
Oligocene, Blakeley Fm

5172b **twinensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 117, pl. 27, fig. 3
Clallam Co., Wash.; W of Twin River for a distance of 3/4 mile SU loc. NP 120
Oligocene, Blakeley Fm

5173 **twinensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 117
Clallam Co., Wash.; W of Twin River for a distance of 3/4 mile SU loc. NP 120
Oligocene, Blakeley Fm

5174 **twinensis, Callianassa:** Rathbun Paratype
Rathbun, 1926, p. 117, pl. 27, fig. 3 (as paratype D)
Wahkiakum Co., Wash.; bluffs on Gray's River SU loc. NP 274
Oligocene, Blakeley Fm

5066 **willapensis, Ranidina:** Rathbun Holotype
Rathbun, 1926, p. 99, pl. 21. figs. 4, 5
Thurston Co., Wash.; bluffs along Willapa River N of Holcomb SU loc. NP 253
Middle Oligocene, Keasey Fm

OSTRACODA

6830 **beaconensis, Cytheridea:** LeRoy Holotype
LeRoy, 1943, p. 359, pl. 58, figs. 21-24
Wilmington Qd., Calif.; San Pedro, Beacon and Second Streets
Pleistocene, San Pedro Fm

6831 **beaconensis, Cytheridea:** LeRoy Paratype
LeRoy, 1943, p. 359, pl. 58, fig. 25
Wilmington Qd., Calif.; San Pedro, Beacon and Second Streets
Pleistocene, San Pedro Fm

6835 **californica, Cytherelloidea:** LeRoy Holotype
LeRoy, 1943, p. 357, pl. 58, figs. 32-35
Wilmington Qd., Calif.; San Pedro, 7.2 inches N, 2.05 inches E of SW corner of sheet
Pleistocene, Lomita Fm

6839 **californiensis, Hemicythere?:** LeRoy Holotype
LeRoy, 1943, p. 366, pl. 61, figs. 29-31
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6840 **californiensis, Hemicythere?:** LeRoy Paratype
LeRoy, 1943, p. 366, pl. 61, figs. 32, 33
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6846 **californiensis, Hemicythere?:** LeRoy Paratype
LeRoy, 1943, p. 366, pl. 62, figs. 5, 6
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6841 **californiensis, Hemicythere?:** LeRoy Paratypes
6842 LeRoy, 1943, p. 366
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6807 **corrugata, Leguminocythereis:** LeRoy Holotype
LeRoy, 1943, p. 372, pl. 59, figs. 7-10
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6808 **corrugata, Leguminocythereis:** LeRoy Paratype
LeRoy, 1943, p. 372, pl. 59, figs. 11, 12
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6800 **corrugata, Leguminocythereis:** LeRoy Paratype
LeRoy, 1943, p. 372, pl. 62, figs. 7, 8
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6779 **corrugata, Leguminocythereis:** LeRoy Paratypes
6809 LeRoy, 1943, p. 372
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6776 **delreyensis, Basslerites:** LeRoy Holotype
LeRoy, 1943, p. 368, pl. 59, figs. 23-26
Los Angeles Co., Calif.; Venice Qd, 6.2 inches S, 3.9 in W of NE corner of map, on Lincoln Blvd
Pleistocene

6777 **delreyensis, Basslerites:** LeRoy Paratypes
LeRoy, 1943, p. 368, pl. 59, fig. 27
Los Angeles Co., Calif.; Venice Qd, 6.2 inches S, 3.9 inches W of NW corner of map, on Lincoln Blvd
Pleistocene

6851 **delreyensis, Basslerites:** LeRoy Paratype
LeRoy, 1943, p. 368, pl. 62, figs. 21, 22
Los Angeles Co., Calif.; Venice Qd, 6.2 inches S, 3.9 inches W of NE corner of map, on Lincoln Blvd
Pleistocene

6853 **delreyensis, Basslerites:** LeRoy Paratype
LeRoy, 1943, p. 368
Los Angeles Co., Calif.; Venice Qd, 6.2 inches S, 3.9 inches W of NE corner of map, on Lincoln Blvd
Pleistocene

6804 **diegoensis, Cythereis:** LeRoy Holotype
LeRoy, 1943, p. 369, pl. 58, figs. 26-29
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6805 **diegoensis, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 369, pl. 58, figs. 30, 31
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6806 **diegoensis, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 369
San Diego, Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6781 **driveri, Brachycythere:** LeRoy Holotype
LeRoy, 1943, p. 361, pl. 61, figs. 6-8
Santa Barbara, Calif.; Bathhouse Beach
"Pliocene," Santa Barbara Fm

6775 **driveri, Brachycythere:** LeRoy Paratype
LeRoy, 1943, p. 361, pl. 61, figs. 9, 10
Santa Barbara, Calif.; Bathhouse Beach
"Pliocene," Santa Barbara Fm

6849 **driveri, Brachycythere:** LeRoy Paratype
LeRoy, 1943, p. 361, pl. 62, figs. 17, 18
Santa Barbara, Calif.; Bathhouse Beach
"Pliocene," Santa Barbara Fm

6782 **driveri, Brachycythere:** LeRoy Paratype
LeRoy, 1943, p. 361
Santa Barbara, Calif.; Bathhouse Beach
"Pliocene," Santa Barbara Fm

6829 **elongata, Bythocypris:** LeRoy Holotype
LeRoy, 1943, p. 358, pl. 59, figs. 13-16
Wilmington Qd, Calif.; San Pedro, Second St., 7.2 inches N, 2.05 inches E of SW corner of sheet
Pleistocene, Lomita Fm

6788 **fragilis, Caudites:** LeRoy Holotype
LeRoy, 1943, p. 372, pl. 60, figs. 10-12
Wilmington Qd, Calif.; San Pedro, Second Street, 100′ E of Pacific Ave
Pleistocene, Lomita Fm

6789 **fragilis, Caudites:** LeRoy Paratype
LeRoy, 1943, p. 372, pl. 60, fig. 13
Wilmington Qd., Calif.; San Pedro, Second Street, 100′ E of Pacific Ave
Pleistocene, Lomita Fm

6778 **granti, Paracytheridea:** LeRoy Syntype
LeRoy, 1943, p. 361, pl. 61, figs. 11, 12, 14
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pleistocene, San Diego Fm

6792 **granti, Paracytheridea:** LeRoy Syntype
LeRoy, 1943, p. 361, pl. 61, fig. 13
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6845 **granti, Paracytheridea:** LeRoy Syntype
LeRoy, 1943, p. 361, pl. 62, figs. 3, 4
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6815 **hispida, Hemicythere? californiensis:** LeRoy Holotype
LeRoy, 1943, p. 367, pl. 60, figs. 1-3
Santa Barbara, Calif.; Bathhouse Beach
"Pliocene," Santa Barbara Fm

6816 **hispida, Hemicythere? californiensis:** LeRoy Paratype
LeRoy, 1943, p. 367, pl. 60, fig. 4
Santa Barbara, Calif.; Bathhouse Beach
"Pliocene," Santa Barbara Fm

6810 **holmani, Archicythereis:** LeRoy Holotype
LeRoy, 1943, p. 371, pl. 58, figs. 1-4
Orange Co., Calif.; Newport Lagoon, Tustin Qd, 2.95 inches N, 1.08 inches E of SW corner of map
Upper Pliocene

6852 **holmani, Archicythereis:** LeRoy Paratype
LeRoy, 1943, p. 371, pl. 62, figs. 23, 24
Orange Co., Calif.; Newport Lagoon, Tustin Qd, 2.95 inches N, 1.08 inches E of SW corner of map
Upper Pliocene

6801 **jollaensis, Hemicythere:** LeRoy Holotype
LeRoy, 1943, p. 365, pl. 59, figs. 28-31
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6802 **jollaensis, Hemicythere:** LeRoy Paratype
LeRoy, 1943, p. 365, pl. 59, figs. 32, 33
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6803 **jollaensis, Hemicythere:** LeRoy Paratype
LeRoy, 1943, p. 365, text-fig. q
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6848 **jollaensis, Hemicythere:** LeRoy Paratype
LeRoy, 1943, p. 365, pl. 62, figs. 15, 16
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6797 **kewi, Cythereis:** LeRoy Holotype
LeRoy, 1943, p. 369, pl. 60, figs. 24-26
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6798 **kewi, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 369, pl. 60, fig. 27
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6843 **kewi, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 369, pl. 62, figs. 9, 10
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6799 **kewi, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 369, text-fig. d
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6836 **lenticulata, Loxoconcha:** LeRoy Holotype
LeRoy, 1943, p. 360, pl. 60, figs. 19-23
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6837 **lenticulata, Loxoconcha:** LeRoy Paratype
LeRoy, 1943, p. 360, text fig. f
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6838 **lenticulata, Loxoconcha:** LeRoy Paratype
LeRoy, 1943, p. 360, text-fig. g
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6774 **lenticulata, Loxoconcha:** LeRoy Paratype
LeRoy, 1943, p. 360, pl. 61, figs. 34-36
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6847 **lenticulata, Loxoconcha:** LeRoy Paratype
LeRoy, 1943, p. 360, pl. 62, figs. 13, 14
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6783 **lincolnensis, Brachycythere:** LeRoy Holotype
LeRoy, 1943, p. 364, pl. 61, figs. 1-3
Los Angeles Co., Calif.; Lincoln Blvd., Venice; Venice Qd, 6.2 inches S, 3.9 inches W of NE corner of sheet
Pleistocene

6784 **lincolnensis, Brachycythere:** LeRoy Paratype
LeRoy, 1943, p. 364, pl. 61, figs. 4, 5
Los Angeles Co., Calif.; Lincoln Blvd., Venice; Venice Qd, 6.2 inches S, 3.9 inches W of NE corner of sheet
Pleistocene

6785 **lincolnensis, Brachycythere:** LeRoy Paratype
LeRoy, 1943, p. 364, pl. 62, figs. 1, 2
Los Angeles Co., Calif.; Lincoln Blvd., Venice; Venice Qd, 6.2 inches S, 3.9 inches W of NE corner of sheet
Pleistocene

5922 **martini, Brachycythere:** Murray and Hussey Paratype
Murray and Hussey, 1942, p. 177
Louisiana; S side of lower Dodson Rd, Winn Parish; NE 1/4, SW 1/4, SW 1/4 Sec. 28, T 13 N, R 3 W
Eocene, Cook Mountain Fm

6823 **microreticulata, Cythereis:** LeRoy Holotype
LeRoy, 1943, p. 370, pl. 59, figs. 17-20
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6824 **microreticulata, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 370, pl. 59, figs. 21, 22
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6825 **microreticulata, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 370, text fig. n
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6780 **minutum, Cytheropteron:** LeRoy Holotype
LeRoy, 1943a, p. 361, pl. 60, figs. 28-30. [LeRoy, 1943b, p. 629, renamed it *Cytheropteron pacificum*]
Los Angeles Co., Calif.; LaHabra Qd, 8.55 inches S, 4.25 inches E of NW corner of map
Pliocene? [specimen missing, July, 1976]

6812 **newportensis, Archicythereis:** LeRoy Syntype
LeRoy, 1943, p. 372, pl. 58, figs. 7, 8
Orange Co., Calif.; Newport Lagoon, Tustin Qd, 2.95 inches N, 1.08 inches E of SW corner of sheet
Upper Pliocene

6813 **newportensis, Archicythereis:** LeRoy Syntype
LeRoy, 1943, p. 372, pl. 58, figs. 5, 6
Orange Co., Calif.; Newport Lagoon, Tustin Qd, 2.95 inches N, 1.08 inches E of SW corner of sheet
Upper Pliocene

6814 **newportensis, Archicythereis:** LeRoy Syntype
LeRoy, 1943, p. 372, text fig. b
Orange Co., Calif.; Newport Lagoon, Tustin Qd, 2.95 inches N, 1.08 inches E of SW corner of sheet
Upper Pliocene

6769 **pacificus, Paracypris:** LeRoy Holotype
LeRoy, 1943, p. 358, pl. 61, figs. 15-17 and text fig. z
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6770 **pacificus, Paracypris:** LeRoy Paratype
LeRoy, 1943, p. 358, pl. 61, fig. 18
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6786 **palosensis, Hemicythere:** LeRoy Holotype
LeRoy, 1943, p. 365, pl. 60, figs. 14-16 and text fig. c
Los Angeles Co., Calif.; San Pedro, Wilmington Qd, on Second Street, 100′ E of Pacific Ave
Pleistocene, Lomita Fm

6787 **palosensis, Hemicythere:** LeRoy Paratype
LeRoy, 1943, p. 365, pl. 60, figs. 17, 18
Los Angeles Co., Calif.; San Pedro, Wilmington Qd, on Second Street, 100′ E of Pacific Ave
Pleistocene, Lomita Fm

6826 **pedroensis, Cytheridea?:** LeRoy Holotype
LeRoy, 1943, p. 359, pl. 58, figs. 15-18
Los Angeles Co., Calif.; San Pedro, Wilmington Qd, Beacon and Second Streets
Pleistocene, San Pedro Fm

6827 **pedroensis, Cytheridea?:** LeRoy Paratype
LeRoy, 1943, p. 359, pl. 58, figs. 19, 20
Los Angeles Co., Calif.; San Pedro, Wilmington Qd, Beacon and Second Streets
Pleistocene, San Pedro Fm

6828 **pedroensis, Cytheridea?:** LeRoy Paratype
LeRoy, 1943, p. 359, text-fig. t
Los Angeles Co., Calif.; San Pedro, Wilmington Qd, Beacon and Second Streets
Pleistocene, San Pedro Fm

6817 **pennata, Cythereis:** LeRoy Holotype
LeRoy, 1943, p. 370, pl. 59, figs. 34-37
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6818 **pennata, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 370, text-fig. h
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6850 **pennata, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 370, pl. 62, figs. 19, 20
San Diego Co., Calif.; Pacific Beach, La Jolla Qd
Pliocene, San Diego Fm

6832 **schencki, Cythereis:** LeRoy Holotype
LeRoy, 1943, p. 371, pl. 58, figs. 9-12
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6833 **schencki, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 371, pl. 58, figs. 13, 14
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6834 **schencki, Cythereis:** LeRoy Paratype
LeRoy, 1943, p. 371, text-fig. u
Santa Barbara, Calif.; Bathhouse Beach
"Upper Pliocene," Santa Barbara Fm

6819 **schumannensis, Brachycythere lincolnensis:** LeRoy Holotype
LeRoy, 1943, p. 364, pl. 59, figs. 1-4
Santa Barbara Co., Calif.; Guadalupe Qd, in R.R. cut just N of Schumann
Pliocene, Foxen Mudstone

6820 **schumannensis, Brachycythere lincolnensis:** LeRoy Paratype
LeRoy, 1943, p. 364, pl. 59, figs. 5, 6
Santa Barbara Co., Calif.; Guadalupe Qd, in R.R. cut just N of Schumann
Pliocene, Foxen Mudstone

6821 **schumannensis, Brachycythere lincolnensis:** LeRoy Paratype
LeRoy, 1943, p. 364, text-fig. i
Santa Barbara Co., Calif.; Guadalupe Qd, in R.R. cut just N of Schumann
Pliocene, Foxen Mudstone

6822 **schumannensis, Brachycythere lincolnensis:** LeRoy Paratype
LeRoy, 1943, p. 364, text-fig. j
Santa Barbara Co., Calif.; Guadalupe Qd, in R.R. cut just N of Schumann
Pliocene, Foxen Mudstone

6795 **simiensis, Pyricythereis:** LeRoy Holotype
LeRoy, 1943, p. 368, pl. 61, figs. 24-26
Ventura Co., Calif.; Piru Qd, Happy Canyon, N side of Simi Valley
Pliocene, "San Diego" Fm

6796 **simiensis, Pyricythereis:** LeRoy Paratype
LeRoy, 1943, p. 368, pl. 61, figs. 27, 28, text fig. e
Ventura Co., Calif.; Piru Qd, Happy Canyon, N side of Simi Valley
Pliocene, "San Diego" Fm

6771 **verdesensis, Bairdia:** LeRoy Holotype
LeRoy, 1943, p. 358, pl. 60, figs. 5-7
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6772 **verdesensis, Bairdia:** LeRoy Paratype
LeRoy, 1943, p. 358, pl. 60, figs. 8, 9
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

6773 **verdesensis, Bairdia:** LeRoy Paratype
Los Angeles Co., Calif.; Deadman Island, Wilmington Qd, 4.72 inches N, 4.6 inches E of SE corner of sheet
Pleistocene, Timms Point Fm

FORAMINIFERA

7330a **acris, Schwagerina pavilionensis:** Thompson and Wheeler Syntypes
7330b Thompson and Wheeler, 1942, p. 707, pl. 105, figs. 1, 2
Southern British Columbia, Canada; Marble Canyon
Permian, Marble Canyon Ls

7710 **aculeata, Schwagerina:** Thompson and Hazzard Holotype
Thompson and Hazzard, 1946, p. 45, pl. 12, fig. 5
San Bernardino Co., Calif.; E front of Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7706 **aculeata, Schwagerina:** Thompson and Hazzard Paratypes
7709 Thompson and Hazzard, 1946, p. 45, pl. 12, figs. 1, 4, 6, 7, 8
7711 San Bernardino Co., Calif.; Providence Mts., S of Gilroy Mine, 1.5
7712 miles N of end of road to Mitchell's Caverns
7713 Permian, Bird Spring Fm

7707 **aculeata, Schwagerina:** Thompson and Hazzard Paratypes
Thompson and Hazzard, 1946, p. 45, pl. 12, fig. 2
San Bernardino Co., Calif., along ridge and main divide, Providence Mts., about 1.25 miles W of mouth of large canyon just N of Gilroy Mine
Permian, Bird Spring Fm

7708 **aculeata, Schwagerina:** Thompson and Hazzard Paratype
Thompson and Hazzard, 1946, p. 45, pl. 12, fig. 3
San Bernardino Co., Calif., along ridge and main divide, Providence Mts., about 1.25 miles W of mouth of large canyon just N of Gilroy Mine
Permian, Bird Spring Fm

753 **advena, Bolivina:** Cushman Paratype
Cushman, 1925c, p. 29
San Luis Obispo Co., Calif., Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

6134 cell 36 **aequa, Globorotalia crassata:** Cushman and Renz Paratype
Cushman and Renz, 1942, p. 12
Trinidad, British W. I., Soldado Rock
Paleocene, Soldado Fm

7824 **afghanensis, Polydiexodina:** Thompson Holotype
Thompson, 1946, p. 150, pl. 26, fig. 2
Shibar Pass, Afghanistan, on road from Kabul to Bamian, ca. 7 km W of summit
Permian, Bamian Ls

7825 to 7833 **afghanensis, Polydiexodina:** Thompson Paratypes
Thompson, 1946, p. 150, pl. 26, figs. 3-5; pl. 24, figs. 1-6
Shibar Pass, Afghanistan, on road from Kabul to Bamian, ca. 7 km W of summit
Permian, Bamian Ls

5633 **alazanensis, Bolivina:** Cushman Paratype
Cushman, 1926a, p. 82
Veracruz, Mexico, km post 20.15, Tampico-Panuco R.R.
Eocene-Oligocene?, Alazan Clay

5632 **aliformis, Bolivina mexicana:** Cushman Paratype
Cushman, 1926a, p. 82
Veracruz, Mexico; Rio Buena Vista, .5 km S 25° E from Tumbadero Hacienda House
Eocene-Oligocene?, Alazan Clay

