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Living and Fossil Macrocyprididae (Ostracoda)

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Now, clearly if we are going to get sense into the classification of ostracods we must use both the characters of the carapace and the characters of the soft parts, and the mystery lying behind classification must always be which characters are evolving and which are remaining static in the phylogeny; we need to know which are the conservative characters, the ones which mark common ancestry, and which characters are evolving quickly and therefore adapting themselves to environment and likely to produce convergences. Now as far as I can make out, there is not one character in the ostracods which does not sometimes behave in one way and sometimes in the other. You cannot lay down general rules of what is important in classification and what is not.

Peter C. Sylvester-Bradley, 1969, p. 245

LIVING AND FOSSIL MACROCYPRIDIDAE (OSTRACODA)

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ABSTRACT

This comprehensive taxonomic revision of the family Macrocyprididae is based on the analysis of 138 species, of which 123 are living and 15 are fossil. Thirty-six previously named species are redescribed from type and additional specimens, 54 new species are named, and 48 additional species are described in open nomenclature. Appendage and genital characters are described for 73 of these species. A review of more than 100 additional species that have at one time or another been classified in Macrocyprididae suggests that at least 23 are likely to belong there, bringing known diversity to at least 161 species. Seven species names (*Macrocyprina decora, Mn. hieroglyphica, Mn. maculata, Macrocypris calabra, M. compressa, M. elongata, M. trigona*) should be abandoned as *nomina dubia*.

Eight genera are recognized, of which four are existing or elevated from subgeneric rank (*Macrocypris, Macrocypria, Macrocyprissa, Macrocyprina*) and four are new (*Macropyxis, Macromckenziea, Macrosarisa, Macroscapha*). *Paramacrocypris* is shown to be a synonym of *Macrocyprissa*. *Pseudomacrocypris* is referred to the Pontocyprididae as a close relative of *Propontocypris*. *Novocypris* is a marine cypridid related to *Paracypris*. *Premacrocypris* and the Acratiinae, so far as known at present, lack the diagnostic features of Macrocyprididae as here revised.

The Macrocyprididae are morphologically homogeneous and conservative with compellingly cypridacean rather than bairdiacean affinities. No Paleozoic or Triassic and only two Jurassic species can be identified, but Cretaceous and Cenozoic species abound. There are many more species with correspondingly narrower geographic ranges than previously recognized. There may be several hundred living species of Macrocyprididae, which are most abundant on coral reefs, near the edges of continental shelves, in the oxygen-minimum zone, in bathyal and abyssal depths, and beneath cold or upwelling surface currents, wherever high biological productivity produces food-rich bottom sediments. Adult and juvenile anatomy, development of late instars, sexual dimorphism, size-depth clines, and geographic and bathymetric distributions are analyzed.

INTRODUCTION

The family Macrocyprididae is the smallest and most homogeneous of the three families that make up the superfamily Cypridacea. Although globally ubiquitous in nearly all euhaline environments, the family is rarely represented at any one location by more than one or two species, and those species are never predominant and rarely common constituents of the local podocopid ostracode fauna. The external morphological features are remarkably constant, so much so that until 1960 a single genus was considered sufficient to comprehend almost the entire family, and several of the constituent species were reported worldwide. Unlike the burgeoning complex of Paracypridinae, the Macrocyprididae have not adapted to low or fluctuating salinities, and they are poorly represented in most coastal habitats. There is also no evidence for any commensal or ectoparasitic associations with larger invertebrates, such as those displayed by some of the Pontocyprididae. Instead, they are solitary, sluggish, sediment-ingesting bottom-crawlers. They tend to be relatively large and include the largest known marine podocopid ostracodes.

Like other podocopid Ostracoda, populations of macrocypridid species show considerable individual variation, analysis of which must precede species identification. The right and left valves are distinctly asymmetrical, and the shape of the larger right valve is more distinctive and representative of the species than is that of the smaller left valve, most characters of which can be predicted from the right valve. Both sexes are present, and male and female carapaces may show either size or shape dimorphism or both. Juveniles develop through a series of eight instars before reaching the adult size and shape (Müller, 1894), up to six of which have been recognized in the material studied here. Late instars have a fairly broad calcified inner lamella, broader than that found in comparable developmental stages of other podocopid ostracodes though not as wide as in the adult. This makes it easy to mistake isolated juveniles for adults of the same or a different species and has contributed to past misidentifications. Species of Macrocyprididae also show variability in size and shape between populations from different depths and geographic locations, which has further contributed to difficulties in identification. This unreliability of species recognition has hindered use of the family in paleoecologic and biostratigraphic interpretation.

This is a family of respectable antiquity. There are probable records in the Jurassic, and by the Cretaceous it was already very diverse. The family has remained stubbornly conservative, with relatively few morphological innovations. The adductor muscle-scar pattern, for example, remains curiously devoid of taxonomic significance below the family level. Though complex, with more constituent scars than any other cypridacean taxon, this scar is invariant in its general features, while displaying vigorous but apparently meaningless variability in its minor details. It offers neither the distinctive rearrangements of a few discrete scars seen in the Cyprididae and Pontocyprididae nor the repetitive fusion or fission of individual scars within a constant spatial deployment that characterizes Cytheracea and Bairdiacea.

It is this deceptively primitive scar pattern that has caused some workers to link the Macrocyprididae with the Bairdiacea rather than the Cypridacea. There is no other anatomical evidence for such a classification, of course, in the appendages, genitalia, or carapace characters. Nonetheless, some macrocypridid scar configurations invoke homologies with basic pontocypridid, cypridid, and bairdiid scar patterns. If real, these homologies would sustain a unitary, five-clade concept of the living Podocopida (Maddocks, 1976, 1982), as contrasted to the two- or three-clade model espoused by McKenzie et al. (1983) and Gründel (1969, 1978). In other words, it is the Macrocyprididae through which it is easiest to trace connections of Cypridacea with the other four living branches of the Podocopida.