9396 **almgreni, Lenticulina:** Martin Holotype
Martin, Lewis, 1964, p. 65, pl. 6, figs. 1a, 1b
Merced Co., Calif., Laguna Seca Creek, Laguna Seca Hills, 7 miles N of Little Panoche Creek
Upper Cretaceous, Panoche Fm

709 **alticostatus, Robulus mexicanus:** Cushman and Barksdale Holotype
Cushman and Barksdale, 1930, p. 63, pl. 11, fig. 7
Contra Costa Co., Calif., Carquinez Qd., on Shell Co. property 1.5 miles E of Arroyo del Hambre, 1.1 miles S of Bull's Head Point
Eocene, upper Martinez Fm [Paleocene]

710 **alticostatus, Robulus mexicanus:** Cushman and Barksdale Paratypes
711 Cushman and Barksdale, 1930, p. 63, pl. 11, figs. 4-6
712 Contra Costa Co., Calif., Carquinez Qd., on Shell Co. property 1.5 miles E of Arroyo del Hambre, 1.1 miles S of Bull's Head Point
Eocene, upper Martinez Fm [Paleocene]

7752 **angulata, Entosolenia marginata:** Uchio Paratype
Uchio, 1951a, p. 38
Chiba-ken, Japan; Tomiya, Takeoka-mura, Kimitsu-gun
Pliocene, Tomiya Fm

586 **angulostriata, Quinqueloculina:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 12, as *angulo-striata*
Channel Islands off southern California

5801 **appressa, Valvulineria californica:** Cushman Paratypes
Cushman, 1926d, p. 60
San Luis Obispo Co., Calif., Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

6132 **arbenzi, Planularia:** Cushman and Renz Paratype
cell 37 Cushman and Renz, p. 13
Falcon, Venezuela; Pozon, 17.7 km SE of Pueblo Jacura, District Acosta.
Miocene, Agua Salada (Zone II)

7732 **arta, Pseudoschwagerina:** Thompson and Hazzard Syntypes
7733 Thompson and Hazzard, 1946, p. 49, pl. 18, figs. 1-3
7734 San Bernardino Co., Calif., along ridge and summit of main divide, Providence Mts., ca. 1.25 miles W of mouth of large canyon just N of Gilroy Mine
Permian, Bird Spring Fm

7749 **asanoi, Cassidulina:** Uchio Paratype
Uchio, 1950, p. 190, text-fig. 13
Chiba-ken, Japan; Otaniki, Tsuchimutsu-mura, Chosei-gun
upper Pliocene

6561 **aster, Asterocyclina:** Woodring Paratypes
Woodring, 1930, p. 152
Santa Barbara Co., Calif., Canada de los Sauces
Eocene

6133 **attenuata, Uvigerina auberiana:** Cushman and Renz Paratype
cell 13 Cushman and Renz, 1941, p. 21
Falcon, Venezuela; Isidro, 35.0 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada (Zone III)

8112 **australis, Bolivinoides decorata:** Edgell Holotype
Edgell, 1954, p. 71, pl. 13, fig. 6
Northwest Australia, C.Y. Creek, W flank of Giralia Anticline
Upper Cretaceous

947 **baggi, Planulina:** Kleinpell Holotype
Kleinpell, 1938, p. 349, pl. VIII, figs. 14a, 14b, 14c
Monterey Co., Calif., Reliz Canyon
Miocene, Salinas Shale

7517 **baileyi, Cibicides:** Beck Holotype
Beck, 1943, p. 611, pl. 109, figs. 7-9
Lewis Co., Wash., W bank of Cowlitz River, 1.5 miles E of Vader, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W
Eocene, Cowlitz Fm

9465 **bandyi, Rotalia:** Martin Holotype
Martin, Lewis, 1964, p. 94, pl. 12, figs. 10a, 10b, 10c
Fresno Co., Calif.; Moreno Gulch, Panoche Hills, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

5466 **barbarense, Elphidium fax:** Nicol Holotype
Nicol, 1944, p. 178, pl. 29, figs. 10, 12
Santa Barbara, California
Pleistocene, Santa Barbara Fm

7446 **barksdalei, Astacolus:** Beck Holotype
Beck, 1943, p. 597, pl. 104, fig. 17
Lewis Co., Wash.; E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W; 1.5 miles E of Vader, on W bank of Cowlitz River
Eocene, Cowlitz Fm

6133 **basicordata, Uvigerina gallowayi:** Cushman and Renz Paratype
cell 14 Cushman and Renz, 1941, p. 21
Falcon, Venezuela; Tocuyo, 18.7 km S of San Juan de los Cayos, District Acosta
Miocene, Agua Salada (Zone II)

6132 **basispinosa, Marginulina:** Cushman and Renz Paratype
cell 19 Cushman and Renz, 1941, p. 13
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada (Zone IV)

756 **beali, Cristellaria:** Cushman Paratype
Cushman, 1925b, p. 25
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

7048 **beatus, Cibicides:** Martin Holotype
Martin, Lois, 1943, p. 30, pl. 8, figs. 6a-6c
Fresno Co., Calif.; Lodo Gulch, Tumey Hills Qd
Eocene, Lodo Fm

836 **belridgensis, Nonion:** Barbat and Johnson Holotype
Barbat and Johnson, 1934, p. 11, pl. 1, fig. 8
Kern Co., Calif.; McKittrick Qd, Sec. 30, T 28 S, R 21 E; Ohio Oil Co., Bearstate No. 23, Belridge field
Miocene, Reef Ridge Shale

710 **belridgensis, Nonion:** Barbat and Johnson Paratype
Barbat and Johnson, 1934, p. 11, pl. 1, fig. 9
Kern Co., Calif.; McKittrick Qd, Sec. 30, T 28 S, R 21 E; Ohio Oil Co., Bearstate No. 23, Belridge field
Miocene, Reef Ridge Shale

591 **biserialis, Dyocibicides:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 30
Channel Islands, off southern California

6131 **biserialis, Siphonides:** Feray Paratype
Feray, 1941, p. 175
Smithville, Texas; S bank of the Colorado River
Middle Eocene, Weches Fm, Claiborne Group

6881 **bleeckeri, Bulimina:** Hedberg Paratypes
Hedberg, 1937, p. 675
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

7392 **bradburyi, Bulimina:** Martin Paratype
Martin, Lois, 1943, p. 19, pl. 6, figs. 4a, 4b
Fresno Co., Calif.; Panoche Qd, Lodo Gulch [Tumey Hills Qd]
Eocene, Lodo Fm

6084 **bramlettei, Bolivina:** Kleinpell Paratype
Kleinpell, 1938, p. 67, pl. 21, figs. 10, 11
Los Angeles Co., Calif.; Palos Verdes Hills
Miocene, Valmonte Diatomite

758 **brevior, Bolivina:** Cushman Paratype
Cushman, 1925c, p. 31
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

6132 **brevis, Textularia miocenica:** Cushman and Renz Paratype
cell 28 Cushman and Renz, 1941, p. 9
Falcon, Venezuela; Tocuyo, 18.7 km S of San Juan de los Cayos, District Acosta
Lower Miocene, Agua Salada Fm (Zone II)

745 **byramensis, Pulvinulina:** Cushman Paratype
Cushman, 1922, p. 99, pl. XXII, figs. 4, 5
Byram, Miss.
Oligocene, Byram Marl

5796 **californica, Buliminella:** Cushman Paratype
Cushman, 1925c, p. 33
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

5629 **californica, Cassidulina:** Cushman and Hughes Paratypes
Cushman and Hughes, 1925, p. 12
San Pedro, Calif.; Timms Point SU loc. 2024
"Pliocene," Timms Point Fm [Pleistocene]

570 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 27, figs. 4, 6
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine; S 72° W from Pioneer School, S 44° E from Lone Hill
Eocene, "Tejon" Fm

571 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 28, figs. 2, 5
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

572 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 28, fig. 4
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

573 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 28, fig. 3
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

574 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 29, fig. 1
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

575 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 29, fig. 3
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

576 **californica, Discocyclina:** Schenck Paratype
Schenck, 1929, p. 224, pl. 30, fig. 3
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

577 **californica, Discocyclina:** Schenck Paratypes
578 Schenck, 1929, p. 224, pl. 30, fig. 3 (type 577)
Santa Clara Co., Calif.; New Almaden Qd, .25 miles NE of Guadalupe quicksilver mine
Eocene, "Tejon" Fm

7349 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Holotype
Schenck and Childs, 1942, p. 17, pl. 2, fig. 4; pl. 3, fig. 4
San Luis Obispo Co., Calif.; Adelaida Qd, near BM 836, center Sec. 7, T 26 S, R 10 E, SU loc. 1155
Oligocene, Vaqueros Fm

7358 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Paratypes
7359 Schenck and Childs, 1942, p. 17, pl. 1, figs. 1 (type 7358), 2 (type
7360 7365), 3 (type 7359), 4 (type 7360)
7365 San Luis Obispo Co., Calif.; Adelaida Qd, center Sec. 7, T 26 S, R 10 E, SU loc. 1155
Oligocene, Vaqueros Fm

7356 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Paratype
Schenck and Childs, 1942, p. 17, pl. 2, fig. 1; pl. 3, fig. 1
San Luis Obispo Co., Calif.; Adelaida Qd, Sec. 7, T 26 S, R 10 E
Oligocene, Vaqueros Fm

7350 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Paratype
Schenck and Childs, 1942, p. 17, pl. 2, fig. 2; pl. 3, fig. 6
San Luis Obispo Co., Calif.; Adelaida Qd, Sec. 7, T 26 S, R 10 E
Oligocene, Vaqueros Fm

7355 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Paratype
Schenck and Childs, 1942, p. 17, pl. 2, fig. 3; pl. 3, fig. 9
San Luis Obispo Co., Calif.; Adelaida Qd, Sec. 7, T 26 S, R 10 E
Oligocene, Vaqueros Fm

7353 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Paratypes
7354 Schenck and Childs, 1942, p. 17, pl. 3, figs. 2 (type 7353), 3 (type
7351 7354), 5 (type 7351), 7 (type 7352), 8 (type 7357)
7352 San Luis Obispo Co., Calif.; Adelaida Qd, Sec. 7, T 26 S, R 10 E
7357 Oligocene, Vaqueros Fm

7361 **californica, Lepidocyclina (Lepidocyclina):** Schenck and Childs Paratypes
7363 Schenck and Childs, 1942, p. 17, pl. 4, figs. 1, 5 (type 7361), figs. 2,
7362 6 (type 7363), 3 (type 7362), 4 (type 7364)
7364 San Luis Obispo Co., Calif.; Adelaida Qd, Sec. 7, T 26 S, R 10 E
Oligocene, Vaqueros Fm

6100 **californica, Suggrunda:** Kleinpell Holotype
Kleinpell, 1938, p. 287, pl. 18, figs. 8-10
Contra Costa Co., Calif.; San Pablo Creek
Miocene, Tice Shale

5800 **californica, Valvulineria:** Cushman Paratype
Cushman, 1926d, p. 60
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

9331a **californicus, Bathysiphon:** Martin Holotype
Martin, Lewis, 1964, p. 43, pl. 1, figs. 2a, 2b
Fresno Co., Calif.; eastern Panoche Hills Martin loc. MG 247
Cretaceous, Panoche group, Uhalde Shale [missing; no record that specimen was received at SU]

7685 **californicus, Triticites:** Thompson and Hazzard Syntypes
7686 Thompson and Hazzard, 1946, p. 42, pl. 10, figs. 10 (type 7685), 11
7687 (type 7686), 12 (type 7687), 13 (type 7688), 14 (type 7689)
7688 San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy
7689 Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7633 **calx, Parafusulina?** Thompson and Wheeler Syntypes
7634 Thompson and Wheeler, 1946, p. 29, pl. 4, figs. 4 (type 7634), 5
7636 (type 7633), 6 (type 7636)
Shasta Co., Calif.; Redding Qd, NE 1/4 SE 1/4 Sec. 23, T 34 N, R 4 W, crest of ls ridge S of Potter Ck, elev. 1660′
Permian, McCloud Fm

7635 **calx, Parafusulina?:** Thompson and Wheeler Syntypes
7636 Thompson and Wheeler, 1946, p. 29, pl. 6, figs. 4 (type 7637), 5 (type 7635)
Shasta Co., Calif.; Redding Qd, NE 1/4 SE 1/4 Sec. 23, T 34 N, R 4 W, crest of ls ridge S of Potter Ck, elev. 1660′
Permian, McCloud Fm

5022 **californiensis, Anomalina:** Cushman and Hobson Paratypes
5023 Cushman and Hobson, 1935, p. 64
Santa Cruz Co., Calif.; Santa Cruz Qd, Bear Creek SU loc. 1102
Oligocene, San Lorenzo Fm

5024 **californiensis, Anomalina:** Cushman and Hobson Paratype
Cushman and Hobson, 1935, p. 64
Santa Cruz Co., Calif.; Santa Cruz Qd, Kings Creek, SU loc. 1103
Oligocene, San Lorenzo Fm [missing since 1940-41]

5797 **californiensis, Virgulina:** Cushman Paratypes
Cushman, 1925c, p. 32
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

9393 **campbelli, Marginulina:** Martin Holotype
Martin, Lewis, 1964, p. 64, pl. 5, figs. 11a, 11b
Merced Co., Calif.; Laguna Seca Hills, Laguna Seca Ck, 7 miles N of Little Panoche Ck
Upper Cretaceous, Panoche Fm

863 **cancriformis, Baggina:** Kleinpell Holotype
Kleinpell, 1938, p. 324, pl. IX, fig. 24a-24c
Monterey Co., Calif.; Reliz Canyon
Miocene, Salinas Shale

6883 **capayana, Uvigerina pygmaea:** Hedberg Paratypes
Hedberg, 1937, p. 677
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6882 **carapitana, Bolivina aenariensis:** Hedberg Paratypes
Hedberg, 1937, p. 676
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6887 **carapitana, Cassidulina:** Hedberg Paratype
Hedberg, 1937, p. 680
Anzoategui, Venezuela: District Libertad
Oligocene, Carapita Fm

6884 **carapitana, Uvigerina:** Hedberg Paratypes
Hedberg, 1937, p. 667
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6869 **carapitanus, Bathysiphon:** Hedberg Paratype
Hedberg, 1937, p. 665
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6877 **caribbeana, Nodosaria raphanistrum:** Hedberg Paratypes
Hedberg, 1937, p. 671
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6132 **carinata, Clavulina:** Cushman and Renz Paratype
cell 17 Cushman and Renz, 1941, p. 8
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

7750 **carinata, Entosolenia circulocosta:** Uchio Paratype
Uchio, 1951a, p. 37 (as *circulo-costacarinata*)
Chiba-ken, Japan; Hoonji, Nishi-mura, Chosei-gun
Pleistocene, Chonan Fm

6132 **carinatum, Haplophragmoides:** Cushman and Renz Paratype
cell 26 Cushman and Renz, 1941, p. 2
Falcon, Venezuela; Curamichate, 17.6 km W of San Juan de los Cayos, District Acosta
Miocene, Agua Salada Fm (Zone III)

9432 **caryi, Praeglobotruncana:** Martin Holotype
Martin, 1964, p. 78, pl. 9, fig. 3a-3c
Eastern Panoche Hills, Calif.; Martin loc. MG 578
[missing; no record of type having been received at SU]

6132 **caudriae, Bolivina:** Cushman and Renz Paratype
cell 6 Cushman and Renz, 1941, p. 19
Falcon, Venezuela; Pozon, 27 km E of Pueblo Jacura, District Acosta
Lower Miocene, Lower Agua Salada Fm (Zone II)

7396 **childsi, Gyroidina:** Martin Holotype
Martin, Lois, 1943, p. 22, pl. 6, figs. 6a-6c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd]
Eocene, Lodo Fm

9434 **churchi, Globotruncana:** Martin Holotype
Martin, Lewis, 1964, p. 79, pl. 9, figs. 5a-5c
Fresno Co., Calif.; eastern Panoche Hills Martin loc. MG 544
Cretaceous [missing; no record of specimen being received at SU]

6088 **cienegaensis, Nodogenerina:** Kleinpell Holotype
Kleinpell, 1938, p. 244, pl. 6, fig. 4
Kern Co., Calif.; Bitter Creek
Oligocene, Maricopa Shale

6635 **colei, Dentalina:** Cushman and Dusenbury Paratype
Cushman and Dusenbury, 1934, p. 54, pl. 7, fig. 10
San Diego Co., Calif.; La Jolla Qd, Murray Canyon, 1 1/8 miles S 38° W of BM 394
Eocene, Poway Conglomerate

6636 **colei, Dentalina:** Cushman and Dusenbury Paratype
Cushman and Dusenbury, 1934, p. 54, pl. 7, fig. 11
San Diego Co., Calif.; La Jolla Qd, Murray Canyon, 1 1/8 miles S 38° W of BM 394
Eocene, Poway Conglomerate

6637 **colei, Dentalina:** Cushman and Dusenbury Paratype
Cushman and Dusenbury, 1934, p. 54, pl. 7, fig. 12
San Diego Co., Calif.; La Jolla Qd, Murray Canyon, 1 1/8 miles S 38° W of BM 394
Eocene, Poway Conglomerate

7939 **collyra, Haplophragmoides:** Nauss Holotype
Nauss, 1947, p. 337, pl. 49, fig. 2a, 2b
Alberta, Canada; Clonmel Well No. 1, Legal subdivision 1, Sec. 32, T 55, R 20, W 4th meridian, depth 1765-1788′
Upper Cretaceous, Lloydminster Shale

7940 **collyra, Haplophragmoides:** Nauss Paratype
Nauss, 1947, p. 337, pl. 49, fig. 5
Alberta, Canada; Clonmel Well No. 1, Legal subdivision 1, Sec. 32, T 55, R 20, W 4th meridian, depth 1765-1788′
Upper Cretaceous, Lloydminster Shale

746 **columbiensis, Pulvinulina:** Cushman Paratype
Cushman, 1925d, p. 43, pl. 7, fig. 1a-c
Queen Charlotte Sound, British Columbia, Canada, in 20 fms

6132 **compressa, Cibicides floridanus:** Cushman and Renz Paratype
cell 15 Cushman and Renz, 1941, p. 26
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

5464 **concinnum, Elphidium:** Nicol Holotype
Nicol, 1944, p. 179, pl. 29, figs. 5, 6
Baja California, Mexico; San Quintin

7692 **concisa, Dunbarinella:** Thompson and Hazzard Holotype
Thompson and Hazzard, 1946, pl. 42, pl. 11, fig. 9
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchells' Caverns
Permian, Bird Spring Fm

7690 **concisa, Dunbarinella:** Thompson and Hazzard Paratype
Thompson and Hazzard, 1946, p. 42, pl. 11, figs. 8, 11
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Springs Fm

7691 **concisa, Dunbarinella:** Thompson and Hazzard Paratype
Thompson and Hazzard, 1946, p. 42, pl. 11, fig. 10
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7693 **concisa, Dunbarinella:** Thompson and Hazzard Paratype
Thompson and Hazzard, 1946, p. 42, pl. 11, fig. 12
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

760 **conica, Bolivina:** Cushman Paratype
Cushman, 1925c, p. 30
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

721 **conscripta, Lagena isabella:** Cushman and Barksdale Holotype
Cushman and Barksdale, 1930, p. 65, pl. 12, fig. 4
Contra Costa Co., Calif.; Carquinez Qd, on Shell Co. property 1.5 miles E of mouth of Arroyo del Hambre, 1.1 miles S of Bull's Head Point, 2.35 miles N 61° W of Vine Hill
Eocene, upper Martinez Fm [missing, ca. 1940-1941] [Paleocene]

7418 **contorta, Karreriella:** Beck Holotype
Beck, 1943, p. 592, pl. 98, figs. 4, 5
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

7416 **coombsi, Ammodiscus:** Beck Holotype
Beck, 1943, p. 591, pl. 98, fig. 1
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

5937 **coralliformis, Ferayina:** Frizzell Paratype
Frizzell, 1949, pp. 483-486, figs. 1-3
Bastrop Co., Texas; Smithville, S bank of Colorado River, about 0.1 mile W of bridge
Middle Eocene, Weches Fm, Claiborne Grp

7491 **cowlitzensis, Bulimina ovata:** Beck Holotype
Beck, 1943, p. 605, pl. 107, fig. 22
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

7430 **cowlitzensis, Biloculina:** Beck Holotype
Beck, 1943, p. 594, pl. 101. figs. 6, 7
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

7435 **cowlitzensis, Robulus propinquus:** Beck Holotype
Beck, 1943, p. 595, pl. 104, figs. 6, 12
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

7465 **cowlitzensis, Saracenaria mackini:** Beck Holotype
Beck, 1943, p. 600, pl. 106, figs. 18, 19
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

7506 **cowlitzensis, Siphonina claibornensis:** Beck Holotype
Beck, 1943, p. 608, pl. 108, figs. 16, 18
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W [SU loc. M-335]
Eocene, Cowlitz Fm

6132 **crassa, Liebusella pozoensis:** Cushman and Renz Paratype
cell 34 Cushman and Renz, 1941, p. 10
Falcon, Venezuela; Isidro, 35.7 km E of Puerto Piritu, District Zamura
Lower Miocene, Agua Salada Fm (Zone II)

5020 **crassipunctata, Cassidulina:** Cushman and Hobson Paratype
Cushman and Hobson, 1935, p. 63
Santa Cruz Co., Calif.; Bear Creek SU loc. 987
Oligocene, San Lorenzo Fm

5021 **crassipunctata, Cassidulina:** Cushman and Hobson Paratype
Cushman and Hobson, 1935, p. 63
Santa Cruz Co., Calif.; on Kings Creek near San Lorenzo River, Sec. 18, T 9 S, R 2 W SU loc. 1103
Oligocene, San Lorenzo Fm

6886 **crebbsi, Eponides:** Hedberg Paratypes
Hedberg, 1937, p. 679
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

7389 **crowleyi, Lagena:** Martin Holotype
Martin, Lois, 1943, p. 18, pl. 5, figs. 5a, 5b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7950 **cummingensis, "Verneuilina":** Nauss Holotype
Nauss, 1947, p. 341, pl. 49, fig. 4
Alberta, Canada; NW Mannville Well No. 1, Legal subdivision 1, Sec. 18, T 50, R 8 W, 4th meridian. Depth 2152-2162′
Lower Cretaceous, Mannville Fm, Cummings Mbr

938 **cuneata, Bolivina tumida:** Kleinpell Holotype
Kleinpell, 1938, p. 285, pl. XIV, figs. 9a, 9b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

855 **cuneiformis, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 270, pl. IX, fig. 3
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

7751 **cushmani, Entosolenia marginata:** Uchio Paratype
Uchio, 1951a, p. 37
Chiba-ken, Japan; Tomiya, Takeoka-mura, Kimitsu-gun
Middle Pliocene, Tomiya Fm

7393 **debilis, Bulimina:** Martin Holotype
Martin, Lois, 1943, p. 20, pl. 6, figs. 1a-1c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7399 **decepta, Globigerina:** Martin Holotype
Martin, Lois, 1943, p. 24, pl. 7, figs. 2a-2c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

6681 **decepta, Nodosaria:** Bagg Holotype
Bagg, 1912, p. 55, pl. 16, fig. 1
San Pedro, Calif.; Timms Point [SU loc. 2024]
"Pliocene"

7388 **deliciae, Nodosaria:** Martin Holotype
Martin, Lois, 1943, p. 17, pl. 6, figs. 3a, 3b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

928 **delmonteensis, Bulimina montereyana:** Kleinpell Holotype
Kleinpell, 1938, p. 255, pl. XVI, fig. 9
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

6676 **dentaliformis, Lagena:** Bagg Syntypes
Bagg, 1912, p. 45, pl. 13, figs. 1a-2b
San Pedro, California; Timms Point SU loc. 2024
"Pliocene"

683 **dubia, Buliminella:** Barbat and Johnson Holotype
Barbat and Johnson, 1934, p. 13, pl. 1, fig. 14
Kern Co., Calif.; McKittrick Qd, Sec. 30, T 28 S, R 21 E; Ohio Oil Co. Bearstate No. 23, Belridge field SU loc. 696
Miocene, Reef Ridge Shale

713 **dubia, Buliminella:** Barbat and Johnson Paratypes
Barbat and Johnson, 1934, p. 13, pl. 1, fig. 15
Kern Co., Calif.; McKittrick Qd, Sec. 30, T 28 S, R 21 E
Miocene, Reef Ridge Shalc

909 **dubia, Planularia:** Kleinpell Holotype
Kleinpell, 1938, p. 207, pl. XIII, fig. 4
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

919 **dunlapi, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 271, pl. XV, fig. 2
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

7456 **dusenburyi, Dentalina:** Beck Holotype
Beck, 1943, p. 599, pl. 105, fig. 23
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7456a **dusenburyi, Dentalina:** Beck Paratype
Beck, 1943, p. 599, pl. 105, fig. 20
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7932 **elkensis, Bolivina:** Nauss Holotype
Nauss, 1947, p. 334, pl. 48, figs. 7a, 7b
Alberta, Canada; Imperial Core Test No. 73, in Elk Point, Legal subdivision 9, Sec. 1, T 57, R 7 W, 4th meridian, depth 285-290′, 360′ above base of formation
Upper Cretaceous, Lea Park Shale

722 **eocenica, Spiroplectoides:** Cushman and Barksdale Holotype
Cushman and Barksdale, 1930, p. 66, pl. 12, figs. 5a, 5b
Contra Costa Co., Calif.; Carquinez Qd, .9 miles S 78° W of Hill 187, E of town of Martinez SU loc. 327
Eocene, Martinez Fm [Paleocene]

7409 **eponidiformis, Cibicides:** Martin Holotype
Martin, Lois, 1943, p. 30, pl. 6, figs. 7a-7c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

6132 **erecta, Cassidulinoides:** Cushman and Renz Paratype
cell 13 Cushman and Renz, 1941, p. 25
Falcon, Venezuela; core from Aguide Well No. 1, depth 111′, 2.5 km S of Pueblo Aguide, District Acosta
Middle Miocene ?, upper Agua Salada Fm

6953 **ervinensis, Dunbarinella:** Thompson Syntypes
6953a Thompson, 1942, p. 419
Osage Co., Okla.; old quarry on N side of Highway 11, 3.7 miles W of river bridge at Pawhuska
Pennsylvanian, Deer Creek Fm, Ervine Creek Mbr

6078 **estorffi, Nodosaria:** Kleinpell Holotype
Kleinpell, 1938, p. 217, pl. 4, fig. 21
Kern Co., Calif.; Carneros Spring, W side of county
Oligocene, Temblor Fm

5933 **estorffi, Nodosaria:** Kleinpell Paratype
Kleinpell, 1938, p. 217, pl. 6, fig. 5
Kern Co., Calif.; Carneros Spring, W side of county
Oligocene, Temblor Fm

7911 **etigoense, Elphidium:** Husezima and Maruhasi Paratype
Husezima and Maruhasi, 1944, p. 392
Niigata-ken, Japan; Kashiwazaki Oil Field, Well No. 2, depth 94.8-110.5 m
Pliocene, upper Haizume Fm

5018 **evolutus, Cibicides pasudoungerianus:** Cushman and Hobson Paratypes
5019 Cushman and Hobson, 1935, p. 64
Santa Cruz Co., Calif.; Bear Creek, SU loc. 987 (type 5018); SU loc. 1102, Sec. 21, T 9 S, R 2 W (type 5019)
Oligocene, San Lorenzo Fm

761 **excolata, Guembelina:** Cushman Paratype
Cushman, 1926c, p. 20
San Luis Potosi, Mexico; near Coco, on Tampico R.R.
Cretaceous, Mendez Shale

5463 **excubitor, Elphidium:** Nicol Holotype
Nicol, 1944, p. 178, pl. 29, figs. 4, 8
Sonora, Mexico; Punta Penasco, lat. 31° 21′ N

6133 **falconensis, Textularia:** Cushman and Renz Paratype
cell 9 Cushman and Renz, 1941, p. 3
Lara, Venezuela; central Falcon, 16.5 km N of Siquisique, District Urdaneta
Lower Miocene, Agua Salada Fm (Zone II)

5462 **fax, Elphidium fax:** Nicol Holotype
Nicol, 1944, p. 177, pl. 29, figs. 3, 11
Clallam Co., Wash.; Dallas Bank, Straits of Juan de Fuca

7934 **fax, Epistomina:** Nauss Holotype
Nauss, 1947, p. 335, pl. 48, fig. 16
Alberta, Canada; Vermilata Frankview Well. No. 1. Legal subdivision 16, Sec. 28, T 50, R 5 W, 4th meridian, depth 660-670′, 180-190′ above base of fm
Upper Cretaceous, Lea Park Shale

7935 **fax, Epistomina:** Nauss — Paratype
Nauss, 1947, p. 335, pl. 48, fig. 15
Alberta, Canada; Vermilata Frankview Well No. 1, Sec. 28, T 50, R 5 W, 4th meridian, depth 660-670′, 180-190′ above base of fm
Upper Cretaceous, Lea Park Shale

6722 **fax, Schwagerina:** Thompson and Wheeler — Syntypes
6723 Thompson and Wheeler, 1946, p. 27, pl. 1, figs. 1 (type 6723), 2 (type
6724 6724), 3 (type 6722), 4 (type 6725)
6725 Shasta Co., Calif.; Redding Qd, W side of limestone hogback, NW 1/4, NE 1/4 Sec. 15, T 33 N, R 4 W. Elev. 1400′ SU loc. 774
Permian, McCloud Fm

7410 **felix, Cibicides:** Martin — Holotype
Martin, Lois, 1943, p. 31, pl. 8, figs. 7a-7c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

6133 **flexilis, Valvulina:** Cushman and Renz — Paratype
cell 15 Cushman and Renz, 1941, p. 7
Falcon, Venezuela, Aguide, 3.85 km SE of Pueblo Aguide, District Acosta
Lower Miocene, Agua Salada Fm (Zone II)

7411 **fortunatus, Cibicides:** Martin — Holotype
Martin, Lois, 1943, p. 31, pl. 8, figs. 5a-5c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

9436 **fresnoensis, Globotruncana:** Martin — Holotype
Martin, Lewis, 1964, p. 80, pl. 9, figs. 8a-8d
Fresno Co., Calif.; eastern Panoche Hills, Martin loc. MG 574
Cretaceous, Panoche Group, upper Marlife Shale [missing; no record of type having been deposited at SU]

6115 **frizzelli, Eponides:** Kleinpell — Holotype
Kleinpell, 1938, p. 318, pl. 2, figs. 15, 16
Santa Barbara Co., Calif.; near Gaviota Pass SU loc. 1436
Oligocene, "Sespe" Fm

7817 **furoni, Schwagerina:** Thompson — Holotype
Thompson, 1946, p. 147, pl. 24, fig. 7
Afghanistan; Shibar Pass, on road from Kabul to Bamian, about 7 km W of summit SU loc. 2612
Permian, Bamian ls

7818 **furoni, Schwagerina:** Thompson — Paratypes
7819 Thompson, 1946, p. 147, pl. 23, figs. 1 (type 7818), 2 (type 7819), 3
7822 (type 7822), 4 (type 7823); pl. 24, fig. 10 (tye 7822)
7823 Afghanistan; Shibar Pass, on road from Kabul to Bamian, about 7 km W of summit SU loc. 2612
Permian, Bamian ls

7820 **furoni, Schwagerina:** Thompson — Paratypes
7821 Thompson, 1946, p. 147, pl. 24, figs. 8 (type 7821), 9 (type 7820)
Afghanistan; Shibar Pass, on road from Kabul to Bamian, about 7 km W of summit SU loc. 2612
Permian, Bamian ls

6092 **galliheri, Bulimina:** Kleinpell — Holotype
Kleinpell, 1938, p. 253, pl. 17, figs. 2, 5
Monterey Co., Calif.; Monterey Qd, 1 mile N of Carmel SU loc. 333
Miocene, Monterey Shale

590 **gallowayi, Cibicides:** Cushman and Valentine — Paratype
Cushman and Valentine, 1930, p. 30
Channel Islands, off southern California

689 **galvestonensis, Elphidium gunteri:** Kornfeld Syntype
Kornfield, 1931, p. 87, pl. 15, figs. 3a, 3b
Galveston Co., Texas; E end of Galveston Island in beach sand

691 **galvestonensis, Elphidium gunteri:** Kornfeld Syntype
Kornfeld, 1931, p. 87, pl. 15, figs. 1a, 1b
Galveston Co., Texas; E end of Galveston Island in beach sand

692 **galvestonensis, Elphidium gunteri:** Kornfeld Syntype
Kornfeld, 1931, p. 87, pl. 15, figs. 2a, 2b
Galveston Co., Texas; E end of Galveston Island in beach sand

6130 **galvinensis, Cassidulina:** Cushman and Frizzell Paratype
Cushman and Frizzell, 1940, p. 43
Lewis Co., Wash.; R.R. cuts .25 miles N of Galvin, SW 1/4 Sec. 28, T 15 N, R 3 W SU loc. 1167
Oligocene, Lincoln Fm

7427 **gilboei, Triloculina:** Beck Holotype
Beck, 1943, p. 594, pl. 101, figs. 1-3
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

749 **glabrata, Anomalina:** Cushman Paratype
Cushman, 1924, p. 39, pl. 12, figs. 5-7
Pago Pago, Samoa, in 50 fms

906 **globosa, Baggina robusta:** Kleinpell Holotype
Kleinpell, 1938, p. 326, pl. XIII, figs. 2a-2c
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

925 **globula, Pullenia miocenica:** Kleinpell Holotype
Kleinpell, 1938, p. 340, pl. XVI, figs. 2a, 2b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

9435 **goudkoffi, Globotruncana:** Martin Holotype
Martin, Lewis, 1964, p. 80, pl. 10, figs. 1a-1c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

7650 **gracilis, Fusulina:** Meek Neotype
Meek, 1864b, p. 4, pl. 2, figs. 1-1c. Neotype designated by Thompson and Wheeler, 1946, p. 31, pl. 1, fig. 10 [as *Parafusulina*]
Shasta Co., Calif.; Redding Qd, W side of limestone hogback, NE 1/4, NE 1/4 Sec. 10, T 33 N, R 4 W, elev. 1660′
Permian, McCloud Fm

7646 **gracilis, Fusulina:** Meek Paraneotypes
7647 Meek, 1864, p. 4, illustrated by Thompson and Wheeler, 1946, p. 31, pl. 1, figs. 6, 7 [as *Parafusulina*]
Shasta Co., Calif.; Redding Qd, W side of limestone hogback, NE 1/4, NE 1/4 Sec. 10, T 33 N, R 4 W, elev. 1660′
Permian, McCloud Fm

7648 **gracilis, Fusulina:** Meek Paraneotypes
7649 Meek, 1864b, p. 4, illustrated by Thompson and Wheeler, 1946, p. 31, pl. 1, figs. 8, 9
Shasta Co., Calif.; Redding Qd, W side of limestone hogback, NE 1/4, NE 1/4 Sec. 10, T 33 N, R 4 W, elev. 1660′
Permian, McCloud Fm

8315 **grahami, Eofabiania:** Küpper Holotype
Küpper, 1955, p. 136, pl. 19, fig. 4; text fig. 1, fig. 1
Santa Clara Co., Calif.; New Almaden Qd, near Old Guadalupe quicksilver mine SU loc. 309
Middle Eocene

8316 **grahami, Eofabiania:** Küpper Paratypes
8317 Küpper, 1955, p. 136, text fig. 1, pl. 19, figs. 1 (type 8317), 2, 3 (type
8318 8318), 5 (type 8316), 6, 7 (type 8319)
8319 Santa Clara Co., Calif.; New Almaden Qd, near old Guadalupe quicksilver mine SU loc. 309
Middle Eocene

9467 **grahami, Gyroidinoides:** Martin Holotype
Martin, Lewis, 1964, p. 95, pl. 13, figs. 1a-1c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

6871 **grenadana, Textularia:** Hedberg Paratype
Hedberg, 1937, p. 667
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6132 **grimsdalei, Lingulina:** Cushman and Renz Paratype
cell 35 Cushman and Renz, 1941, p. 14
Falcon, Venezuela; Tocuyo, 17.7 km S of San Juan de los Cayos, District Acosta
Upper Oligocene, Agua Salada Fm (Zone I)

6872 **halconi, Heterostomella (?):** Hedberg Paratype
Hedberg, 1937, p. 667
Anzoategui, Venezuela; District Libertad
Oligocene, Carapite Fm

6079 **hamilli, Nodosaria:** Kleinpell Holotype
Kleinpell, 1938, p. 218, pl. 4, fig. 5
Kern Co., Calif.; Bitter Creek
Oligocene, Vaqueros Fm

6080 **hamilli, Nodosaria:** Kleinpell Paratype
Kleinpell, 1938, p. 218, pl. 4, fig. 4
Kern Co., Calif.; Bitter Creek
Oligocene, Vaqueros Fm

7500 **hannai, Angulogerina:** Beck Holotype
Beck, 1943, p. 607, pl. 108, figs. 26, 28
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

764 **hannai, Uvigerina:** Kleinpell Holotype
Kleinpell, 1938, p. 294
Monterey Co., Calif.; Monterey Qd, 108.7 mm E, 105 mm N of intersection of lat. 36° 30′, long. 121° 55′ on map, 25-40′ from top of hill SU loc. 336
Miocene, Monterey Shale, type locality, upper Mohnian Stage

7811 **haydeni, Yangchienia:** Thompson Holotype
Thompson, 1946, p. 146, pl. 23, fig. 6
Afghanistan; SW of summit of Shibar Pass, 7 km on road from Kabul to Bamian SU loc. 2612
Permian, Bamian Ls

7812 **haydeni, Yangchienia:** Thompson Paratypes
7813 Thompson, 1946, p. 146, pl. 23, figs. 1, 11 (type 7812), 8 (type 7813),
7814 5 (type 7814)
Afghanistan; Shibar Pass, on road from Kabul to Bamian, about 7 km W of summit SU loc. 2612
Permian, Bamian Ls

7815 **haydeni, Yangchienia:** Thompson Paratypes
7816 Thompson, 1946, p. 146, pl. 23, figs. 9 (type 7816), 10 (type 7815)
Afghanistan; Shibar Pass, on road from Kabul to Bamian, about 7 km W of summit SU loc. 2612
Permian, Bamian Ls

7936 **hectori, Gaudryina:** Nauss Holotype
Nauss, 1947, p. 335, pl. 48, figs. 6a, 6b
Alberta, Canada; NW Mannville Well No. 1 in Legal subdivision 1, Sec. 18, T 50, R 8 W, 4th meridian, depth 1806-1813′, 20-25′ above base of formation
Upper Cretaceous, Lloydminster Shale