Within the Cypridacea the Macrocyprididae stand well apart from the other two main branches and deserve full family rank, coequal with the Pontocyprididae and the Cyprididae (Alm, 1915; Sars, 1922–1928; Maddocks, 1969a; Danielopol, 1976). Indeed, their conservatism of morphology and habitat provides a refreshing contrast to the unruly Cyprididae, which have swarmed over nearshore marine, brackish-water, freshwater, subterranean, and damp subaerial habitats. The extraordinary breadth of adaptive radiations and frequency of convergence within the Cyprididae have generated disproportional inflationary tendencies in the classification of Cypridacea, such as the proposed segregation of marine representatives into a separate "Family Paracyprididae" (see McKenzie, 1979, 1982 for rationale) or the proposed isolation of supralittoral invaders into a "Family Terrestricyprididae" (Schornikov, 1980). The Pontocyprididae also show prolific ecological diversification, encompassing phytal, soft-bottom crawling and burrowing, ectoparasitic or symbiotic, interstitial, anchialine, xylophile, and many other specializations; they occupy the full range of marine habitats from the strandline to the deep sea. By contrast, the Macrocyprididae seem monotonous, even humdrum, in their archaic morphology and lack of ecomorphotypic innovation. Nevertheless, from the perspective of one who works with the Macrocyprididae the tripartite division of the Cypridacea is plain.

TAXONOMIC PRINCIPLES AND OBJECTIVES

Zoological classification attempts to find order in the diversity of animals and to express their inferred evolutionary relationships (Mayr, 1969). Although the functional unit in nature and in taxonomy is the species, which is essentially a genetic and ecologic phenomenon, for ostracode species we know little of the genome except its morphologic expression. By their functions, skeletons are both conservative and subject to homeomorphy, so that evolutionary hypotheses based on only skeletal characters are likely to oversimplify the true history. In Ostracoda, fortunately, the skeleton is part of the external integument of the body and therefore likely to have more numerous biological functions and more taxonomically useful characters than a mere external secretion or test. Even so, there are all too many podocopid ostracodes with smooth, elongate carapaces that are almost featureless externally. For these cypridiform taxa, extra emphasis must be given to the few available distinguishing features, chiefly valve overlap, hingement, muscle scars, pore canals, and marginal structures. In the case of the Macrocyprididae these internal details are nearly invariant as well, while the ineffable shape differences are extremely difficult to define, communicate, and evaluate. It is also not easy to recognize male, female, and juvenile carapaces, all of which must be included in a natural species concept. As a result, most species have not been consistently recognizable, and the diversity of Macrocyprididae has been underestimated.

For optimal taxonomy, both carapace and soft-part characters should be used, and it cannot be denied that the species and genera of Macrocyprididae are most easily recognized by using a combination of both. A primary strategy of this revision has been to incorporate as much information as possible from the external soft anatomy, mostly appendages and genitalia, to supplement that from the carapace. In this way it has been possible to distinguish males and females, adults and juveniles, and probable species with much less uncertainty than if carapace traits alone were used. With this larger pool of characters, it then becomes possible to calibrate, as it were, those carapace traits that show high correlations with the soft-part features and to use them as reliable diagnostic characters for fossils.

Experience with Bairdiidae and Pontocyprididae has suggested that trends or relationships marked by obvious carapace features are always corroborated by soft-part characters, when the latter become available, and that trends determined from soft parts are always confirmed by carapace traits, albeit often subtle ones that had been overlooked previously or that are ambiguous when taken alone. The conservative carapace of Macrocyprididae makes the family ideal for further testing of this thesis. Indeed, any macrocypridid species diagnosed by soft-part characters also turns out to be recognizable from the carapace features, and vice versa. This familiar but often queried premise has been reconfirmed for the 73 macrocypridid species represented by soft parts in this study, making it possible then to describe many additional species from empty and fossil carapaces with only slightly less confidence.

Genera are clusters of species thought to share common ancestry, but most ostracode genera have been proposed initially with too few species. Even though most names have proved to be useful later on, as newly discovered species leafed out this branch of the evolutionary tree, rarely have the original taxonomic diagnoses proved satisfactory. Undue emphasis on one or a few key taxonomic characters has hindered phylogenetic analysis. Indeed, only after most of the member-species are known can the shared-derived attributes of a taxon be listed; and because each lineage evolves independently of others, the more numerous the species the fewer attributes are likely to be shared by all. Again, the twigs-on-a-branch analogy reminds us that a genus should be defined, not by the boundaries of the morphological space those species occupy but by their common origin. To attempt to specify, *a priori*, which anatomical structures should have taxonomic value at any particular hierarchical level (DeDeckker, 1979) is futile. Most ostracode genera and higher taxa prove to be polythetic, with rampant mosaic evolution, as Sylvester-Bradley (1969), Danielopol (1976), Maddocks (1976), McKenzie (1982), and others have warned.

The family Macrocyprididae presents in a microcosm the classic problems of ostracode taxonomy. Developmental stages and sexual dimorphs have not always been clearly distinguished within local populations of a species, while depth and other components of geographic variability among populations of a species have never been analyzed. Of the four genera and subgenera (*Macrocypris, Macrocypria, Macrocyprissa, Macrocyprina*) established before this study, one had only a single fossil species (*Mc. cylindracea*), and another contained only a single living species (*Ma. sarsi*) (see p. 5 for abbreviations). For the third and fourth, only two species had been fully described for each (*M. minna, Mx. sapeloensis, Mn. propinqua, Mn. succinea*), although partial or inaccurate soft-part information had been published for a few other species. The relatively small number of species, as was then supposed, their conservative carapace characters, and their very broad reported geographic ranges made it seem feasible to attempt a comprehensive, global review of this family.