6132 **hedbergi, Robulus:** Cushman and Renz Paratype
cell 25 Cushman and Renz, 1941, p. 10
Falcon, Venezuela; Tocuyo, 18.0 km S of San Juan de los Cayos, District Acosta
Upper Oligocene, Agua Salada Fm (Zone I)

6134 **herberti, Trifarina:** Cushman and Renz Paratype
cell 39 Cushman and Renz, 1942, p. 9
Trinidad, B.W.I.; Soldado Rock
Paleocene, Soldado Fm

7495 **hobsoni, Virgulina:** Beck Holotype
Beck, 1943, p. 606, pl. 107, figs. 6, 10
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

6132 **horizontalis, Cassidulina subglobosa:** Cushman and Renz Paratype
cell 12 Cushman and Renz, 1941, p. 26
Falcon, Venezuela; Isidro, 35.7 km E of Pueblo Piritu, District Zamura
Middle Miocene, upper Agua Salada Fm (Zone III)

412 **hughesi, Elphidium:** Cushman and Grant Holotype
Cushman and Grant, 1927, p. 75, pl. 7, fig. 1
Monterey Co., Calif.; Pine Valley, N 1/2 Sec. 12, T 21 S, R 10 E
Lower Pliocene, Pancho Rico Fm

417 **hughesi, Elphidium:** Cushman and Grant Paratypes
Cushman and Grant, 1927, p. 75
Monterey Co., Calif.; Pine Valley, N 1/2 Sec. 12, T 21 S, R 10 E
Lower Pliocene, Pancho Rico Fm

663 **hughesi, Robulus:** Kleinpell Holotype
Kleinpell, 1938, p. 198, pl. 7, figs. 18a, 18b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

7927 **humei, Ammobaculites:** Nauss Holotype
Nauss, 1947, p. 333, pl. 48, fig. 1
Alberta, Canada; NW Mannville Well No. 1 in Legal subdivision 1, Sec. 18, T 50, R 8 W, 4th meridian
Lower Cretaceous, Mannville Fm, Cummings Mbr

7914 **ikebei, Angulogerina:** Husezima and Maruhasi Paratype
Husezima and Maruhasi, 1944, p. 396
Niigata-ken, Japan; Kashiwazaki Oil Field, well no. 1, 200 m
Pliocene, lower Haizume Fm

6132 **illingi, Angulogerina:** Cushman and Renz Paratype
cell 1 Cushman and Renz, 1941, p. 21
Falcon, Venezuela; Tocuyo, 16.9 km S of San Juan de los Cayos, District Acosta
Miocene, Agua Salada Fm (Zone III)

757 **imbricata, Bolivina:** Cushman Paratype
Cushman, 1925c, p. 31
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

9349 **impensus, Haplophragmoides:** Martin Holotype
Martin, Lewis, 1964, p. 48, pl. 2, figs. 3a, 3b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

9349a **impensus, Haplophragmoides:** Martin Paratype
Martin, Lewis, 1964, p. 48, pl. 2, figs. 4, 4b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

9350 **incognatus, Haplophragmoides:** Martin Holotype
Martin, Lewis, 1964, p. 49, pl. 2, figs. 6a, 6b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

9350a **incognatus, Haplophragmoides:** Martin Paratype
Martin, Lewis, 1964, p. 49, pl. 2, figs. 7a, 7b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

6132 **inconspicua, Bolivina:** Cushman and Renz Paratype
cell 8 Cushman and Renz, 1941, p. 18
Falcon, Venezuela; Aguide, 2.5 km S of Pueblo Aguide, core from Aguide well no. 1, 1646′, District Acosta
Miocene ?, Agua Salada Fm (Zone II?)

6666 **involuta, Valvulineria:** Cushman and Dusenbury Holotype
Cushman and Dusenbury, 1934, p. 63, pl. 8, figs. 12a-12c
San Diego Co., Calif.; La Jolla Qd, Murray Canyon, 1 1/8 miles S 38° W of BM 394 SU loc. 1150
Eocene, Poway Conglomerate

6132 **irregularis, Gaudryina jacksonensis:** Cushman and Renz Paratype
cell 29 Cushman and Renz, 1941, p. 6
Falcon, Venezuela; Araurima, 11.6 km SE of Pueblo Jacura, District Acosta
Upper Oligocene, Agua Salada Fm (Zone I)

6089 **irregularis, Nodogenerina:** Kleinpell Holotype
Kleinpell, 1938, p. 245, pl. 17, fig. 12
Santa Barbara Co., Calif.; near Naples
Miocene, Monterey Shale

6132 **isidroensis, Bolivina:** Cushman and Renz Paratype
cell 3 Cushman and Renz, 1941, p. 17
Falcon, Venezuela; Isidro, 33.75 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

6132 **isidroensis, Cibicides:** Cushman and Renz Paratype
cell 14 Cushman and Renz, 1941, p. 26
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

6132 **isidroensis, Dentalina:** Cushman and Renz Paratype
cell 27 Cushman and Renz, 1941, p. 15
Falcon, Venezuela; Isidro, 34.4 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone III)

6133 **isidroensis, Textularia:** Cushman and Renz Paratype
cell 5 Cushman and Renz, 1941, p. 4
Falcon, Venezuela; Pozon, 21.1 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

6133 **isidroensis, Uvigerina:** Cushman and Renz Paratype
cell 12 Cushman and Renz, 1941, p. 20
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

747 **jacksonensis, Discorbis:** Cushman and Applin Paratype
Cushman and Applin, 1926, p. 178, pl. 9, figs. 8, 9
San Augustine Co., Texas; Bridge Ck, 1.5 miles above Angelina River
Upper Eocene, Jackson group

6133 cell 11 **jacuraensis, Vulvulina:** Cushman and Renz Paratype
Cushman and Renz, 1941, p. 5
Falcon, Venezuela; 11.65 km SE of Pueblo Jacura, District Acosta
Lower Miocene, Agua Salada Fm (Zone II)

7747 **japonica, Pseudoeponides:** Uchio Paratype
Uchio, 1950, p. 190, text fig. 16
Chosei-gun, Chiba Prefecture, Japan; in fine sand along Otaki-Chonan Highway, beside a bridge 200 m SE of Primary School, Satsubo, Nishi-mura
Upper Pliocene, Kakinokidae Fm

6133 cell 18 **jarvisi, Hastigerinella:** Cushman Paratype
Cushman, 1930, p. 18
Trinidad, B.W.I.; 17.25 miles out on Cunapo Southern Road
Middle Eocene, Navet Fm

6132 cell 39 **jarvisi, Pulvinulinella:** Cushman and Renz Paratype
Cushman and Renz, 1941, p. 24
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone II)

9486 **jarvisi, Valvulineria:** Martin Holotype
Martin, Lewis, 1964, p. 103, pl. 15, figs. 4a-4c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

9451 **joaquinensis, Bulimina:** Martin Holotype
Martin, Lewis, 1964, p. 87, pl. 11, figs. 5a, 5b, 6a, 6b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

6107 **joaquinensis, Uvigerina:** Kleinpell Holotype
Kleinpell, 1938, p. 296, pl. 17, figs. 6, 10
Kern Co., Calif.; Chico Martinez Creek
Miocene, Monterey Shale

6108 **joaquinensis, Uvigerina:** Kleinpell Paratype
Kleinpell, 1938, p. 296, pl. 17, fig. 11
Kern Co., Calif.; Chico Martinez Creek
Miocene, Monterey Shale

7406 **judas, Anomalina:** Martin Holotype
Martin, Lois, 1943, p. 28, pl. 7, figs. 4a-4c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hill Qd] SU loc. M-74
Eocene, Lodo Fm

7407 **keenae, Anomalina:** Martin Holotype
Martin, Lois, 1943, p. 29, pl. 7, figs. 5a-5c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7385 **kelleyi, Vaginulinopsis,** Martin Holotype
Martin, Lois, 1943, p. 15, pl. 5 figs. 8a-8c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

8113 **kentuckyensis, Hyperammina:** Conkin Paratype
Conkin, 1954, p. 166
Jefferson Co., Kentucky; Mitchell Kill, SW part of the county
Mississippian, Floyds Knob Fm

5794 **kernensis, Nonion incisum:** Kleinpell Holotype
Kleinpell, 1938, p. 232
Kern Co., Calif.; Carneros Springs SU loc. 675
Miocene, Temblor Fm

7434 **kincaidi, Robulus:** Beck Holotype
Beck, 1943, p. 595, pl. 102, figs. 1, 7
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7497 **kleinpelli, Bolivina:** Beck Holotype
Beck, 1943, p. 606, pl. 107, fig. 39
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

6129 **kleinpelli, Eponides:** Cushman and Frizzell Paratype
Cushman and Frizzell, 1940, p. 42
Lewis Co., Wash.; on R.R. .25 miles N of Galvin, SW 1/4 Sec. 27, T 15 N, R 3 W SU loc. 1167
Oligocene, Lincoln Fm

6134 **kugleri, Bulimina:** Cushman and Renz Paratype
cell 32
Cushman and Renz, 1942, p. 9
Trinidad B.W.I.; Soldado Rock
Paleocene, Soldado Fm

6132 **kugleri, Cibicides:** Cushman and Renz Paratype
cell 16
Cushman and Renz, 1941, p. 27
Falcon, Venezuela; Pozon, 20.8 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone III)

6133 **kugleri, Siphogenerina:** Cushman and Renz Paratype
cell 1 Cushman and Renz, 1941, p. 22
Falcon, Venezuela; Pozon, 20.2 km SE of Pueblo Jacura, District Acosta
Lower Miocene, Agua Salada Fm (Zone II)

6133 **kugleri, Textularia:** Cushman and Renz Paratype
cell 10 Cushman and Renz, 1941, p. 5
Falcon, Venezuela; Aguide, 12.3 km S of Pueblo Aguide, District Acosta
Lower Miocene, Agua Salada Fm (Zone II)

5920 **laimingi, Plectofrondicularia miocenica:** Kleinpell Holotype
Kleinpell, 1938, p. 241
Ventura Co., Calif.; Los Sauces Creek
Oligocene, Rincon Shale, middle mbr, Lower Saucesian stage
[specimen missing since 1942]

6133 **lalickeri, Textularia:** Cushman and Renz Paratype
cell 7 Cushman and Renz, 1941, p. 3
Falcon, Venezuela; Aguide, 2.5 km S of Pueblo Aguide, District Acosta; from well core at 237′ depth
Lower Miocene, Agua Salada Fm (Zone II)

587 **lata, Nonionella:** Cushman and Valentine Paratype
Cushman and Valentine, p. 20
Channel Islands off southern California

6133 **lehneri, Globorotalia:** Cushman and Jarvis Paratype
cell 17 Cushman and Jarvis, 1929, p. 17
Trinidad, B.W.I.; source of Moruga River
Middle Eocene, Navet Fm

6133 **lehneri, Hantkenina:** Cushman and Jarvis Paratype
cell 16 Cushman and Jarvis, 1929, p. 16
Trinidad, B.W.I.; source of Moruga River
Middle Eocene, Navet Fm

6730 **lepida, Schwagerina:** Schwager Syntypes
6731 Schwager *in* Richthofen, 1883, p. 138. Also *in* Schenck and Thompson, 1940, p. 588
Hupei Province, China; right bank of Yangtze River, opposite Kitschou
Permian

6133 **leuzingeri, Textularia:** Cushman and Renz Paratype
cell 6 Cushman and Renz, 1941, p. 3
Falcon, Venezuela; Isidro, 34.0 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

7431 **lewisensis, Cornuspira:** Beck Holotype
Beck, 1934, p. 594, pl. 101, figs. 4, 5
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7453 **lewisensis, Vaginulinopsis saundersi:** Beck Holotype
Beck, 1943, p. 598, pl. 105, figs. 3, 13
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

5630 **limbata, Cassidulina:** Cushman and Hughes Paratype
Cushman and Hughes, 1925, p. 12
San Pedro, Calif.; Timms Point SU loc. 2024
"Pliocene," Timms Point Fm

7943 **linki, Haplophragmoides:** Nauss Holotype
Nauss, 1947, p. 339, pl. 49, figs. 7a, 7b
Alberta, Canada; Dina Omega Well No. 1, legal subdivision 14, Sec. 9, T 45, R 1 W, 4th meridian, depth 1478-1488′, 17-27′ above base of fm
Upper Cretaceous, Lloydminster Shale

9333 **llanadoensis, Psammosiphonella:** Martin Holotype
Martin, Lewis, 1964, p. 43, pl. 1, figs. 4a, 4b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch surface section, Martin loc. MG 574
Cretaceous, Panoche Group, upper Marlife Shale [missing; no record of type having been received at SU]

6132 **lobata, Valvulineria inaequalis:** Cushman and Renz Paratype
cell 11 Cushman and Renz, 1941, p. 23
Falcon, Venezuela; Pozon, 20.3 km SE of Pueblo Jacura, District Acosta
Lower Miocene, lower Agua Salada Fm (Zone II)

7398 **lodoensis, Eponides:** Martin Holotype
Martin, Lois, 1943, pl. 6, figs. 8a-8c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7384 **lodoensis, Palmula henbesti:** Martin Holotype
Martin, Lois, 1943, p. 15, pl. 9, figs. 1a 1b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7395 **lodoensis, Uvigerina:** Martin Holotype
Martin, Lois, 1943, p. 21, pl. 6, figs. 2a, 2b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7382 **lododensis, Zeauvigerina:** Martin Holotype
Martin, Lois, 1943, p. 21, pl. 5, figs. 1a, 1b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7937 **loetterli, Globigerina:** Nauss Holotype
Nauss, 1947, p. 336, pl. 49, figs. 11a-11c
Alberta, Canada; Clonmel Well No. 1, Legal subdivision 1, Sec. 32, T 55, R 20 W, 4th meridian, W of Vermilion area; depth 1875-1885', 485-495' below top of fm
Upper Cretaceous Lloydminster Shale

841 **luciana, Planularia:** Kleinpell Holotype
Kleinpell, 1938, p. 207, pl. IX, figs. 25a, 25b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

7464 **mackini, Saracenaria:** Beck Holotype
Beck, 1943, p. 600, pl. 106, figs. 1, 5
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

6950 **marblensis, Millerella:** Thompson Paratypes
Thompson, 1942, p. 405
Marble Falls, Texas; near water level, 150 yds downstream from bridge
Pennsylvanian, Marble Falls Ls

763 **marginata, Bolivina:** Cushman Paratype
Cushman, 1925c, p. 30
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

7402 **marksi, Globorotalia:** Martin Holotype
Martin, Lois, 1943, p. 26, pl. 8, figs. 1a-1c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

726 **martinezensis, Cibicides:** Cushman and Barksdale Holotype
Cushman and Barksdale, 1930, p. 68, pl. 12, figs. 9a-9c
Contra Costa Co., Calif.; Carquinez Qd, on Shell Co. property 1.5 miles E of mouth of Arroyo del Hambre, 1.1 mile S of Bull's Head Point and 2.35 miles N 61° W of Vine Hill SU loc. 322
Eocene, upper Martinez Fm [Paleocene]

7682 **masoni, Schubertella:** Thompson and Hazzard Syntypes
7683 Thompson and Hazzard, 1946, p. 41, pl. 13, figs. 7, 8 (type 7682), 10
7684 (type 7684), 9 (type 7683)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

701 **matagordana, Nonion depressula:** Kornfeld Holotype
Kornfeld, 1931, p. 87, pl. 13, figs. 2a, 2b
Matagorda Co., Texas; Gulf of Mexico, in beach sand

6134 **mauryae, Cancris:** Cushman and Renz Paratype
cell 33 Cushman and Renz, 1942, p. 11
Trinidad, B.W.I.; Soldado Rock
Paleocene, Soldado Fm

748 **mayori, Calcarina:** Cushman Paratype
Cushman, 1924, p. 44, pl. 14, figs. 4-7
Pago Pago, Samoa, in 18 fms

7520 **mcmastersi, Cibicides:** Beck Holotype
Beck, 1943, p. 612, pl. 109, figs. 2, 4, 15
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

5795 **mediocostata, Nonionina:** Cushman Paratype
Cushman, 1926b, p. 89, pl. 13, figs. 1a-1c, as *medio-costata*
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

6132 **melvilli, Robulus:** Cushman and Renz Paratype
cell 20 Cushman and Renz, 1941, p. 12
Falcon, Venezuela; Isidro, 33.5 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

5634 **mexicana, Bolivina:** Cushman Paratypes
Cushman, 1926a, p. 81
Vera Cruz, Mexico; Panuco-Tampico R.R., between km posts 21 and 22
Eocene-Oligocene ?, Alazan Clay

700 **mexicana, Haplophragmoides canariensis:** Kornfeld Neotype
Kornfeld, 1931, p. 83, pl. 13, figs. 4a-4c
Cameron Parish, Louisiana; E of Calcasieu Pass, in beach sand

693 **mexicanum, Elphidium incertum:** Kornfeld Syntype
Kornfeld, 1931, p. 89, pl. 16, figs. 2a, 2b
Galveston Co., Texas; E end of Galveston Island, in beach sand

694 **mexicanum, Elphidium incertum:** Kornfeld Syntype
Kornfeld, 1931, p. 89, pl. 16, figs. 1a, 1b
Galveston Co., Texas; E end of Galveston Island, in beach sand

7422 **milleri, Quinqueloculina:** Beck Holotype
Beck, 1943, p. 593, pl. 99, figs. 8, 9, 10
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7942 **minor, Haplophragmoides gigas:** Nauss Holotype
Nauss, 1947, p. 338, pl. 49, figs. 10a, 10b
Alberta, Canada; NW Mannville Well No. 1 in Legal subdivision 1, Sec. 18, T 50, R 8 W, 4th meridian, depth 2173-2183', 5-51' above base of member
Lower Cretaceous, Mannville Fm, Cummings mbr

7423 **minuta, Quinqueloculina:** Beck Holotype
Beck, 1943, p. 593, pl. 99, figs. 5-7
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

9466 **minuta, Rotalia:** Martin Holotype
Martin, Lewis, 1964, p. 94, pl. 12, figs. 11a-11c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

7331a **minuta, Yabeina:** Thompson and Wheeler Syntypes
7331b Thompson and Wheeler, 1942, p. 707, pl. 106, figs. 6, 8 (type 7331a),
7331c 7 (type 7331b), 9 (type 7331c), 10 (type 7331d)
7331d Marble Canyon, southern British Columbia, Canada
Permian, Marble Canyon Ls

6907 **miocenica, Cristellaria:** Chapman Holotype
Chapman, 1900, p. 250, pl. 30, figs. 1, 1a
Santa Clara Co., Calif.; from a well
Miocene

5792 **miocenica, Pullenia:** Kleinpell Holotype
Kleinpell, 1938, p. 338, pl. 14, fig. 6
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

9412 **mirabilis, Planularia:** Martin Holotype
Martin, Lewis, 1964, p. 71, pl. 7, figs. 5a-5c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

7701 **modica, Schwagerina:** Thompson and Hazzard Syntypes
7702 Thompson and Hazzard, 1946, p. 44, pl. 11, figs. 1 (type 7701), 2
7703 (type 7702), 3, 6 (type 7703)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7704 **modica, Schwagerina:** Thompson and Hazzard Syntypes
7705 Thompson and Hazzard, 1946, p. 44, pl. 11, figs. 4, 5 (type 7704), 7 (type 7705)
San Bernardino Co., Calif.; E front, Providence Mts., 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

6071 **mohnensis, Robulus:** Kleinpell Holotype
Kleinpell, 1938, p. 200, pl. 18, figs. 1, 2
Los Angeles Co., Calif.; Mohn Springs
Miocene, Modelo Shale

7743 **momiyamensis, Elphidiella:** Uchio Paratype
Uchio, 1951b, p. 372, pl. 5. figs. 7a, 7b
Tochigi Prefecture, Japan; in cliff facing Tobu electric R.R., 600 m NW of Momiyama Station
Miocene, Kanuma Fm

893 **montereyana, Bulimina:** Kleinpell Holotype
Kleinpell, 1938, p. 254, pl. XII, fig. 13
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

5976 **montis, Neofusulinella:** Thompson and Wheeler Holotype
Thompson and Wheeler, 1946, p. 26, pl. 2, figs. 7, 8
Shasta Co., Calif.; Redding Qd, crest of limestone ridge S of Potter Creek, elev. 1675', NE 1/4, SE 1/4 Sec. 23, T 34 N, R 4 W. SU loc. 757
Permian, McCloud Fm

5977 **montis, Neofusulinella:** Thompson and Wheeler Paratypes
5978 Thompson and Wheeler, 1946, p. 26, pl. 2, figs. 5 (type 5977), 6 (type
6720 5978), 9 (type 6720)
Shasta Co., Calif.; Redding Qd, crest of limestone ridge S of Potter Creek, elev. 1675', NE 1/4 SE 1/4 Sec. 23, T 34 N, R 4 W. SU loc. 757
Permian, McCloud Fm

6122 **moorei, Pullenia:** Kleinpell Holotype
Kleinpell, 1938, p. 340, pl. 18, figs. 11, 16
Santa Barbara Co., Calif.; near Naples
Miocene, Monterey Shale

7719 **multispira, Schwagerina?:** Thompson and Hazzard Syntypes
7720 Thompson and Hazzard, 1946, p. 46, pl. 15, figs. 1 (type 7719), 2
7721 (type 7720), 3 (type 7721), 4 (type 7722)
7722 San Bernardino Co., Calif.; along ridge and summit of main divide, Providence Mts., ca. 1.25 miles W of mouth of large canyon opening just N of Gilroy Mine
Permian, Bird Spring Fm

7748 **nakamurai, Cassidulina:** Uchio Paratype
Uchio, 1950, p. 190, text fig. 14
Chiba-ken, Japan; S entrance of Odoroa Tunnel, Kamitaki-mura, Isumi-gun
Upper Pliocene

7521 **natlandi, Cibicides:** Beck Holotype
Beck, 1943, p. 612, pl. 109, figs. 2, 4, 15
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7403 **naussi, Globorotalia:** Martin Holotype
Martin, Lois, 1943, p. 26, pl. 8, figs. 3a-3c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

6951 **needhami, Pseudostaffella:** Thompson Syntype
Thompson, 1942, p. 411
NW side of Mud Springs Mt., New Mexico; W end of Whiskey Canyon
Pennsylvanian, Magdalena Fm, Bend Series

7401 **nicoli, Globorotalia:** Martin Holotype
Martin, Lois, 1943, p. 27, pl. 7, figs. 3a-3c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7912 **niigataensis, Eponides:** Husezima and Maruhasi Paratype
Husezima and Maruhasi, 1944, p. 398
Niigata-ken, Japan; Kashiwazaki Oil Field, well no. 1, depth 94.8-110.5 m
Pliocene, upper Haizume Fm

7400 **nitida, Globigerina:** Martin Holotype
Martin, Lois, 1943, p. 25, pl. 7, figs. 1a-1c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

6890 **nolani, Anomalina:** Hedberg Paratypes
Hedberg, 1937, p. 681
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

7661 **nosonensis, Parafusulina:** Thompson and Wheeler Syntypes
7662 Thompson and Wheeler, 1946, p. 33
Shasta Co., Calif.; Redding Qd, SW 1/4, SE 1/4 Sec. 22, T 33 N, R 4 W, elev. 180′ above base of Nosoni Fm SU loc. 2577
Permian, Nosoni Fm

7663 **nosonensis, Parafusulina:** Thompson and Wheeler Syntypes
7664 Thompson and Wheeler, 1946, p. 33, pl. 7, figs. 1 (type 7663), 2 (type
7665 7664), 3 (type 7665), 4 (type 7666)
7666 Shasta Co., Calif.; Redding Qd, SW 1/4, SE 1/4 Sec. 22, T 33 N, R 4 W SU loc. 2577
Permian, Nosoni Fm

7667 **nosonensis, Parafusulina:** Thompson and Wheeler Syntypes
7668 Thompson and Wheeler, 1946, p. 33, pl. 7, figs. 5, 9 (type 7667), 6
7669 (type 7668), 7 (type 7669), 8, 10 (type 7670)
7670 Shasta Co., Calif.; Redding Qd, SW 1/4, SE 1/4 Sec. 22, T 33 N, R 4 W SU loc. 2577
Permian, Nosoni Fm

5786 **nuciformis, Siphogenerina:** Kleinpell Holotype
Kleinpell, 1938, p. 303, pl. 15, fig. 10
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

5787 **nuciformis, Siphogenerina:** Kleinpell Paratype
Kleinpell, 1938, p. 303, pl. 14, fig. 12
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

6879 **nuttalli, Nodosaria:** Hedberg Paratypes
Hedberg, 1937, p. 673
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6132 **nuttalli, Robulus:** Cushman and Renz Paratype
cell 21 Cushman and Renz, 1941, p. 11
Falcon, Venezuela; Isidro, 35 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone III)

5798 **obesa, Uvigerinella:** Cushman Paratype
Cushman, 1926d, p. 59
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

703 **obliqua, Bolivina:** Barbat and Johnson Holotype
Barbat and Johnson, 1934, p. 15, pl. 1, fig. 20
Kings Co., Calif.; Coalinga Qd, Kettleman Hills, Sec. 35, T 21 S, R 17 E, Associated Oil Co., Whepley No. 1
Miocene, Reef Ridge Shale

712 **obliqua, Bolivina:** Barbat and Johnson Paratype
Barbat and Johnson, 1934, p. 15
Kings Co., Calif.; Coalinga Qd, Kettleman Hills, Sec. 35, T 21 S, R 17 E, Associated Oil Co., Whepley No. 1
Miocene, Reef Ridge Shale

9366 **obscura, Eggerella:** Martin Holotype
Martin, Lewis, 1964, p. 55, pl. 3 figs. 10a, 10b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

9366a **obscura, Eggerella:** Martin Paratype
Martin, Lewis, 1964, p. 55, pl. 3 fig. 11
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

9492 **occidentalis, Anomalina:** Martin Holotype
Martin, Lewis, 1964, p. 105, pl. 16, figs. 3a-3c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

5972 **occidentalis, Neofusulinella:** Thompson and Wheeler Holotype
Thompson and Wheeler, 1946, p. 25, pl. 2, fig. 2
Shasta Co., Calif.; Redding Qd, "Bass Ranch," SE 1/4, SE 1/4 Sec. 15, T 33 N, R 4 W, elevation 1100′ SU loc. 775
Permian, McCloud Fm

5973 **occidentalis, Neofusulinella:** Thompson and Wheeler Paratypes
5974 Thompson and Wheeler, 1946, p. 25, pl. 2, figs. 1 (type 5975), 3 (type
5975 5974), 4 (type 5973)
Shasta Co., Calif.; Redding Qd, "Bass Ranch," SE 1/4, SE 1/4 Sec. 15, T 33 N, R 4 W, elevation 1100′ SU loc. 775
Permian, McCloud Fm

7522 **olequaensis, Cibicides natlandi:** Beck Holotype
Beck, 1943, p. 612, pl. 109, figs. 3, 20, 22
Lewis Co., Wash.; 1.5 miles E of Vader, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W, on W bank of Cowlitz River SU loc. M-335
Eocene, Cowlitz Fm

7420 **olequaensis, Quinqueloculina goodspeedi:** Beck Holotype
Beck, 1943, p. 592, pl. 99, figs. 3, 4
Lewis Co., Wash.; 1.5 miles E of Vader, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W, on W bank of Cowlitz River SU loc. M-335
Eocene, Cowlitz Fm

6874 **orinocoensis, Sigmoilina:** Hedberg Paratype
Hedberg, 1937, p. 669
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

754 **ornata, Bolivina advena:** Cushman Paratype
Cushman, 1925c, p. 29
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

5802 **ornata, Valvulineria:** Cushman Paratypes
Cushman, 1926d, p. 61
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

7741 **otukai, Vaginulina:** Uchio Paratype
Uchio, 1951b, p. 370, pl. 5, figs. 4a-4c
Tochigi Prefecture, Japan; in cliff facing Tobu electric R.R., 600 m NW of Momiyama Station
Miocene, Kanuma Fm

7742 **ozawai, Elphidium:** Uchio Paratype
Uchio, 1951b, p. 372, pl. 5, figs. 11a, 11b
Tochigi Prefecture, Japan; in bluish grey sandstone of "Terayama group" at Hachimanyama, Ozo, Utsunomiya City
Miocene, Kanuma Fm

5939 **ozawai, Pseudodoliolina:** Yabe and Hanzawa Paratype
Yabe and Hanzawa, 1932, p. 40-43
Gifu Prefecture, Japan; Akasaka, Nino Province

7417 **pacifica, Cyclammina:** Beck Holotype
Beck, 1943, p. 591, pl. 98, figs. 2, 3
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

582 **pacificus, Ammodiscus:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 7
Channel Islands, off southern California

7333a **packardi, Yabeina:** Thompson and Wheeler Syntypes
7333e Thompson and Wheeler, 1942, p. 710, pl. 106, fig. 4 (type 7333a); pl. 108, fig. 4 (type 7333e)
Jefferson Co., Ore.; near base of Gray Butte, near Madras
Permian

7333b **packardi, Yabeina:** Thompson and Wheeler Syntypes
7333c Thompson and Wheeler, 1942, p. 710, pl. 107, figs. 2 (type 7333b), 3
7333d (type 7333c), 4 (type 7333d)
Jefferson Co., Ore.; near Madras, near base of Gray Butte
Permian

945 **panzana, Cassidulina:** Kleinpell Holotype
Kleinpell, 1938, p. 335, pl. 8, figs. 9a, 9b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

6889 **pariana, Anomalina:** Hedberg Paratypes
Hedberg, 1937, p. 681
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6878 **pariana, Nodosaria:** Hedberg Paratypes
Hedberg, 1937, p. 672
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6870 **parianus, Ammodiscus:** Hedberg Paratype
Hedberg, 1937, p. 666
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6132 **parva, Gyroidina:** Cushman and Renz Paratype
cell 31 Cushman and Renz, 1941, p. 23
Falcon, Venezuela; Pozon, 18.5 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

859 **parva, Uvigerinella californica:** Kleinpell Holotype
Kleinpell, 1938, p. 289, pl. 9, fig. 14
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

6132 **paucicostata, Pseudoglandulina gallowayi:** Cushman and Renz
cell 38 Paratype
Cushman and Renz, 1941, p. 16
Falcon, Venezuela; Isidro, 34.5 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone III)

7329a **pavilionensis, Schwagerina:** Thompson and Wheeler Syntypes
7329b Thompson and Wheeler, 1942, p. 706, pl. 105, figs. 3, 4, 5, 6
7329c British Columbia, Canada; Marble Canyon, near Lillooet
7329d Permian, Marble Canyon Ls

9459 **paynei, Bolivinoides:** Martin Holotype
Martin, Lewis, 1964, p. 90, pl. 12, figs. 1a-1c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

7424 **paynei, Quinqueloculina:** Beck Holotype
Beck, 1943, p. 593, pl. 98, figs. 6, 7, 8
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

671 **perrini, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 278, pl. 7, figs. 4a, 4b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

5461 **pingue, Elphidium fax:** Nicol Holotype
Nicol, 1944, p. 177, pl. 29, figs. 1, 2
Monterey Co., Calif.; Mussel Point, Monterey Bay

7910 **planum, Elphidium:** Husezima and Maruhasi Paratype
Husezima and Maruhasi, 1944, p. 392
Niigata-ken, Japan; Kashiwazaki Oil Field, well No. 1, depth 60 m
Pliocene, upper Haizume Fm

7714 **plena, Schwagerina aculeata:** Thompson and Hazzard Syntypes
7715 Thompson and Hazzard, 1946, p. 46, pl. 13, figs. 1 (type 7714), 2 (7715)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7716 **plena, Schwagerina aculeata:** Thompson and Hazzard Syntypes
7717 Thompson and Hazzard, 1946, p. 46, pl. 13, figs. 3 (type 7716), 4, 6
7718 (type 7717), 5 (type 7718)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

6132 **pozoensis, Bolivina:** Cushman and Renz Paratype
cell 5 Cushman and Renz, 1941, p. 16
Falcon, Venezuela; Pozon, 18.35 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

6132 **pozoensis, Liebusella:** Cushman and Renz Paratype
cell 33 Cushman and Renz, 1941, p. 9
Falcon, Venezula; Pozon, 17.7 km SE of Pueblo Jacura, District Zamura
Lower Miocene, Agua Salada Fm (Zone II)

6133 **pozoensis, Siphonina:** Cushman and Renz Paratype
cell 3 Cushman and Renz, 1941, p. 24
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

6133 **pozoensis, Textularia:** Cushman and Renz Paratype
cell 8 Cushman and Renz, 1941, p. 4
Falcon, Venezuela; Pozon, 21.1 km SE of Pueblo Jacura, District Acosta
Middle Miocene, Agua Salada Fm (Zone VI)

9398 **praeconvergens, Lenticulina:** Martin Holotype
Martin, Lewis, 1964, p. 66, pl. 6, figs. 3a, 3b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

8323 **primitiva, Globotruncana (Praeglobotruncana) renzi:** Kupper Holotype
Kupper, 1956, p. 43, pl. 8, fig. 2
Colusa Co., Calif.; Lodoga Qd, 325′ S, 500′ W of NE cor. Sec. 8, T 17 N, R 4 W
Upper Cretaceous

7397 **primus, Eponides:** Martin Holotype
Martin, Lois, 1943, p. 23, pl. 9, figs. 4a-4c
Fresno Co., Calif.; Panoche Qd, Lodo Gulch [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

5938 **proteus, Manorella:** Grice Paratypes
Grice, 1948, pp. 222-224, figs. 1, 3, 4, 5
Travis Co., Texas; Austin-Manor Highway, bridge over Little Walnut Creek
Cretaceous, Austin Chalk

7698 **providens, Schwagerina:** Thompson and Hazzard Holotype
Thompson and Hazzard, 1946, p. 43, pl. 14, fig. 1
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7694 **providens, Schwagerina:** Thompson and Hazzard Paratypes
7695 Thompson and Hazzard, 1946, p. 43, pl. 14, figs. 4 (type 7695), 5 (type
7696 7696), 6 (type 7694)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7697 **providens, Schwagerina:** Thompson and Hazzard Paratypes
7699 Thompson and Hazzard, 1946, p. 43, pl. 14, figs. 2, 7, 8 (type 7697),
7700 3 (type 7699), 9 (type 7700)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

849 **pseudoaffinis, Bulimina:** Kleinpell Holotype
Kleinpell, 1938, p. 257, pl. 9, fig. 9
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

9407 **pseudoligostegius, Robulus:** Martin Holotype
Martin, Lewis, 1964, p. 69, pl. 6, figs. 12a-12c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

6096 **pseudospissa, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 279, pl. 21, fig. 6
Los Angeles Co., Calif.; Mohn Springs
Miocene, Modelo Shale

5060 **psila, Discocyclina:** Woodring Neotype
Woodring, 1930, p. 148, pl. 3, fig. 4
Santa Barbara Co., Calif.; Lompoc Qd, about 5 miles NW of Point Conception lighthouse SU loc. 356
Upper Eocene

6561 **psila, Discocyclina:** Woodring Paratype
Woodring, 1930, p. 148
Santa Barbara Co., Calif.; Lompoc Qd, Canada de los Sauces SU loc. 167
Upper Eocene

7913 **pulchella, Epistominella:** Husezima and Maruhasi Paratype
Husezima and Maruhasi, 1944, p. 398
Niigata-ken, Japan; Kashiwazaki Oil Field, well No. 1, depth 221.5-222 m
Pliocene, lower Haizume Fm

97799 **putahensis, Globotruncana:** Takayanagi Holotype
Takayanagi, 1965, p. 221, pl. 27, figs. 2a-2c
Yolo Co., Calif.; Putah Creek, hole No. 5A, Sec. A, 70′
Upper Cretaceous, Forbes Fm

5627 **quadrata, Cassidulina subglobosa:** Cushman and Hughes Paratype
Cushman and Hughes, 1925, p. 15
Los Angeles Co., Calif.; Palos Verdes Hills, Lomita Quarry SU loc. 1125
Pleistocene, San Pedro Fm

6097 **rankini, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 290, pl. 22, figs. 4, 9
Los Angeles Co., Calif.; near Girard
Miocene, Modelo Diatomite

7383 **rectiangula, Gaudryina (Siphogaudryina):** Martin Holotype
Martin, Lois, 1943, p. 14, pl. 5, figs. 4a, 4b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

9399 **rectovalis, Lenticulina:** Martin Holotype
Martin, Lewis, 1964, p. 66, pl. 6, figs. 4a, 4b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

660 **reedi, Robulus:** Kleinpell Holotype
Kleinpell, 1938, p. 201, pl. 7, figs. 23a, 23b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

931 **reedi, Robulus:** Kleinpell Paratype
Kleinpell, 1938, p. 201, pl. 8, figs. 5
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

5799 **reedi, Siphogenerina:** Cushman Paratype
Cushman, 1925a, p. 3
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

6132 **regularis, Bolivina floridana:** Cushman and Renz Paratype
cell 2 Cushman and Renz, 1941, p. 17
Falcon, Venezuela; Isidro, 33.5 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

840 **relizensis, Cibicides:** Kleinpell Holotype
Kleinpell, 1938, p. 355, pl. VII, figs. 15a-15c
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

959 **relizensis, Lenticulina:** Kleinpell Holotype
Kleinpell, 1938, p. 205, pl. 10, figs. 6a, 6b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

5016 **relizensis, Pulvinulinella:** Kleinpell Holotype
Kleinpell, 1938, p. 329, pl. X, figs. 10a-10c
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale [specimen missing, ca. 1940-1941]

942 **reliziana, Gyroidina:** Kleinpell Holotype
Kleinpell, 1938, p. 315, pl. X, figs. 11a, 11b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

7404 **rex, Globorotalia:** Martin Holotype
Martin, Lois, 1943, p. 27, pl. 8, figs. 2a-2c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7387 **rex, Vaginulinopsis saundersi:** Martin Holotype
Martin, Lois, 1943, p. 17, pl. 9, figs. 2a, 2b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

762 **rhomboidea, Bolivina:** Cushman Paratype
Cushman, 1926b, p. 19
San Luis Potosi, Mexico; Tamuin River, 5 km SE of Guerrero
Cretaceous, Mendez Shale

7381 **richardi, Spiroplectammina:** Martin Holotype
Martin, Lois, 1943, p. 14, pl. 5, figs. 3a, 3b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