Therefore, this taxonomic revision of the family Macrocyprididae was undertaken with the following objectives: (1) to describe and analyze the ontogenetic development of soft parts and carapace, especially to find criteria for reliable distinction of adults from late instars, and also to evaluate the likelihood of postmaturational molting; (2) to describe and recognize sexual dimorphism, if present, in carapace and soft parts; (3) to examine the variability of carapace and soft parts within local populations in order to evaluate the relative taxonomic usefulness of carapace and soft-part characters; (4) to examine the between-population variability within species, especially to analyze the possible influence of depth on size and shape; (5) from these insights, to develop regionally applicable species concepts that permit accurate recognition of biological species; (6) to redescribe in full, from type specimens and additional material, the carapace and soft parts of the previously named species of living Macrocyprididae; (7) to describe in full the carapace and soft parts of a sufficient number of new living species to provide a satisfactory estimate of taxonomic diversity and trends in this family; (8) to establish sound generic concepts, both by revising previously named genera and by establishing new genera, as necessary and appropriate to express the taxonomic and probable evolutionary affinities of these species; (9) to apply numerical taxonomic methods to the resulting compilation of character traits for a large number of species; (10) to determine which carapace characters are suitable for accurate, consistent identification and generic classification of fossil species; (11) to test the applicability of these findings by redescribing and reclassifying a few previously named fossil species; (12) to compile ecological information for living species, for possible future application in paleoecologic interpretations; (13) to ascertain the geographic distributions of living species and their possible historical implications; (14) to review the stratigraphic occurrences of fossil species, with possible biostratigraphic and evolutionary implications; and (15) to evaluate present evidence relevant to the origin and evolution of Macrocyprididae, and especially to resolve, finally, the question of whether they have cypridacean or bairdiacean affinities.

PROCEDURES AND CONVENTIONS

Dissections.—Most of the specimens collected living had been preserved in alcohol and were not stained. First the assemblage was transferred to a drop of glycerin, and all specimens were counted, measured, and the sex determined if possible. One or more representative specimens of each sex, growth stage, and geographic population were then selected for dissection. With fine needles, the appendages and external genitalia were teased from the body, in the same drop of glycerin that became the mounting medium for the dissection-mount slide. The valves were washed with water, dried, measured again separately, and stored in paper micropaleontological slides. Decalcified or very fragmented carapaces were mounted on the dissection slide. Years later, when much of the glycerin had evaporated from these unsealed slides, it was necessary to remove the cover slip and add additional glycerin or in some cases to transfer all body parts to a new slide mount. The slides were then sealed with Murrayite.

Photographs and drawings.—The carapace and soft parts of most dissected specimens were photographed with a Leitz Orthomat automatic camera microscope, to provide a permanent record. Kodak Panatomic-X film was developed in Kodak Microdol-X or D-19, the latter to increase contrast for soft parts. Only a small number of those many thousands of photographs could be included in this report. Photographs were taken in plane and cross-polarized transmitted light, reflected light, a combination of these, or Zernike phase contrast illumination. For wet valves, the transparency and depth of field improve with immersion in glycerin. Dry valves may be wetted with water or ethanol and immersed again in glycerin, but it is then more difficult to prevent air bubbles from being trapped in the vestibules, especially in specimens of *Macropyxis* with capacious air-filled radial pore canals. Such air bubbles can be seen in the plates, as well as surfaces that resisted wetting, dirt, and cracks or other flaws, especially in the older type specimens. Adhering epidermis and uncalcified inner lamella also are visible in many photographs of live specimens. These unretouched photographs were printed at standard sizes but varying magnifications to facilitate comparison of shapes among species and geographic populations. Within each species, however, the magnifications of the published figures are constant or nearly so.

SEM micrographs were taken with a Cambridge machine at 5 kV and 0°. The relatively large size of deep-sea macrocypridids and the greatly protruding hinge elements and ventral bow-shaped processes made it difficult to obtain more than three points of contact of a specimen with the stage, producing charging and poor resolution. Electronic problems caused distortion of the left edge of many images, distorting lateral outlines slightly, and therefore most of the SEM photos taken are not published here. As for most smooth ostracodes, SEM micrographs proved to be less satisfactory than transmitted-light photographs.

The drawings were done with a mirror mounted on a Leitz research petrographic microscope with a high-intensity xenon lamp, which projects the image onto the drawing surface. In a darkened room the desired structures can be accurately traced by pencil and then inked. All proportions and structures shown in the drawings are traced from actual specimens. However, all legs are shown from the left side to facilitate comparisons, and for complex structures or crumpled specimens some structures may have been moved slightly, separated, or straightened out in the drawing to clarify their relationships. Because all drawings were done after mounting, some structures may be slightly displaced or distorted from life position by the overlying cover glass. Nevertheless, the resulting configurations are standard among such mounted material and readily comparable with each other. Broken or missing structures are represented by dotted or dashed lines. Some minute structures that could not be drawn accurately at the scale of the drawings, such as the fine secondary hairs or barbs that characterize certain setae, have been omitted. To assure standard orientations and comparability of shapes, nearly all drawings of valves are external views, with internal features shown as seen from the exterior in transmitted light. All drawings were done at a constant magnification, so that the range of sizes on the figures presents the true size ranges of these species.

Contrary to usual taxonomic procedures, in this monograph the drawings and photographs are grouped by structure rather than by species. The morphologic conservatism of the Macrocyprididae is such that in isolation many of the species look pretty much alike. Only a close comparison shows subtle differences of shape or details of soft parts. To facilitate such comparisons and to emphasize the differences, or in some cases the lack of significant differences, the illustrations of the same structures of closely related species are grouped together on the same figures and plates, approximately in taxonomic sequence. As much as possible, legs are illustrated in standard, lifelike orientations and as viewed from the left side. For valves, right valves are always on the left-hand pages and left valves of the same species in corresponding positions on the facing right-hand pages. The photographs of valves and genitalia include a selection of specimens from different geographic localities, to illustrate geographic variability in size and shape as well as sexual dimorphism, and to portray a population concept for the species.

Specimen catalog and repositories.—A total of 6733 specimens was examined. Specimens borrowed from museums or individuals have been returned to that museum or individual. All other specimens have been deposited in the United States National Museum of Natural History (USNM). Paratypes for certain species have been deposited in The University of Kansas Museum of Invertebrate Paleontology (KUMIP). The repositories and museum catalog numbers are given within the species descriptions and also in Appendix IV. Abbreviations for other institutions are explained in Appendices III and IV and in the species descriptions.

Specimens that were dissected, illustrated, or in any other way singled out have been given identification numbers in my specimen catalog. This includes some museum specimens for which the museum catalog number applies to the whole assemblage rather than to individual specimens. Appendix IV gives a complete listing of these 939 specimens. Those numbers were recorded on both slides containing the valves and soft parts of each individual, on the drawings, photographs, and measurements of that individual, and in all specimen by specimen records. So essential did these numbers become for accurate records, as species multiplied and identifications of certain specimens altered, that they have been retained on the illustrations and in the text of this monograph, even though most of these specimens now have additional museum catalog numbers. Indeed, because most macrocypridid species look very much alike and are easily confused in isolation, only the fact that these specimen numbers were affixed to the illustrations through every step of preparation assures the accuracy of the final figure and plate captions. Therefore, again contrary to tradition, the specimen numbers and species names have been labeled directly on the drawings and photos, though never obscuring any important structure, to help the reader make direct comparisons without having to make frequent reference to the captions.

Systematic descriptions.—For each species, a full synonymy of the name and species concept is given. All disposition of previously identified material is based on study of actual specimens, unless otherwise noted. "Derivation of Name" explains the Greek or Latin source of a new name. "Material" describes the number and preservation of living (preserved in alcohol, containing soft parts), dead, and fossil specimens that were actually studied. "Types" lists the repository and museum catalog numbers for the primary types. Lectotypes were designated from the available syntypes for many previously named species. "Type locality" lists the age, location, and other data for the sample or station where the holotype or lectotype was found. Some of the depths listed are beginning and end points of dredgings rather than ecological depth ranges. "Occurrence" lists all the stations or samples in which this species was found in the material studied, including the type locality, together with counts of live (carapace plus soft body) and other specimens (empty valves or carapaces). In parentheses the numbers of living males, females, and instars are given for each sample, as identified from soft parts. Full locality data are listed for these samples in Appendix III. "Distribution" describes the known geographic, bathymetric, and chronostratigraphic range of the species, taking into account both these occurrence data and reports in previous literature. "Dimensions" lists the length, measured parallel to the ventral margin, and height, measured perpendicular to length, of the holotype or lectotype. Additional measurements, identified by sex (as determined from soft parts), by instar, and by station, are presented in the accompanying length-height graphs. Sex and instar were always determined from appendage structure, not inferred from carapace dimensions. "Diagnosis" presents a brief verbal list of diagnostic morphologic characters of the carapace and soft parts, ignoring those that prevail throughout the genus and emphasizing those that distinguish the species from other closely related species. "Comparisons" explains how this species may be distinguished from others that occur at the same locality or nearby or from other closely related species. "Remarks" adds other taxonomic, distributional, or ecologic comments.

Abbreviations.—The abbreviations appended to the specimen numbers to indicate sex and age are as follows: J = juvenile, J–1 = the last or A–1 (adult minus one) instar, J–2 = the next-to-last or A–2 instar, etc., LV = left valve, RV = right valve, W = a whole carapace without soft body, M = male (determined from soft parts), F = female (determined from soft parts), MF? = pathological adult individual of indeterminate sex or combining both male and female characters in the soft parts, M? = presumed male (determined from valves), F? = presumed female (determined from valves). The podomeres of certain legs may be numbered from proximal to distal.

Names of genera are abbreviated as follows: *M. = Macrocypris; Mk. = Macromckenziea; Mx. = Macropyxis; Ma. = Macrocypria; Mc. = Macrocyprissa; Ms. = Macrosarisa; Mh. = Macroscapha; Mn. = Macrocyprina.*

Individual drawings within the Figures and Plates are designated by decimals (e.g., Fig. 1.3 = part 3 of Fig. 1, Plate 2.7 = part 7 of Plate 2).

All measurements of carapaces are given in millimeters (mm). All bathymetric depths are given in meters (m). N and S designate north and south latitude; E and W designate east and west longitude.

The samples, collecting stations, or museum catalog numbers from which these specimens came are identified in the text and plate captions by a brief alphanumeric code. For example, AB-7-361B stands for the United States Research Vessel *Anton Bruun* cruise 7 station 361B; the prefix UH introduces four-digit sample numbers for washed sediment residues in the University of Houston micropaleontological collections; and USNM introduces a six-digit specimen catalog number in the United States National Museum of Natural History. Full listings of the location and other accompanying data are given for each of these in Appendix III, in alphabetical order according to this code, together with the names and number of specimens of macrocypridid species found there.

Quotation marks around a genus or species name have been used to flag an archaic or erroneous use of a name and should warn readers that the contents of the taxon differ from the revised concept presented in this study.

Length-height graphs.—In the length-height graphs that accompany each species, measurements of individuals with male soft parts (adult or juvenile) are marked by a dot (.), adult or juvenile individuals with female soft parts are marked by a prime ('), and the holotype is underlined. Measurements of the smaller, left valve, if plotted, are marked by a right parenthesis ( )). For most species only dimensions of right valves were plotted. Numerals and letters designate geographic populations of a species or in some cases different species, according to the legend provided in each diagram. For some very abundant species, numerous additional specimens were measured but not plotted because their dimensions fell on top of points already plotted. The dashed lines separate successive instars and adults, as interpreted from this evidence. An accompanying bar scale shows the bathymetric depths where these populations were collected, and size-depth clines are apparent for many but not all species. The sketch map shows the approximate geographic locations of these populations for easy assessment of geographic ranges. The alphanumeric codes used for collecting localities are explained in Appendix III, where full locality data are given.