873 **robusta, Baggina:** Kleinpell Holotype
Kleinpell, 1938, p. 325, pl. XI, figs. 8a-8c
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

7628 **robusta, Fusulina:** Meek Neotype
Meek, 1864b, pp. 3-4, pl. 2, figs. 3a-3c. Neotype designated by Thompson and Wheeler, 1946, pp. 28-29, pl. 3, fig. 1 [as *Pseudoschwagerina robusta* (Meek)]
Shasta Co., Calif.; Redding Qd, W side of ls hogback, NW 1/4, NE 1/4 Sec. 15, T 33 N, R 4 W, elev. 1400′ SU loc. 774
Permian, McCloud Ls

7629 **robusta, Fusulina:** Meek Paraneotypes
7630 Meek, 1864b, pp. 3-4. Paraneotypes illustrated by Thompson and Wheeler, 1946, pp. 28-29, pl. 6, figs. 7 (type 7629), 6 (type 7630)
Shasta Co., Calif.; Redding Qd, W side of ls hogback, NW 1/4, NE 1/4 Sec. 15, T 33 N, R 4 W, elev. 1400′ SU loc. 774
Permian, McCloud Ls

7631 **robusta, Fusulina:** Meek Paraneotypes
7632 Meek, 1864b, pp. 3-4. Paraneotypes illustrated by Thompson and Wheeler, 1946, pp. 28-29, pl. 3, figs. 2 (type 7631), 3 (type 7632)
Shasta Co., Calif.; Redding Qd, W side of ls knoll in SE 1/4, SE 1/4 Sec. 15, T 33 N, R 4 W, elev. 1100′ SU loc. 775
Permian, McCloud Ls

585 **robustior, Massilina:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 8
Channel Islands, off southern California

7726 **roeseleri, Pseudoschwagerina:** Thompson and Hazzard Holotype
Thompson and Hazzard, 1946, p. 47, pl. 17, fig. 4
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7723 **roeseleri, Pseudoschwagerina:** Thompson and Hazzard Paratypes
7724 Thompson and Hazzard, 1946, p. 47, pl. 17, figs. 5 (type 7725), 6
7725 (type 7723); pl. 18, fig. 4 (type 7724)
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

9479 **rosaceus, Globorotalites:** Martin Holotype
Martin, Lewis, 1964, p. 99, pl. 14, figs. 5a-5c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

7944 **rota, Haplophragmoides:** Nauss Holotype
Nauss, 1947, p. 339, pl. 49, figs. 1a, 1b
Alberta, Canada; Imperial core test No. 14, Legal subdivision 5, Sec. 7, T 51, R 8 W, 4th meridian, depth 55-60′, 10-15′ above base of member
Upper Cretaceous, Belly River Fm, Grizzly Bear tongue

7945 **rota, Haplophragmoides:** Nauss Paratype
Nauss, 1947, p. 339, pl. 49, figs. 3a, 3b
Alberta, Canada; Imperial core test No. 2, depth 190-200′, Vermilion area
Upper Cretaceous, Belly River Fm, Grizzly Bear tongue

6132 **rudderi, Bolivina:** Cushman and Renz Paratype
cell 10 Cushman and Renz, 1941, p. 19
Falcon, Venezuela; Pozon, 18.6 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

6133 **rutschi, Sphaeroidinella:** Cushman and Renz Paratype
cell 4 Cushman and Renz, 1941, p. 25
Falcon, Venezuela; Isidro, 33.5 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

908 **salinasensis, Anomalina:** Kleinpell Holotype
Kleinpell, 1938, p. 347, pl. XIII, figs. 1a-1c
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

918 **salinasensis, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 280, pl. 15, fig. 3
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

854 **salinasensis, Bolivina:** Kleinpell Paratype
Kleinpell, 1938, p. 280, pl. 9, fig. 6
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

6090 **sanctaecrucis, Nodogenerina:** Kleinpell Holotype
Kleinpell, 1938, p. 246, pl. 4, fig. 22
Santa Cruz Co., Calif.; Santa Cruz Mts. SU loc. 1162
Oligocene, Vaqueros Fm

7835 **schencki, Afghanella:** Thompson Holotype
Thompson, 1946, p. 153, pl. 25, fig. 2
Afghanistan; Shibar Pass, ca. 7 km W of summit on Kabul to Bamian road
Permian, Bamian Ls

7836 **schencki, Afghanella:** Thompson Paratypes
7837 Thompson, 1946, p. 153, pl. 25, figs. 1 (type 7836), 4 (type 7838), 5
7838 (type 7837), 7 (type 7839), 8 (type 7840)
7839 Afghanistan; Shibar Pass, ca. 7 km W of Summit on Kabul to Bamian
7840 road
Permian, Bamian Ls

7841 **schencki, Afghanella:** Thompson Paratypes
7842 Thompson, 1946, p. 153, pl. 25, figs. 9 (type 7841), 10 (type 7842),
7843 11 (type 7843), 12 (type 7844)
7844 Afghanistan; Shibar Pass, ca. 7 km W of Summit on Kabul to Bamian
road
Permian, Bamian Ls

7492 **schencki, Bulimina:** Beck Holotype
Beck, 1943, p. 605, pl. 107, figs. 28, 33
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W
Eocene, Cowlitz Fm

6659 **schencki, Elphidium:** Cushman and Dusenbury Holotype
Cushman and Dusenbury, 1934, p. 60, pl. 8, figs. 8a, 8b
San Diego Co., Calif.; La Jolla Qd, Murray Canyon, 1 1/8 miles S 38° W of BM 394 SU loc. 1150
Eocene, Poway Conglomerate

9401 **schencki, Lenticulina:** Martin Holotype
Martin, Lewis, 1964, p. 67, pl. 6, figs. 6a, 6b
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

962 **schencki, Nonion:** Kleinpell Holotype
Kleinpell, 1938, p. 235
Monterey Co., Calif.; diatomite quarry SU loc. 662
Miocene, Monterey Shale

926 **schencki, Nonion:** Kleinpell Paratype
Kleinpell, 1938, p. 235, pl. XVI, figs. 11a, 11b
Monterey Co., Calif.; Reliz Canyon SU loc. 691, sample F_1, 3110′ above Vaqueros Ss
Miocene, Monterey Shale

5025 **schencki, Saracenaria:** Cushman and Hobson Paratype
Cushman and Hobson, 1935, p. 57
Santa Cruz Co., Calif.; Santa Cruz Qd, Bear Creek SU loc. 1102
Oligocene, San Lorenzo Fm

583 **schencki, Textularia:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 8
Channel Islands, off southern California

6091 **semihispida, Buliminella:** Kleinpell Holotype
Kleinpell, 1938, p. 250, pl. 20, figs. 8, 15, 16
Santa Barbara Co., Calif.; near Naples
Miocene, Monterey Shale

6132 cell 22 **senni, Robulus:** Cushman and Renz Paratype
Cushman and Renz, 1941, p. 12
Falcon, Venezuela; Pozon, 18.9 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

6880 **senni, Saracenaria:** Hedberg Paratype
Hedberg, 1937, p. 674
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6133 cell 2 **senni, Siphogenerina:** Cushman and Renz Paratype
Cushman and Renz, 1941, p. 22
Falcon, Venezuela; Isidro, 34.9 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone III)

6673 **sesquistriata, Lagena:** Bagg Holotype
Bagg, 1912, p. 50, pl. 13, figs. 13, 14b
San Pedro, Calif.; Timms Point SU loc. 2024
"Pliocene"

6674 **sesquistriata, Lagena:** Bagg Paratype
Bagg, 1912, p. 50, pl. 13, figs. 12, 14a
San Pedro, Calif.; Timms Point SU loc. 2024
"Pliocene"

6067 **shivelyi, Textularia:** Kleinpell Holotype
Kleinpell, 1938, p. 190, pl. 1, figs. 5, 9
Santa Barbara Co., Calif.; near Gaviota Pass SU loc. 1436
Oligocene, "Sespe" Fm

6132 cell 4 **simplex, Bolivina interjuncta:** Cushman and Renz Paratype
Cushman and Renz, 1941, p. 20
Falcon, Venezuela; Pozon, 21.1 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

7482 **sinuata, Globulina minuta:** Beck Holotype
Beck, 1943, p. 603, pl. 106, fig. 13
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

910 **smileyi, Robulus:** Kleinpell Holotype
Kleinpell, 1938, p. 202, pl. XV, figs. 14a, 14b
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

6658 **smithi, Elphidium:** Cushman and Dusenbury Holotype
Cushman and Dusenbury, 1934, p. 61, pl. 8, figs. 7a, 7b
San Diego Co., Calif.; La Jolla Qd, Murray Canyon, 1 1/8 miles S 38° W of BM 394 SU loc. 1150
Eocene, Poway Conglomerate

6109 **smithi, Siphogenerina:** Kleinpell Holotype
Kleinpell, 1938, p. 304, pl. VI, fig. 1
Santa Barbara Co., Calif.; Elwood Field, Doty well No. 4
Oligocene, Rincon Shale

6110 **smithi, Siphogenerina:** Kleinpell Paratype
Kleinpell, 1938, p. 304, pl. VI, fig. 2
Santa Barbara Co., Calif.; Elwood Field, Doty well No. 4
Oligocene, Temblor Shale

6134 cell 34 **soldadoensis, Discorbis midwayensis:** Cushman and Renz Paratype
Cushman and Renz, 1942, p. 10
Trinidad, B.W.I.; Soldado Rock
Paleocene, Soldado Fm

6134 **soldadoensis, Nonionella:** Cushman and Renz Paratype
cell 38 Cushman and Renz, 1942, p. 7
Trinidad, B.W.I; Soldado Rock
Paleocene, Soldado Fm

7929 **solis, Anomalina:** Nauss Holotype
Nauss, 1947, p. 333, pl. 49, figs. 9a-9c
Alberta, Canada; Imperial Core test No. 82, Legal subdivision 16, Sec. 24, T 56, R 7 W, 4th meridian, depth 420-425'
Upper Cretaceous, Lea Park Shale

7948 **sphaera, Quinqueloculina:** Nauss Holotype
Nauss, 1947, p. 340, pl. 48, figs. 14a-14c
Alberta, Canada; Vermilata Frankview Well No. 1, Legal subdivision 16, Sec. 28, T 50, R 5 W, 4th meridian, 630-640', 220' above base of fm
Upper Cretaceous, Lea Park Shale

588 **spinatum, Elphidium:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 21
Channel Islands off southern California

6952 **spiveyi, Waeringella:** Thompson Syntype
Thompson, 1942, p. 414
SE of Graham, Texas; Herron Bend, Brazos River
Pennsylvanian, Salem School Ls

7946 **sproulei, Miliammina:** Nauss Holotype
Nauss, 1947, p. 339, pl. 48, figs. 13a, 13b
Alberta, Canada; NW Mannville well No. 1, Legal subdivision 1, Sec. 18, T 50, R 8 W, 4th meridian, depth 2152-2162'. Vermillion area
Lower Cretaceous, Mannville Fm, Cummings Mbr

5941 **sproulei, Miliammina:** Nauss Paratype
Nauss, 1947, p. 339
Alberta, Canada; NW Mannville well No. 1, Legal subdivision 1, Sec. 18, T 50, R 8 W, 4th meridian, depth 2152-2162'. Vermillion area
Lower Cretaceous, Mannville Fm, Cummings Mbr

6132 **stainforthi, Nodosaria:** Cushman and Renz Paratype
cell 36 Cushman and Renz, 1941, p. 15
Falcon, Venezuela; Isidro, 33.75 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

759 **striatella, Bolivina advena:** Cushman Paratype
Cushman, 1925c, p. 30
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

6113 **subcasitasensis, Valvulineria casitasensis:** Kleinpell Holotype
Kleinpell, 1938, p. 311, pl. 2, figs. 3, 4, 14
Santa Barbara Co., Calif.; near Gaviota Pass SU loc. 1436
Oligocene, "Sespe" Fm

755 **subfusiformis, Buliminella:** Cushman Paratype
Cushman, 1925c, p. 33
San Luis Obispo Co., Calif.; Sec. 24, T 28 S, R 14 E
Miocene, Monterey Shale

686 **subplana, Virgulina:** Barbat and Johnson Holotype
Barbat and Johnson, 1934, p. 14, pl. 1, fig. 17
Kings Co., Calif.; Associated Oil Co., Whepley No. 1, Kettleman Hills; Coalinga Qd, Sec. 35, T 21 S, R 17 E SU loc. 697
Miocene, lower Reef Ridge Shale

684 **subplana, Virgulina:** Barbat and Johnson Paratype
Barbat and Johnson, 1934, p. 14, pl. 1, fig. 16
Kings Co., Calif.; Coalinga Qd, Sec. 35, T 21 S, R 17 E, Associated Oil Co., Whepley No. 1, Kettleman Hills SU loc. 697
Upper Miocene, lower Reef Ridge Shale

6132 **superba, Marginulina:** Cushman and Renz Paratype
cell 23 Cushman and Renz, 1941, p. 14
Falcon, Venezuela; Pozon, 18.4 km SE of Pueblo Jacura, District Acosta
Miocene, Agua Salada Fm (Zone IV)

6132 **suteri, Bolivina:** Cushman and Renz Paratype
cell 9 Cushman and Renz, 1941, p. 18
Falcon, Venezuela; Tocuyo, 15.7 km E of San Juan de los Cayos, District Acosta
Miocene, Agua Salada Fm (Zone IV)

6132 **suteri, Robulus:** Cushman and Renz Paratype
cell 18 Cushman and Renz, 1941, p. 10
Falcon, Venezuela; Isidro, 33.2 km E of Pueblo Piritu, District Zamura
Miocene, Agua Salada Fm (Zone IV)

7930 **talaria, Anomalina:** Nauss Holotype
Nauss, 1947, p. 334, pl. 48, figs. 11a-11c
Alberta, Canada; Imperial Core Test No. 27, Legal subdivision 1, Sec. 4, T 54, R 8 W, 4th meridian, depth 260-270′
Upper Cretaceous, Lea Park Shale

7930a **talaria, Anomalina:** Nauss Paratype
Nauss, 1947, p. 334, pl. 48, figs. 12a-12c
Alberta, Canada; Imperial Core Test No. 27, Legal subdivision 1, Sec. 4, T 54, R 8 W, 4th meridian, depth 260-270′
Upper Cretaceous, Lea Park Shale

7746 **tanaii, Eponides:** Uchio Paratype
Uchio, 1951b, p. 376, figs. 8a-8c, 9a-9c
Tochigi Prefecture, Japan; in cliff facing Tobu electric R.R., 600 m NW of Momiyama Station
Miocene, Kanuma Fm

6132 **thalmanni, Gaudryina:** Cushman and Renz Paratype
cell 30 Cushman and Renz, 1941, p. 7
Falcon, Venezuela; Pozon, 27 km SE of Pueblo Jacura, District Acosta
Lower Miocene, Agua Salada Fm (Zone II)

6098 **ticensis, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 284, pl. 18, figs. 6, 7
Contra Costa Co., Calif.; San Pablo Creek
Miocene, Tice Shale

7744 **tochigiensis, Rotalia:** Uchio Paratype
Uchio, 1951b, p. 374, pl. 5, figs. 1a-1c
Tochigi Prefecture, Japan; in cliff facing Tobu electric R.R., 600 m NW of Momiyama Station
Miocene, Kanuma Fm

7753 **tomiyensis, Cassidulina:** Uchio Paratype
Uchio, 1951a, p. 40
Chiba-ken, Japan; Tomiya, Takeoka-mura, Kimitsu-gun
Pliocene, Tomiya Fm

5631 **tortuosa, Cassidulina:** Cushman and Hughes Paratype
Cushman and Hughes, 1925, p. 14
San Pedro, Calif.; Timms Point SU loc. 2024
"Pliocene," Timms Point Fm

5628 **translucens, Cassidulina:** Cushman and Hughes Paratype
Cushman and Hughes, 1925, p. 15
Los Angeles Co., Calif.; Palos Verdes Hills, Lomita Quarry SU loc. 1125
Pleistocene, San Pedro Fm

6691 **trilocularia, Polymorphina:** Bagg Holotype
Bagg, 1912, p. 75, pl. 20, figs. 15, 17 (?)
San Pedro, Calif.; Timms Point SU loc. 2024
"Pliocene"

6134 **trinitatensis, Discorbis midwayensis:** Cushman and Renz
cell 35 Paratype
Cushman and Renz, 1942, p. 10
Trinidad, B.W.I.; Soldado Rock
Paleocene, Soldado Fm

6134 **trinitatensis, Gumbelina:** Cushman and Renz Paratype
cell 37 Cushman and Renz, 1942, p. 8
Trinidad, B.W.I.; Soldado Rock
Paleocene, Soldado Fm

9477a **turbinata, Gavelinella:** Martin Holotype
Martin, Lewis, 1964, p. 99, pl. 14, figs. 2a-2c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Moreno Fm

9477b **turbinata, Gavelinella:** Martin Paratype
Martin, Lewis, 1964, p. 99, pl. 14, figs. 3a-3c
Fresno Co., Calif.; Panoche Hills, Sec. 6, T 15 S, R 12 E
Upper Cretaceous, Moreno Fm

589 **turbinata, Rotalia:** Cushman and Valentine Paratype
Cushman and Valentine, 1930, p. 25
Channel Islands off southern California

7638 **turgida, Parafusulina?:** Thompson and Wheeler Syntypes
7639 Thompson and Wheeler, 1946, p. 30, pl. 4, fig. 1, pl. 5, fig. 6 (type
7640 7639); pl. 4, fig. 2 (type 7641); pl. 5, figs. 1 (type 7640), 2 (type
7641 7638)
Shasta Co., Calif.; Redding Qd, crest of ls ridge S of Potter Creek, NE 1/4, SE 1/4 Sec. 23, T 34 N, R 4 W, elev. 1675′ SU loc. 757
Permian, McCloud Fm, middle part

7642 **turgida, Parafusulina?:** Thompson and Wheeler Syntypes
7643 Thompson and Wheeler, 1946, p. 30, pl. 5, figs. 3 (type 7642), 4 (type
7644 7643), 5 (type 7644); pl. 4, fig. 3 (type 7645)
7645 Shasta Co., Calif.; Redding Qd, crest of ls ridge S of Potter Creek,
NE 1/4, SE 1/4 Sec. 23, T 34 N, R 4 W, elev. 1675′ SU loc. 757
Permian, McCloud Fm, middle part

7928 **tyrrelli, Ammobaculites:** Nauss Holotype
Nauss, 1947, pp. 333-334, pl. 48, fig. 2
Alberta, Canada; Dina Omega Well No. 1, Legal subdivision 14, Sec. 9, T 45, R 1 W, 4th meridian, depth 1478-1488′ Vermillion area
Upper Cretaceous, Lloydminster Shale

5940 **tyrrelli, Ammobaculites:** Nauss Paratype
Nauss, 1947, pp. 333-334
Alberta, Canada; Dina Omega Well No. 1, Legal subdivision 14, Sec. 9, T 45, R 1 W, 4th meridian, depth 1478-1488′ Vermillion area
Upper Cretaceous, Lloydminster Shale

7730 **uber, Pseudoschwagerina:** Thompson and Hazzard Holotype
Thompson and Hazzard, 1946, p. 48, pl. 17, fig. 1
San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