HISTORY OF PROJECT

In 1964 I had the good fortune to participate in the International Indian Ocean Expedition by collecting shallow-water Ostracoda around Nosy Be, Madagascar. These collections yielded an extraordinarily diverse array of reefal podocopid ostracode species, hardly any of which could be identified at that time. Tantalizing glimpses of Indo-Pacific ostracode diversity had been provided by Brady (1880, 1890), A. Scott (1905), Hartmann (1964a), and a few others, but poor illustrations, heterogeneous syntypes, and inadequate generic concepts precluded identification from most previous faunal monographs without accompanying reanalysis of type material and lectotype selection. For these and other reasons, my initial paper (Maddocks, 1966) emphasized the live and dead distribution patterns, focusing on then-new numerical methods and leaving all species in open nomenclature.

At the Smithsonian Institution from 1965 to 1967, as a postdoctoral research associate with Richard H. Benson, I began the formal taxonomic analysis. Virtually every species was new, and most could not be accommodated in existing genera. Plainly, merely proposing an endless series of new names would have been of little value without accompanying clarification of the taxonomic concepts associated with established taxa. With egregious optimism, I decided to revise each of the families in turn. The Indian Ocean Expedition and other collections were searched for additional species to flesh out and test the emerging new generic concepts. A major though unavoidable defect of the resulting monographs on Bairdiidae and Pontocyprididae (Maddocks, 1969a, 1969b) was their focus on new species without accompanying restudy of type material for already named species. At that time the two most significant collections were inaccessible, the *Challenger* collection of Brady (1880) being studied by Puri and Hulings (1976) and the G. S. Brady collection in the Hancock Museum being studied by McKenzie (1967b). Through the courtesy of Harbans S. Puri and Kenneth G. McKenzie, I was able to examine briefly a few of the most important specimens, however.

At the University of Houston from 1967 on, the responsibilities of academic life precluded concentration on a monograph, although the framework for comparable revisions of Macrocyprididae and the more formidable marine Cyprididae had already been sketched out. My intermittent attacks eventually yielded a set of tentative but premature and partly erroneous interpretations (Maddocks, 1977), showing both the potential value of a thorough analysis and the unsuspected taxonomic richness of this supposedly small, homogeneous family. From 1978 to 1980 a grant from the National Science Foundation supported intensive accumulation and examination of species, tripling the initially predicted number of species and exploding the original assumption that this would be a relatively easy family to analyze. Another defect of my earlier monographs was targeted by deliberately including selected fossil species in addition to living ones. Some unusual morphological phenomena were described, and a preliminary R-mode numerical taxonomic analysis of appendage characters was presented (Maddocks, 1979, 1988a). In 1979 Roger L. Kaesler applied Fourier analysis to selected lateral carapace outlines (Kaesler and Maddocks, 1988).

After 1980, preparations for the Eighth International Symposium on Ostracoda and increased academic responsibilities again took precedence, and progress was slow. As word of the project spread, additional species were proffered by other workers, and in some years progress in analyzing the species on hand was exceeded by influx of new acquisitions. Enough! After two cycles of reconstructing the plates to insert additional species, in 1984 a halt was called and no further species accepted.

Not all of the original objectives have been achieved. Definitive numerical taxonomic and cladistic analyses remain as much in the future as ever. Full anatomical illustration was possible for only 22 of the 73 living species. Time, expense, and the difficulty of achieving consistent accuracy for these more elaborate structures made it impractical to illustrate the first four cephalic appendages for the remaining species or to investigate their ontogenic development. The resulting emphasis on characters of the carapace and posterior body may be rationalized on grounds of practical use but remains, nonetheless, a deficiency. Yet the rapid progress of ostracodology and the impending *Treatise* revision dictate publication of these partial results in order that they may be tested by other workers. Coverage of taxonomic literature (except Russian, Indian, and Chinese) is fairly complete to 1984 but spotty thereafter, and other inconsistencies and omissions may have arisen from the intermittent pace of this project. The lists in Appendices I and II are not complete, as the period of this study has coincided both with exponential growth of ostracode literature and with cuts in library holdings. Indeed, like Robert Ripley's (*Believe It or Not!*) Chinese marching eternally in single file past a fixed point, we may well have reached the point where new names and records are generated in the regional and alpha-taxonomic literature more rapidly than the reviser can evaluate and dispose of them. At times, it has seemed so for Macrocyprididae.

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ANATOMY OF MACROCYPRIDIDAE

CARAPACE

Color.—Most Macrocyprididae have a thick, yellowish-white, translucent carapace, which may become opaque white in long-preserved specimens in alcohol and in fossils. Cold-water species of *Macroscapha* and some species of *Macromckenziea* have thick, yellow-brown inner chitinous linings that give the whole animal a yellow, medium brown, or even dark brown color. In shallow water, species of *Macrocyprina* have two to four central, white, opaque patches and additional marginal patches in an otherwise glassy, transparent carapace. Adjacent regions of the central epidermis may be bright yellow to light brown. The result is a tricolored living animal with a mottled pattern of light yellow, dark yellow, and brown. In the anterodorsal region just above the end of the inner margin there may be a small colorless patch, although no recognizable eye structure is present below, and there is never an eye tubercle on the carapace.

Surface.—The exterior surface of the macrocypridid carapace is completely smooth. Once dry, fresh specimens may be very difficult to wet again and and may cling stubbornly to the water surface. Elofson (in Neale, 1964, p. 296) suggested that this property might provide an effective means of local (50–100 m) dispersion of smooth-shelled, shallow-water ostracodes. It is more likely that this smooth surface protects the carapace against attaching bacteria and diatoms, which are not usually found on live animals.

Though smooth, the surface is not flat but gently undulating, especially near pore canals (see Plates 65.4 and 74.7). Occasional specimens show minute surface irregularities, which are of primary origin but of unknown cause and probably have no taxonomic significance. Examples include the quilted epicuticle in Plates 71.1,2 and 74.5, the rippled pattern of Plate 76.1, and the zig-zag, *en echelon* grooves of Plates 75.5,8 and 76.1. Juveniles and recently molted adults have clean, inviolate surfaces, but some live adults, which probably last molted a long time ago, show finely abraded, scratched, etched, or corroded valves (see, for example, Plates 67.1, 71.3–6, and 75.1,2,6,8). In general, the normal pore canals are more resistant to corrosion than is the intervening surface (see Plates 76.5, 77.1,6).

In species of *Macroscapha* the chitinous phase of the carapace may be conspicuous, including a separate, thick, brown inner chitinous lining of the outer lamella. In some specimens of *Mh. tensa, Mh. inaequata, Mh. sinuata,* and *Mh. opaca* the calcified layer of the outer lamella has cracked and peeled away from this brown inner lining. In Plate 35.8, the apparent hole is actually covered by this transparent lining. In Plates 36 to 39 other photos show air bubbles trapped in the space between the calcified layer and this inner chitinous lining. This thick lining also imparts a brown color to the valve in transmitted light. It cannot be confused with the soft epidermis of the uncalcified inner lamella, as Bate and East (1972, 1975) supposed. The latter is nearly colorless, flexible, and shows cell structure. Plates 38.3–6 and 39.3–6 show strands of uncalcified inner lamella still adhering to the inner margin, which is not uncommon in dissected live animals but has never been seen in dead carapaces. It may be noteworthy that the inner chitinous lining is most conspicuous in these cold-water, Antarctic dwellers. A few specimens of *Macromckenziea* also had a brown inner carapace surface, but none showed the cracking and separation of the carapace layers that was common in Antarctic *Macroscapha.*

Pore Canals and Setae.—Small, simple, funnel-shaped normal pore canals (type A" of Puri, 1974) are scattered sparsely and non-uniformly over the exterior. They are too small to show distinctly in SEM photos over more than a small region of the strongly curved carapace, and they are also too small to be traced and mapped accurately in transmitted-light photos and drawings. Thus, it has not been possible to determine whether their relative positions are fixed, and whether each pore is a unique entity, as has been repeatedly demonstrated for the pore-conuli of cytheracean ostracodes. It seems likely that this is the case. But so far, all that is known is that they are far less numerous and much smaller than the pores of *Propontocypris* (Pontocyprididae) and are smaller and less conspicuous than those of *Paracypris* and other marine Cyprididae. Contrary to some statements (Puri and Dickau, 1969; Puri, 1974; Keyser, 1980), the three families of Cypridacea display significant differences in their array of pores and setae, and these characters have greater taxonomic value at the generic and familial ranks than at the species level. The following description applies to the entire family Macrocyprididae, except as noted, and is based on SEM examination of more than 30 species.

On a single individual, these funnel-pores may vary somewhat in diameter and in prominence, from a simple funnel set almost flush with the surface (Plate 64.4) to a thick-rimmed, steeply sloping funnel (Plate 64.5). Some pores have the outer rim demarcated from the inner funnel by a narrow groove (Plate 74.4). Occasional pores with tassel-setae (Sylvester-Bradley and Benson, 1971) tend to have excentric openings and a local, mound-shaped prominence (Plate 76.5). None of these details appears to have taxonomic significance at the species or genus level.

Most normal pores have simple, straight setae. The length and thickness may vary somewhat on the same specimen. They are rarely large enough to be seen in lateral views at low magnifications. A few pores on each specimen have tassel-setae with two to five dichotomous or sequential branches (Plates 65.3, 66.11, 76.3). One such pore with tassel-seta is consistently located in the anteroventral region (Plates 74.7, 76.7). It is not known whether their number and locations are consistent.

The anterior and posterior margins are bordered by a narrow, flattened rim and a row of deep, elongate, almost rectangular, rimless, regularly spaced, marginal pores with short, thick, smooth, stiff setae (Plates 64.6, 66.10). In an SEM photo they resemble a row of boot lacings.

Dentiform Corner.—Sars (1922–1928) used the term **dentiform corner** to describe the sharp anterior angle of *Ma. sarsi,* but Maddocks (1979) first illustrated its detailed structure. Plates 68 through 73 illustrate the varied forms of this unique organ. Basically, it consists of a pair of modified marginal pores and a toothlike projection of the carapace edge. These two pores are enlarged, circular, deep, rimless, and displaced inward from the usual marginal position. They may be connected by grooves or a sulcate depression with the more or less scalloped valve edge. Ventral to these two pores, the valve edge is thickened and projects forward as a tiny, curved tooth or hook. The radial pore canals leading to the two pores diverge from each other and are separated by wide spaces from the others. These pores have large, fan-shaped or blade-shaped, lamelliform setae with short, thick, cylindrical shafts. Generally, the upper seta is directed ventrally and the lower one anteriorly, so that they overlap each other and cover the sulcate depression in front of the tooth. This canopy of setae may effectively mask the sulcus and tooth even in SEM photos.

A dentiform corner is located anteroventrally in both the right and left valves and forms a more or less distinct anteroventral angle in the lateral outline. In *Macrocypria*, its location is asymmetrical, near the venter in the right valve but distinctly above the venter and just below mid-height in the left valve. As a consequence, the left and right anterior margins do not match in these species. The degree of development of the tooth varies, from the conspicuous tusk of *Ma. sarsi* to the faintly scalloped margin of *Ms. capacis*. In empty and fossil valves with abraded edges, the dentiform corner may be more difficult to detect. It has been recognized, however, in several Cretaceous species, in which a tiny notch consistently indents the valve edge at this position even in abraded specimens.