7727 **uber, Pseudoschwagerina:** Thompson and Hazzard Paratypes
7728 Thompson and Hazzard, 1946, p. 48, pl. 14, figs. 10 (type 7731), 11
7729 (type 7729); pl. 17, figs. 2 (type 7727), 3 (type 7728)
7731 San Bernardino Co., Calif.; E front, Providence Mts., S of Gilroy
Mine, 1.5 miles N of end of road to Mitchell's Caverns
Permian, Bird Spring Fm

9362 **uvigerinaeformis, Bermudezina:** Martin Holotype
Martin, Lewis, 1964, p. 53, pl. 3, figs. 6a-6c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch
Upper Cretaceous, Moreno Fm
[Missing; no record that specimen was received at SU]

7469 **vaderensis, Frondicularia:** Beck Holotype
Beck, 1943, p. 601, pl. 107, fig. 18
Lewis Co., Wash.; 1.5 miles E of Vader, W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

9496 **validus, Cibicidoides:** Martin Holotype
Martin, Lewis, 1964, p. 107, pl. 16, figs. 5a-5c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

6888 **venezuelana, Globigerina:** Hedberg Paratypes
Hedberg, 1937, p. 681
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6375 **venezuelana, Planularia:** Hedberg Paratype
Hedberg, 1937, p. 670
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6873 **venezuelana, Rzehakina:** Hedberg Paratype
Hedberg, 1937, p. 669
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

6885 **venezuelana, Valvulineria:** Hedberg Paratypes
Hedberg, 1937, p. 678
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

7933 **venusae, Bulimina:** Nauss Holotype
Nauss, 1947, p. 334, pl. 48, fig. 10
Alberta, Canada; Imperial core test no. 7, Legal subdivision 11, Sec. 8, T 51, R 7 W, 4th meridian, depth 125', 15' above base of mbr
Upper Cretaceous, Belly River Fm, Vanesti tongue

7336 **verruculosa, Vaginulinopsis,** Martin Holotype
Martin, Lois, 1943, p. 16, pl. 5, figs. 6a, 6b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7651 **virga, Parafusulina:** Thompson and Wheeler Syntypes
7652 Thompson and Wheeler, 1946, p. 32, pl. 6, figs. 1 (type 7652), 2 (type
7653 7653), 3 (type 7651)
Shasta Co., Calif.; Redding Qd, SW 1/4, SW 1/4 Sec. 2, T 33 N, R 4 W, elev. 1600'
Permian, Nosoni Fm

7654 **virga, Parafusulina:** Thompson and Wheeler Syntypes
7655 Thompson and Wheeler, 1946, p. 32, pl. 9, figs. 1 (type 7654), 2 (type
7656 7655), 3 (type 7656), 4 (type 7657)
7657 Shasta Co., Calif.; Redding Qd, SW 1/4, SW 1/4 Sec. 2, T 33 N, R 4 W, elev. 1600'
Permian, Nosoni Fm

7658 **virga, Parafusulina:** Thompson and Wheeler Syntypes
7659 Thompson and Wheeler, 1946, p. 32, pl. 9, figs. 5 (type 7658), 6 (type
7660 7659), 7 (type 7660)
Shasta Co., Calif.; Redding Qd, SW 1/4, SW 1/4 Sec. 2, T 33 N, R 4 W, elev. 1600'
Permian, Nosoni Fm

7931 **vitta, Bathysiphon:** Nauss Holotype
Nauss, 1947, p. 334, pl. 48, fig. 4
Alberta, Canada; Imperial Core Test No. 83, Legal subdivision 4, Sec. 4, T 56, R 5 W, 4th meridian, depth 265-270′, about 270′ above base of fm
Upper Cretaceous, Lea Park Shale

6876 **wallacei, Marginulina:** Hedberg Paratype
Hedberg, 1937, p. 670
Anzoategui, Venezuela; District Libertad
Oligocene, Carapita Fm

7444 **washingtonensis, Lenticulina:** Beck Holotype
Beck, 1943, p. 597, pl. 104, figs. 18, 21
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7489 **washingtonensis, Robertina:** Beck Holotype
Beck, 1943, p. 604, pl. 107, figs. 17, 19
Lewis Co., Wash.; 1.5 miles E of Vader on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

7390 **watsonae, Lagena:** Martin Holotype
Martin, Lois, 1943, p. 18, pl. 15, figs. 7a, 7b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7436 **weaveri, Robulus:** Beck Holotype
Beck, 1943, p. 595, pl. 103, figs. 3, 8
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

9493 **whitei, Anomalina:** Martin Holotype
Martin, Lewis, 1964, p. 106, pl. 16, figs. 4a-4c
Fresno Co., Calif.; Panoche Hills, Moreno Gulch, 4 miles SE of Little Panoche Creek
Upper Cretaceous, Panoche Fm

7394 **whitei, Bulimina:** Martin Holotype
Martin, Lois, 1943, p. 20, pl. 6, figs. 5a, 5b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7412 **whitei, Cibicides:** Martin Holotype
Martin, Lois, 1943, p. 32, pl. 8, figs. 4a-4c
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7391 **whitei, Plectofrondicularia:** Martin Holotype
Martin, Lois, 1943, p. 19, pl. 5, figs. 2a, 2b
Fresno Co., Calif.; Lodo Gulch, Panoche Qd [Tumey Hills Qd] SU loc. M-74
Eocene, Lodo Fm

7425 **whitei, Quinqueloculina:** Beck Holotype
Beck, 1943, p. 593, pl. 99, figs. 11, 12, 13
Lewis Co., Wash.; 1.5 miles E of Vader, on W bank of Cowlitz River, E 1/2, SE 1/4 Sec. 28, T 11 N, R 2 W SU loc. M-335
Eocene, Cowlitz Fm

6854 **whitei, Siphogenerinoides:** Church Paratypes
Church, 1941, p. 182
Fresno Co., Calif.; Panoche Hills, near center of Sec. 6, T 15 S, R 12 E
Upper Cretaceous, Moreno Shale

944 **williami, Cassidulina:** Kleinpell Holotype
Kleinpell, 1938, p. 337, pl. XIV, fig. 5
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

678 **williami, Valvulineria:** Kleinpell Holotype
Kleinpell, 1938, p. 315, pl. VII, figs. 14a-14c
Monterey Co., Calif.; Reliz Canyon SU loc. 691
Miocene, Salinas Shale

9937 **yabei, Parafusulina:** Hanzawa Paratypes
Hanzawa, 1942, p. 127-128
Ago-gun, Totigi Prefecture, Japan; Tomuro, Miyosi-mura
Permian

6099 **yneziana, Bolivina:** Kleinpell Holotype
Kleinpell, 1938, p. 286, pl. 2, fig. 8
Santa Barbara Co., Calif.; near Gaviota Pass SU loc. 1436
Oligocene, "Sespe" Fm

6087 **ynezianum, Nonion:** Kleinpell Holotype
Kleinpell, 1938, p. 237, pl. II, figs. 1, 2
Santa Barbara Co., Calif.; near Gaviota Pass
Oligocene, "Sespe" Fm

COELENTERATA

7553 **browni, Astrangia:** Palmer Paratype
Palmer, 1928b, p. 27
Oaxaca, Mexico; 4 miles W of Puerto Angel

8524 **confluens, Heliophyllum obconicum:** Fenton and Fenton Plastoholotype
Fenton and Fenton, 1938, p. 221, pl. 21, fig. 1
New York, near East Bethany
Devonian, Moscow Fm [holotype 37765 from Walker Museum, now probably in the Field Museum Nat. Hist., Chicago]

8522 **decorosum, Heliophyllum:** Fenton and Fenton Plastoholotype
Fenton and Fenton, 1938, p. 216, pl. 18, figs. 7, 8
Leicester, N.Y.; Little Beard Creek
Devonian, Moscow Fm [cast from Carnegie Museum sections 6754, 6755]

7374 **fresnoense, Flabellum:** Durham Holotype
Durham, 1943, p. 197, pl. 32, figs. 2, 3
Fresno Co., Calif.; SU loc. M-49, Cheney Well No. 1, 5800′
Upper Cretaceous

6767 **hannibali, Coenocyathus?:** Durham Holotype
Durham, 1942, p. 93, pl. 17, fig. 14, text fig. 1
Mason Co., Wash.; NP loc. 207, T 21 N, R 5 W; bluffs on Vance's Ck 2.5 miles above jct. with Skokomish River, 13 miles above Union City
Lower Oligocene

5210 **hannibali, Dendrophyllia:** Nomland Syntype
Nomland, 1916a, p. 67, pl. 6, figs. 1, 2
Grays Harbor Co., Wash.; NP loc. 51, bluffs at old log dam on Porter Ck, 1.5 miles above Porter
Oligocene, Lincoln Fm

5211 **hannibali, Dendrophyllia:** Nomland Syntype
Nomland, 1916a, p. 67, pl. 6, fig. 3
Grays Harbor Co., Wash.; NP loc. 51, bluffs at old log dam on Porter Ck, 1.5 miles above Porter
Oligocene, Lincoln Fm

362 **hyatti, Astrocoenia:** Wells Paratype
Wells, 1942, p. 1
Wyoming; 3 miles W of Cody, bank of Shoshone River
Jurassic, Sundance Fm

9505a **hypatiae, Multithecopora:** Wilson Paratype
Wilson, 1963, p. 158, pl. 21, figs. 3, 4; pl. 22, figs. 1-3, 7
White Pine Co., Nevada; near Lund. SU loc. 3474
Middle Pennsylvanian, Ely Fm

7554 **mexicana, Cycloseris:** Durham Paratypes
Durham, 1947, p. 24
Gulf of California; Amortajada Bay, in La Paz Bay, Carmen Island

5905 **oldroydi, Dendrophyllia:** Oldroyd ex Faustino MS Syntype
Oldroyd, I. S., 1925, pl. 49, fig. 7 (part of the type colony). Described by Faustino, 1931, pp. 286-287, pl. 1
Sunken Valley, Calif.; between San Pedro and Redondo, 200 fms

7556 **palmata, Pocillopora:** Palmer Syntype
Palmer, 1928b, p. 31, pl. 2, fig. 3; pl. 3, fig. 1
Oaxaca, Mexico; Puerto Angel harbor

7954 **quaylei, Cyathoceras:** Durham Paratype
Durham, 1947, p. 32
Monterey Co., Calif.; off Point Sur, 160 fms

221 **radcliffi, Sidastrea:** Faustino Holotype
Faustino, 1931, p. 285, pl. 1, fig. 1
Ventura Co., Calif.; Camulos Qd, near Simi Peak
Lower Eocene, Martinez Fm [Paleocene]

8523 **teres, Heliophyllum obconicum:** Fenton and Fenton Plastoholotype
Fenton and Fenton, 1938, p. 222, pl. 19, fig. 6
Western N.Y., near Le Roy
Devonian, Moscow Fm [cast of 2 sections, Carnegie Museum Nos. 6868, 6864]

6765 **townsendensis, Trochocyathus:** Durham Holotype
Durham, 1942, p. 90, pl. 15, fig. 6
Jefferson Co., Wash.; NP loc. 148, sea cliffs .25 miles N of old Woodman Wharf, Port Discovery; NE 1/4 Sec. 8, T 29 N, R 1 W
Lower Oligocene, Quimper

6546 **whitei, Deltocyathus:** Durham Holotype
Durham, 1943, p. 200, pl. 32, figs. 13, 16, text fig. 1
Fresno Co., Calif.; SU loc. 2073, Tumey Hills Qd, jct of Silver and Panoche Creeks
Paleocene, Lodo Fm

PORIFERA

9860 **astoma, Polytholosia:** Seilacher Holotype
Seilacher, 1962, p. 758, pl. 3, figs. 1, 2
Cedar Mts., Nevada
Triassic, Luning Fm., Karnic

9860a **astoma, Polytholosia:** Seilacher Paratype
Seilacher, 1962, p. 758, pl. 3, figs. 3, 4, 5
Cedar Mts., Nevada
Triassic, Luning Fm., Karnic

9863 **cylindrica, Polytholosia cylindrica:** Seilacher Holotype
Seilacher, 1962, p. 758, 764, pl. 5, fig. 1
Mineral Co., Nevada; Dunlap Canyon, Pilot Mts.
Triassic, lower Luning Fm, Karnic

9864 **cylindrica, Polytholosia cylindrica:** Seilacher Paratypes
Seilacher, 1962, p. 758, 764, pl. 5, figs. 2-5; pl. 6, fig. 1
Mineral Co., Nevada; Dunlap Canyon, Pilot Mts.
Triassic, lower Luning Fm, Karnic

6756 **ellipticus, Receptaculites:** Walcott Plastoholotype
Walcott, 1884, p. 67, pl. 11, fig. 12
Eureka district, Nevada; Goodwin Canyon, White Mt.
Ordovician, Pogonip Fm [holotype USNM 24548]
6755 **elongatus, Receptaculites:** Walcott Plastoholotype
Walcott, 1884, p. 66
White Pine district, Nevada; Treasure City
Ordovician, Pogonip Fm [holotype USNM 24635]
9865 **expansum, Ascosymplegma:** Seilacher Holotype
Seilacher, 1962, p. 759, 768, pl. 8, figs. 2, 3, 4
Mineral Co., Nevada; Cinnabar Canyon, near Mina
Triassic, Luning, Karnic
9865a **expansum, Ascosymplegma:** Seilacher Paratype
Seilacher, 1962, p. 759, 768, pl. 8, fig. 1
Mineral Co., Nevada; Cinnabar Canyon, near Mina
Triassic, Luning, Karnic
6754 **mammillaris, Receptaculites:** Walcott Plastoholotype
Walcott, 1884, p. 65, pl. 11, fig. 11
Eureka district, Nevada; Goodwin Canyon, White Mt.
Ordovician, upper Pogonip Fm [holotype USNM 24636]
9861 **polystoma, Polytholosia:** Seilacher Holotype
Seilacher, 1962, p. 758, 762, pl. 4, fig. 1
Augusta Mt., Nevada
Triassic, Karnic, Winnemucca Fm
9862 **polystoma, Polytholosia:** Seilacher Paratypes
Seilacher, 1962, p. 758, 762, pl. 4, figs. 2, 4, 5
Augusta Mt., Nevada
Triassic, Karnic, Winnemucca Fm

ECHINODERMATA

7795 **alaskense, Echinarachnius:** Durham Plastoholotype
Durham, 1957, p. 628, pl. 72, figs. 6, 8
Lituya Bay, Alaska; SE shore Cenotaph Island
Pliocene [holotype USNM 562073 *fide* Durham]
409 **arnoldi, Actinocrinus:** Wachsmuth and Springer Holotype
Wachsmuth and Springer, 1890, p. 168, pl. 17, fig. 10
Marshall Co., Iowa; Le Grand
Lower Carboniferous, Kinderhook group [crinoid]
8329 **bahiaensis, Orthopsis:** Machado-Brito Paratype
Machado-Brito, 1964, p. 6, pl. 2, fig. 1
Bahia, Brazil; Boipeba Island, Camamu area
Cretaceous, Algodones Fm
5170 **blancoensis, Scutella:** Kew Syntype
Kew, 1920, p. 64, pl. 11, figs. 1b, 1c
Cape Blanco, Ore.; SU loc. NP 26
Oligocene, "San Lorenzo" Fm
5171 **blancoensis, Scutella:** Kew Syntype
Kew, 1920, p. 64, pl. 11, fig. 1a
Cape Blanco, Ore.; SU loc. NP 26
Oligocene, "San Lorenzo" Fm
5411 **branneri, Cidaris:** Arnold Holotype
Arnold, 1908a, p. 363, pl. 33, fig. 5
Santa Cruz Co., Calif.; Bear Creek, 4 miles above San Lorenzo River
Oligocene, San Lorenzo Fm [Arnold's No. 1056]

7370 **inezana, Encope grandis:** Durham Paratype
Durham, 1950, p. 45
Baja California, Mexico; Santa Inez Point, 10 miles N of Mulege SU loc. 805
Pleistocene

579 **lovenioides, Megapetalus:** Clark Holotype
Clark, 1929, p. 260, pl. 31, figs. 1-6
Ventura Co., Calif.; Santa Paula Qd, E of Coche Canyon on divide between Coche and Sulphur Canyons, 75 yds W of Crest and on top of lateral ridge SU loc. 667
Upper Miocene, Santa Margarita Fm?

389 **lymani, Amphiura:** Waring Holotype
Waring, 1917, p. 58, pl. 9, fig. 13
Ventura Co., Calif.; Chico area, Bell's Canyon, N of Simi fault
Upper Cretaceous, "Chico" Fm

5393 **merriami, Cidaris:** Arnold Plastoholotype
Arnold, 1908a, p. 359, pl. 32, fig. 8
San Mateo Co., Calif.; between headwaters of San Lorenzo River and Pescadero Creek, SE 1/4 Sec. 23, T 8 S, R 3 W, just W of Santa Cruz Co. line
"Eocene" [Oligocene or Miocene, *fide* Keen and Bentson, 1944, p. 231] [holotype USNM 165438]

5388 **merriami, Cidaris:** Arnold Paratypes
5389 Arnold, 1908a, p. 359
5390 San Mateo Co., Calif.; between headwaters of San Lorenzo River and
5391 Pescadero Creek, SE 1/4 Sec. 23, T 8 S, R 3 W
5392 "Eocene" [Oligocene or Miocene, *fide* Keen and Bentson, 1944, p. 231]

5164 **newcombei, Scutella:** Kew Holotype
Kew, 1920, p. 73, pl. 8, figs. 2a, 2b
Vancouver Island, British Columbia, Canada; Jordan River, 1/2 mile E of Slide Hill Telegraph Station SU loc. NP 131
Oligocene, Sooke Fm

7809 **newcombei, Scutella:** Kew Paratype
Kew, 1920, p. 73
Vancouver Island, British Columbia, Canada; Jordan River, 1/2 mile E of Slide Hill Telegraph Station SU loc. NP 131
Oligocene, Sooke Fm

7952 **nipponicus, Astrodapsis:** Nisiyama Paratypes
Nisiyama, 1948, p. 602
Iwate-ken, Japan; Ninohe-gun, 150 m E of bridge of Kita-Fukuoka
Mio-Pliocene, Suenomatsuyama Fm

7762 **nobilis, Megistocrinus:** Wachsmuth and Springer Plastoholotype
Wachsmuth and Springer, 1890, p. 169, pl. 16, fig. 6
Le Grand, Iowa
Mississippian, Kinderhook group

10271 **perrini, Scutella:** Weaver Holotype
Weaver, 1908, p. 273, pl. 22, fig. 2
Fresno Co., Calif.; vicinity of Coalinga
"Miocene" [probably Pliocene]

5373 **sanctaecrucis, Amphiura:** Arnold Holotype
Arnold, 1908b, p. 404, pl. 40, figs. 1, 2. Also in Arnold, 1909, illus. 2, fig. 59
Santa Cruz Co., Calif.; 6 miles NNE of Santa Cruz, hills immediately SE of Scott Valley
Upper Miocene, upper Santa Margarita Fm [Arnold's No. 1078]

57 **semigibbosus, Dendraster (Calaster) oregonensis:** Howe Holotype
Howe, 1922, p. 102, pl. 7, fig. 3
Cape Blanco, Ore. SU loc. NP 27
Pliocene, Empire Fm

7371 **sverdrupi, Encope:** Durham Paratype
Durham, 1950, p. 48
Baja California, Mexico; Santa Inez Point, 10 miles N of Mulege
SU loc. 805
Pliocene

482 **tapinus, Spatangus:** Schenck Paratype
Schenck, 1928, p. 198, pl. 24, fig. 2
Ventura Co., Calif.; Santa Paula Qd, Timber Canyon SU loc. 277
Upper Eocene, Tejon Fm

CHORDATA

5118 **californicus, Desmostylus:** Hay Holotype
Hay, 1923, p. 106. Illustrated *in* Hannibal, 1922, pp. 238-240, pl. 12, figs. 8, 9
San Jose Qd, Calif.; between Monument Peak and Milpitas-Calaveras Rd
Miocene, San Pablo Fm [type includes fragments and worn second or third molar]

5119 **californicus, Desmostylus:** Hay Paratype
Hay, 1923, p. 106, Illustrated *in* Hannibal, 1922, pp. 238-240, pl. 12, fig. 7
San Jose Qd, Calif.; between Monument Peak and Milpitas-Calaveras Rd
Miocene, San Pablo Fm

5120 **californicus, Desmostylus:** Hay Paratypes
5121 Hay, 1923, p. 106
5122 San Jose Qd, Calif.; between Monument Peak and Milpitas-Calaveras
5123 Rd
Miocene, San Pablo Fm

2 **morani, Zalophancylus:** Hannibal Holotype
Hannibal, 1912b, p. 152, pl. 6, fig. 15. Also *in* Hanna, 1925, p. 18-19
Bad Land Hills, Ore.; 1 mile E of Sand Hollow
Pliocene, Idaho Lake beds [originally described as a mollusk, recognized as a fish vertebra by Hanna, 1925]

5878 **nevadanus, Helicoprion:** Wheeler Plastoholotype
Wheeler, 1939, p. 109, fig. 3
Lovelock Qd, Nevada; SE 1/4, SW 1/4 Sec. 16, T 28 N, R 34 E
Anthracolithic [late Paleozoic] Rochester Fm [holotype 1001 Univ. Nevada MacKay Mus. Paleontol.]