Posterior dentiform corners are located at the posteroventral angles of both valves, although they are often not as strongly developed as the anterior ones. They generally have smaller, blade-like or leaf-shaped setae, lack the tooth, and are approximately symmetrical in the two valves.

The dentiform corner is a unique character complex that is diagnostic of the genera *Macrocypria, Macrocyprissa*, and *Macrosarisa*. In all other genera the pores, setae, and valve edge at this position are identical to others elsewhere around the margin. No sexual dimorphism exists. Juveniles also have well-developed dentiform corners. In fact, perhaps because the juvenile carapace is used for a shorter time, its conservation is often better than that of the adult, and minute details such as the dentiform corner may be better preserved in juveniles.

The function of the tooth is unknown, although the setae might be chemosensory. The location of the anterior dentiform corner in *Macrocyprissa* and *Macrosarisa* is not far from the point where the antennules and antennae emerge from the carapace. By analogy with insects, this notch might serve as a cleaning tool or foot-scraper or even to apply some kind of secretion from the specialized pores to these limbs. The posterior dentiform corner might come in contact with the distal claw of the sixth limb.

The dentiform corner is an ancient character and perhaps a primitive one. Already demonstrated in Cretaceous representatives, its presence should be sought in earlier Macrocyprididae. Because the accompanying carapace shape is often similar to that of Paleozoic and early Mesozoic Acratiinae, possible functional analogies with the rostral notch of that taxon should be examined, as well. Also of potential relevance are the nonhomologous manifestations of a rostrum and rostral notch (Triebel, 1960) in some large freshwater Cyprididae (*Cypridea* and *Chlamydotheca*). The specialized, fan-shaped setae are not known elsewhere in the Macrocyprididae, Cyprididae, or most Pontocyprididae. They are somewhat like the flat, oval, leaflike marginal setae of *Argilloecia*, however.

Hinge and valve contact.—The hinge is unique, and its parts are not readily homologized with those of any other ostracode. To describe it as merodont-entomodont, as Morkhoven (1963) and others have done, is misleading, because macrocypridids certainly are not closely related to merodont cytheraceans, and the hinge elements are not homologous. A better adjective would be **macrocypridid**, as the hinge structure appears to be uniform throughout the family and is restricted to this family. The hinge is most fully developed or at least easiest to see in very thick-walled carapaces and in those with steeply arched dorsal margins, but the differences within the family are of degree rather than of kind.

The hinge occupies the whole thickness of the dorsal carapace wall. There is no separate development of any submarginal ridge that could be called a selvage, either in the hinge region or around the free margin; neither is the valve edge folded to produce ridge-and-groove elements as such, although artistic limitations may cause the hinge to be drawn in such conventional symbols. The hinge is three-dimensional, arched in both the vertical and the horizontal planes, and its curving, beveled surfaces are neither horizontal nor vertical, making it difficult to illustrate convincingly. The retouched photos of Triebel (1960, pl. 14) remain unsurpassed (see also Plates 60 to 63). The three-dimensional sinuosity of the dorsal valve-contact and the beveled surfaces of the hinge allow the arched valves to rotate against each other around the hinge axis. Conspicuous valve asymmetry, which is most extreme in high-arched, thick-walled forms, may also facilitate this action. An analogous solution to the functional problem of hinging a strongly arched dorsum has developed independently in *Xestoleberis* (a cytheracean).

The hinge may be described in terms of five elements, although one flows into another without sharp boundaries. In the right valve these consist of anterior and posterior crenulate platform-grooves; two shorter, thinner, sharp-edged, crenulate, arcuate to discoidal, anteromedian and posteromedian teeth; and a fairly smooth median bar. The crenulate faces of the anterior and posterior platform-grooves are approximately vertical, but toward the anterior and posterior ends they slope downward and to the right. They are set back deeply under an overhanging, sharp-edged flange formed by the dorsal edge of the valve, which may be traced around the base of the anteromedian and posteromedian teeth as a shallow step. The median bar of the right valve is rounded or beveled, and a very shallow, incised step may separate it from the dorsal surface. The lateral and ventral faces of the median bar are smooth, although faintly crenulate texture may sometimes be seen on the dorsal face, especially near the ends. The thin, lenticular anteromedian and posteromedian teeth may be crescentic to triangular in profile; they project obliquely ventrally and to the left.

In the left valve, complementary, crenulate anterior and posterior ridges project beyond the dorsal edge of the valve. The arcuate, crenulate sockets into which the terminal teeth of the right valve fit are incised diagonally into the dorsomedian faces of these crenulate ridges and coalesce with the retreating median valve edge, so that in many views these sockets are not easily distinguished from adjacent elements. The median element of the left valve hinge consists only of the sharp dorsal margin, which retreats inside as a smooth, beveled or curved surface; there is no submarginal inner ridge and therefore no groove as such.