6005 **pacificus, Shastasaurus:** Merriam Syntype
Merriam, 1895, p. 57, fig. 1. Also *in* Merriam, 1902, p. 102, pl. 14, fig. 1
Shasta Co., Calif.
Triassic

6006 **pacificus, Shastasaurus:** Merriam Syntype
Merriam, 1895, p. 57, fig. 2. Also *in* Merriam, 1908, p 143, pl. 17, fig. 3
Shasta Co., Calif.
Triassic

6006a **pacificus, Shastasaurus:** Merriam Syntype
Merriam, 1895, p. 57
Shasta Co., Calif.
Triassic

5546 **perrini, Thalattosaurus:** Merriam Holotype
Merriam, 1905, p. 36, pl. 4, fig. 3; pl. 7, fig. 6
Shasta Co., Calif.; Smith Cove, near Squaw Creek
Triassic, Hosselkus Ls

5547 **perrini, Thalattosaurus:** Merriam Syntype
Merriam, 1905, p 36, pl. 5, fig. 3
Shasta Co., Calif.; Smith Cove, near Squaw Creek
Triassic, Hosselkus Ls
5879 **sierrensis, Helicoprion:** Wheeler Plastoholotype
Wheeler, 1939, p. 112, fig. 4
Plumas Co., Calif.; Downieville Qd, SE 1/4, SE 1/4 Sec. 22, T 22 N, R 12 E
Anthracolithic [late Paleozoic] [holotype 1002 Univ. Nevada Mackay Mus. Paleontol.]

PLANTS; ORGANIC AND SILICEOUS MICROFOSSILS

9939 **californicum, Plataninium:** Page Holotype
Page, 1968, p. 169-170, figs. 4-6
Stanislaus Co, Calif.; Patterson 7 1/2′ Qd, Black Gulch, NE 1/4, SE 1/4 Sec. 32, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]
9944 **caudatum, Tunisphaeridium:** Deunff and Evitt Paratypes (4)
Deunff and Evitt, 1968, p. 4, pl. 2, fig. 4 (R 21.5, + 8.6); fig. 8 (R 12.8, + 8.2); figs 10, 11 (R 1.6, + 7.2); fig. 13 (R 16.6, + 9.6)
Rochester, New York; gorge of Genesee River
Middle Silurian Clinton group, Maplewood Shale [acritarch]
9945 **caudatum, Tunisphaeridium:** Deunff and Evitt Paratypes (2)
Deunff and Evitt, 1968, p. 4, pl. 2, fig. 6 (R 25.9, + 4.9); fig. 7 (R 25.3, + 12.9)
Rochester, New York; gorge of Genesee River
Middle Silurian, Clinton group, Maplewood Shale [acritarch]
9948 **caudatum, Tunisphaeridium:** Deunff and Evitt Paratypes (3)
Deunff and Evitt, 1968, p. 4, pl. 2, fig. 2 (R 17.3, + 8.8); fig. 12 (R 25.6, + 5.8); fig. 14 (R 19.2, + 16.3)
Rochester, New York; gorge of Genesee River
Middle Silurian, Clinton group, Maplewood Shale [acritarch]
9998 **cocculoides, Lardizabaloxylon:** Page Holotype
Page, 1970, p. 1139, figs. 1, 2, 8
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Black Gulch, NE 1/4, SE 1/4 Sec. 32, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]
9944 **concentricum, Tunisphaeridium:** Deunff and Evitt Paratype
Deunff and Evitt, 1968, p. 3, pl. 1, fig. 7 (R 11.7, + 7.8)
Rochester, New York; gorge of Genesee River
Middle Silurian, Clinton group, Maplewood Shale [acritarch]
9948 **concentricum, Tunisphaeridium:** Deunff and Evitt Paratypes (7)
Deunff and Evitt, 1968, p. 3, pl. 1, fig. 3 (R 6.1, + 11.9); figs. 4, 10 (R 11.5, + 3.0); fig. 5 (R 24.3, + 3.1); fig. 8 (R 5.9, + 2.3); fig. 9 (R 24.0, + 7.9); fig. 11 (L 6.3, + 6.7); fig. 12 (R 7.0, + 4.5)
Rochester, New York; gorge of Genesee River
Middle Silurian, Clinton group, Maplewood Shale [acritarch]
10100 **cretacea, Margariella:** Page Paratype
Page, 1973, pp. 572-574, figs. 11, 13
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Del Puerto Canyon, SE 1/4, SW 1/4 Sec. 20, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [conifer]
10077 **cretacea, Margariella:** Page Holotype
Page, 1973, pp. 572-574, figs. 1-9, 15
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Del Puerto Canyon, SE 1/4, SW 1/4 Sec. 20, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [conifer]

10000 **cretacea, Riboidoxylon:** Page Holotype
Page, 1970, pp. 1141-1142, figs. 7, 9-11
Stanislaus Co., Calif.; Patterson 7 1/2' Qd, Del Puerto Canyon, SE 1/4, SW 1/4 Sec. 20, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]

10001 **eupomatioides, Mulleroxylon:** Page Holotype
Page, 1970, p. 1143, figs. 12-14
Stanislaus Co., Calif.; Patterson 7 1/2' Qd, Black Gulch, NE 1/4, SE 1/4 Sec. 32, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]

10079 **exilimurum, Inversidinium:** McLean Holotype
McLean, D., 1973, p. 730, pl. 90, figs. 1, 2 (R 26.0, + 12.5), slide CV 53
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 22' 15" N, 77° 17' 50" W, bluffs along S bank of Aquia Creek, 1/2 mile SE of Md.-Va. Monument No. 37
Upper Paleocene, Aquia Fm, type section [dinoflagellate]

10080 **exilimurum, Inversidinium:** McLean Paratype
McLean, D., 1973, p. 730, pl. 90, figs. 3, 6 (R 14.2, + 4.3) Slide CV 18
Prince Georges Co., Md.; Anacostia, Md.-D.C. Qd, 38° 45' 10" N, 76° 59' 15" W, 1/2 mile W of Friendly, Md
Upper Paleocene, Aquia Fm

10081 **exilimurum, Inversidinium:** McLean Paratype
McLean, D., 1973, p. 730, pl. 90, figs. 4, 5 (R 19.0, + 12.0) Slide CV 75
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 22' 15" N, 77° 17' 50" W, bluffs along S bank Aquia Creek, ca. 1/2 mile SE of Md.-Va. Monument No. 37
Upper Paleocene, Aquia Fm, type section [dinoflagellate]

10082 **exilimurum, Inversidinium:** McLean Paratype
McLean, D., 1973, p. 730, pl. 90, figs. 7-9 (R 24.3, + 1.5) Slide CV 87
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 22' 15" N, 77° 17' 50" W, bluffs along S bank Aquia Creek, ca. 1/2 mile SE of Md.-Va. Monument No. 37
Upper Paleocene, Aquia Fm, type section [dinoflagellate]

8360 **hannae, Cyclotella:** Kanaya Holotype
Kanaya, 1957, p. 82, pl. 3, fig. 10
Contra Costa Co., Calif.; Byron Qd, 2.8 miles W of town of Byron SU loc. M-611.7
Eocene, Kellogg Shale [diatom]

8361 **hannae, Cyclotella:** Kanaya Paratype
Kanaya, 1957, p. 82, pl. 3, fig. 11
Contra Costa Co., Calif.; Byron Qd, 2.8 miles W of town of Byron SU loc. M-611.7
Eocene, Kellogg Shale [diatom]

8362 **hannae, Cyclotella:** Kanaya Paratype
Kanaya, 1957, p. 82, pl. 3, fig. 12
Contra Costa Co., Calif.; Byron Qd, 2.8 miles W of town of Byron SU loc. M-611.7
Eocene, Kellogg Shale [diatom]

8363 **hannae, Cyclotella:** Kanaya Paratype
Kanaya, 1957, p. 82, pl. 3, fig. 13
Contra Costa Co., Calif.; Byron Qd, 2.8 miles W of town of Byron SU loc. M-611.7
Eocene, Kellogg Shale [diatom]

7904.2 **keenae, Permopora:** Elias Holotype
Elias, 1947, pp. 53-54, pl. 18, figs. 1, 11
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7905 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54
Cottle Co., Texas; NW cor. Buckle L Ranch, NW cor. Sec. 655, 6 miles S, 4 miles W of Childress
Late Permian, Childress Dolomite [plant fragments]

7906 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54
Cottle Co., Texas; SW cor. Buckle L Ranch, SW cor. Sec. 661, 13 miles S, 4 miles W of Childress
Late Permian, Childress Dolomite [plant fragments]

7904.3 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54, pl. 18, figs. 5, 8, 9
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7904.4 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54, pl. 18, figs. 8, 10
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7904.5 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54, pl. 18, fig. 6
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7904.6 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54, pl. 18, figs. 1, 3
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7904.7 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54, pl. 18, figs. 1, 2, 4
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7904.11 **keenae, Permopora:** Elias Paratype
Elias, 1947, pp. 53-54, pl. 18, fig. 7
Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

7904.1 **keenae, Permopora:** Elias Paratypes
7904.8 Elias, 1947, pp. 53-54
7904.9 Childress Co., Texas; ca. 2.5 miles N 60° E of Childress, NW 1/4
7904.10 Sec. 325, 200 yds. NE of No. 1 G. R. Cooper Well
Late Permian, Childress Dolomite [plant fragments]

5057 **keenani, Archaeolithothamnium:** Howe Holotype
Howe, 1934, p. 513, pl. 54, fig. A. Also in Keenan, 1932, pl. 4, fig. 5
Santa Barbara Co., Calif.; Santa Ynez Qd, just NW of right angle in stream on W bank of E fork Cachuma Creek, T 3 N, R 28 W. 4/5 miles W, 3/5 miles S of intersection of 34° 40′ N, 119° 50′ W SU loc. 1106
Eocene, Sierra Blanca Ls [marine alga]

806 **Lacuma** sp.: Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 92, pl. 35, fig. 1
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

5637 **laminosum, Lithothamnium:** Howe Holotype
Howe, 1934, p. 513, pl. 55, fig. A
Santa Barbara Co., Calif.; Santa Ynez Qd, Indian Creek, at its intersection with ls beds 4 miles S of Big Pine Mt. SU loc. 930
Eocene, Sierra Blanca Ls [marine alga]

10073 **mentitum, Hystrichokolpoma:** McLean Holotype
McLean, D., 1974, p. 67, pl. 8, figs. 1-5 (R 4.0, + 11.4) Slide CV 25
Prince Georges Co., Md.; Anacostia, Md.-D.C. Qd, 38° 45′ 10″ N, 76° 59′ 15″ W, 1/2 mile W of Friendly, Md.
Upper Paleocene, Aquia Fm [dinoflagellate]

8425 **nevadensis, Lyonothamnoxylon:** Page Holotype
5567 Page, 1964, pp. 257-266, 10 figs.
Esmeralda Co., Nevada; David Mt. Qd, Fish Lake Valley, 3/4 mile S of hill 6061, T 1 N, R 35 E
Lower Pliocene [5567 is matrix from which holotype came]

810 **oregona, Ilex:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 80, pl. 22, fig. 5
Lane Co., Ore.; 9 miles S of Goshen, E side Pacific Highway SU loc. 36
Eocene-Oligocene, Goshen Fm

807 **oregona, Symplocos:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 93, pl. 37, fig. 5
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

805 **oregona, Tetracera:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 87, pl. 31, fig. 5
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

809 **oregona, Tetracera:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 87, pl. 31, fig. 7
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

9999 **ostryopsoides: Carpinoxylon:** Page Holotype
Page, 1970, p. 1139-1141, figs. 3-6
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Black Gulch, NE 1/4, SE 1/4 Sec. 32, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]

811 **ovalis, Siparuna:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 71, pl. 15, fig. 4
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

804 **ovoidea, Ocotea:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 75, pl. 20, fig. 3
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

808 **ovoidea, Ocotea:** Chaney and Sanborn Paratype
Chaney and Sanborn, 1933, p. 75, pl. 20, fig. 1
Lane Co., Ore.; 9 miles S of Goshen SU loc. 36
Eocene-Oligocene, Goshen Fm

10002 **panochensis, Magnolioxylon:** Page Holotype
Page, 1970, p. 1143, figs. 15-17
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Black Gulch, NE 1/4, SE 1/4 Sec. 32, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]

6855 **panochetris, Tetracentronites:** Page Holotype
Page, 1968, pp. 170-172, figs. 7-9
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Del Puerto Canyon, SE 1/4, SW 1/4 Sec. 20, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm [angiosperm wood]

9948 **parvum, Tunisphaeridium:** Deunff and Evitt Holotype
Deunff and Evitt, 1968, p. 3, pl. 2, fig. 15 (R 5.3, + 10.7); pl. 2, fig. 18 (L 1.9, + 12.1)
Rochester, New York; gorge of Genesee River
Middle Silurian, Clinton group, Maplewood Shale [acritarch]

9938 **platanoides, Plataninium:** Page Holotype
Page, 1968, pp. 168-169, figs. 1-3
Stanislaus Co., Calif.; Patterson 7 1/2′ Qd, Black Gulch, NE 1/4, SE 1/4 Sec. 32, T 5 S, R 7 E
Upper Cretaceous, Panoche Fm

5635 **schenckii, Mesophyllum:** Howe Holotype
Howe, 1934, p. 512, pl. 52, fig. E
Santa Barbara Co., Calif.; Santa Ynez Qd, where Indian Creek intersects ls beds 4 miles S of Big Pine Mt. SU loc. 930
Eocene, Sierra Blanca Ls

5639 **schenckii, Mesophyllum:** Howe Paratype
Howe, 1934, p. 512, pl. 52, figs. A, B
Santa Barbara Co., Calif.; Santa Ynez Qd, where Indian Creek intersects ls beds 4 miles S of Big Pine Mt. SU loc. 930
Eocene, Sierra Blanca Ls

5641 **schenckii, Mesophyllum:** Howe Paratype
Howe, 1934, p. 512, pl. 52, fig. C
Santa Barbara Co., Calif.; Santa Ynez Qd, where Indian Creek intersects ls beds 4 miles S of Big Pine Mt. SU loc. 930
Eocene, Sierra Blanca Ls

10055 **septatum, Cladopyxidium:** McLean Holotype
McLean, D., 1972, p. 862, pl. 1, figs. 5-8 (R 18.2, + 9.9) Slide CV 83
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 22′ 15″ N, 77° 17′ 50″ W
Upper Paleocene, Aquia Fm, type section [dinoflagellate]

10052 **septatum, Cladopyxidium:** McLean Paratype
McLean, D., 1972, p. 862, pl. 1, fig. 11(R 29.3, + 2.7) Slide CV 28
Prince Georges Co., Md.; Anacostia, Md.-D.C. Qd, 38° 45′ 10″ N, 76° 59′ 15″ W, 1/2 mile W of Friendly, Md.
Upper Paleocene, Aquia Fm [dinoflagellate]

10053 **septatum, Cladopyxidium:** McLean Paratype
McLean, D., 1972, p. 862, pl. 1, fig. 12 (R 19.2, + 2.0) Slide CV 41
Prince Georges Co., Md.; Anacostia, Md.-D.C. Qd, 38° 45′ 10″ N, 76° 59′ 15″ W, 1/2 mile W of Friendly, Md.
Upper Paleocene, Aquia Fm, lowermost part

10054 **septatum, Cladopyxidium:** McLean Paratype
McLean, D., 1972, p. 862, pl. 1, figs. 1-3 (R 27.1, + 1.0) Slide CV 42
Prince Georges Co., Md.; Anacostia, Md.-D.C. Qd, 38° 45′ 10″ N, 76° 59′ 15″ W, 1/2 mile W of Friendly, Md.
Upper Paleocene, Aquia Fm, lowermost part

5638 **sierrablancae, Lithophyllum:** Howe Holotype
Howe, 1934, p. 514, pl. 56, fig. A, as *sierra-blancae*
Santa Barbara Co., Calif.; Santa Ynez Qd, where Indian Creek intersects ls beds 4 miles S of Big Pine Mt. SU loc. 930
Eocene, Sierra Blanca Ls [marine alga]

122 **steamboatea, Nilsonia:** Reagan Holotype
Reagan, 1925, p. 141, fig. 1c
18 miles W of Ganado, Arizona; Steamboat Canyon
Cretaceous, Dakota Ss [leaf]

10075 **tumescens, Hystrichokolpoma:** McLean Holotype
McLean, 1974, p. 66, pl. 8, figs. 7, 8 (R 12.5, + 4.7) Slide CW 14
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 22′ 15″ N, 77° 17′ 50″ W, bluffs along S bank Aquia Creek, ca. 1/2 mile SE of Md.-Va. Monument No. 37
Upper Paleocene, Aquia Fm, type section [dinoflagellate]

10074 **tumescens, Hystrichokolpoma:** McLean Paratype
McLean, D., 1974, p. 66, pl. 8, fig. 6 (R 21.7, + 16.4) Slide CW 50
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 22′ 15″ N, 77° 17′ 50″ W, bluffs along S bank Aquia Creek, ca. 1/2 mile SE of Md.-Va. Monument No. 37
Upper Paleocene, Aquia Fm, type section [dinoflagellate]

10076 **tumescens, Hystrichokolpoma:** McLean Paratype
McLean, D., 1974, p. 66, pl. 8, fig. 9 (R 3.7, + 8.7) Slide CW 63
Stafford Co., Va.; Passapatanzy, Va.-Md. Qd, 38° 20′ 35″ N, 77° 17′ 17″ W, bluffs along S bank Potomac Creek, from .05-.15 mile W of Md.-Va. Monument No. 35
Upper Paleocene, Aquia Fm [dinoflagellate]

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