The imaginary straight line of the functional hinge axis passes through the anteromedian and posteromedian teeth of the right valve. The median elements are smooth, rounded or beveled surfaces, allowing rotation around this axis as the left valve edge slides over the right valve bar. In most cases this median element of the hinge is nearly straight and relatively short, especially in the more highly arched species. Closed empty carapaces and reassembled valves from which the body has been removed may show a narrow, arcuate gap over the median hinge element, suggesting that ligamentary (cuticular) fibers must stretch across this region when the valves are fully closed. The anterior and posterior crenulate platform-ridges and grooves slope both anteriorly or posteriorly and away from the midline to the right or left, so that they are not in full contact except when the valves are closed. This irregular, rough-edged, finely crenulate texture suggests that they are part of the ligamentary connection, where bundles of elastic chitinous fibers pass from one valve to the other, rather than denticulate teeth fitting into locellate sockets in the fashion of a ball-and-socket joint. [A comparable fine crenulation is visible on the dorsal connecting surfaces, not to be confused with the lateral articulating surfaces, of podocopid hinges as taxonomically distant as *Neonesidea* and *Actinocythereis*. This crenulation was described but not interpreted by Morkhoven (1962, p. 74) and has often been mistaken for tooth-and-socket, articulatory hinge crenulation by other writers.] In species with a thick layer of uncalcified endocuticle, such as *Mh. turbida*, all parts of the hinge are covered with dark brown cuticle. In very thick-walled, well-calcified species with thin endocuticle, such as most *Macropyxis*, the median hinge element may be stark white with thinner cuticular covering than the terminal elements.

The dorsal surface of the right valve forms a thin projecting flange that overhangs the anterior and posterior platform-grooves and overlaps the complementary crenulate ridges of the left valve. Anteriorly it expands into a sinuous **stragulum** (Guber and Jaanusson, 1964; Adamczak, 1966). The left valve margin is depressed anterodorsally to accommodate this overlap. The arching median element of the right valve may project slightly across the midline into the retreating left valve, although if there is any overlap at this position it is actually left valve over right. The resulting sinuous embayment may be conspicuous in dorsal view. The posterodorsal edge of the right valve slightly overlaps the left. At the posterior end, the right valve reaches beyond the left valve to a greater or lesser degree but does not overlap it, although in some thick-walled, very asymmetrical species the left valve may nestle snugly inside this overreach. Around the anterior margin the right valve may slightly overreach but never overlaps the left valve. In *Macrocypria* the asymmetric locations of the dentiform corners produce alternately overreaching anterior margins that do not match.

The ventral edge of each valve projects well over the midline, just posterior to the mouth, to form triangular **bow-shaped processes** (Cannon, 1926; Adamczak, 1966). The right process overlaps the left one, which is of similar size and shape and extends equally far into the ventral interior of the right valve. Inside the anteroventral and posteroventral region of the right valve, a thick-walled carapace may show a groove and stop-ridge where the edge of the left valve fits. The mutual overlap of these bow-shaped processes is considerable, even when the valves are partly open with legs protruding in front and behind. Presumably it functions to channel domiciliary water currents in the fashion described by Cannon (1926) and Adamczak (1969). Inside, the ventral duplicature is fused without vestibule, and the result is a nearly impregnable ventral surface. If potential predators probe the closed carapace in the same frustrated fashion as does the dissecting needle, the protective value of this strong venter is obvious.

The stragulum and bow-shaped process of the right valve are visible in the left lateral view of a closed carapace. In thick-walled species the posterodorsal overlap and posterior overreach may be visible as well. In ventral view the overlap of the right bow-shaped process is obvious. In dorsal view, the contact line of the two valves is doubly sinuous, with two left-convexities formed by the overlapping stragulum and the left-arching median hinge element of the right valve. This contact is readily distinguishable from the nearly straight or convex-to-the-right contact line of most podocopid ostracodes with left-valve overlap. While a few other podocopids have right valve overlap, none have the doubly sinuous dorsal contact-line as well.

The antiquity and origin of this hinge and valve contact are not known. In the Cretaceous and Cenozoic fossil specimens studied, it has essentially its modern development. Kozur (1971) stated that supposedly ancestral Triassic *Praemacrocypris* and *Acratina* have smooth hinges, but he did not illustrate or describe them or demonstrate their macrocypridid character. Michaelsen (1975, p. 130) described a "markedly dentate," tripartite hinge of Jurassic species of *Pseudomacrocypris*, which is referred to the Pontocyprididae herein. That hinge is convergent with Macrocyprididae in its robustness and fine, irregularly striate texture, but other features are normal for Pontocyprididae. Likewise the prionodont hinge of *Novocypris,* an Eocene form here referred to the Paracypridinae, is unique and not homologous with that of the Macrocyprididae. Although numerous Paleozoic species have been referred to "*Macrocypris,*" none have the features of overlap and hingement described here (see Appendix II).

Radial Pore Canals and Vestibules.—The duplicature of Macrocyprididae is very broad and well calcified in adults. The inner margin is regular and predictable in its course. In instars the calcified inner lamella is somewhat thinner and more fragile, and the duplicature is narrow, growing wider with each molt. However, because even the young instars have a duplicature that is as broad as the adult condition in some other families of podocopid ostracodes, this has been a source of some confusion. Although somewhat more fragile than in adults, this calcified inner lamella is usually preserved in dead and fossil carapaces of juveniles, which has often caused them to be misinterpreted as adults.

The fused zone (zone of concrescence) is narrow in juveniles, and therefore the juvenile radial pore canals are short, straight, and separate. In adults the fused zone is broader, especially in the anterodorsal, anteroventral, posterodorsal, and posteroventral regions. The broader the fused zone, the longer and more complexly branching the radial pore canals that traverse this zone, and the more numerous the false radial pore canals (captured normal pore canals) incorporated into this pattern. There is a wide range of variation in the pore canals, from the severely simple marginal fringe of *Macrocypris* to the baroque curlicues of *Macropyxis.*

The size of the vestibule depends also on the breadth of the fused zone. In *Macropyxis* and in some *Macrocyprina* the fused zone is expanded in scalloped lobes in the anterodorsal and anteroventral regions, partially constricting the entrance to the vestibule. Around the anterior margin, however, the fused zone remains narrow and the vestibule is deep even in these genera. The posterior vestibule is usually open and not constricted.

Peypouquet (1975, 1979) has shown that the breadth of the fused zone in *Krithe* and *Parakrithe* is proportional to the ambient dissolved-oxygen concentration, so that narrow fused zones and large, open vestibules characterize low-oxygen conditions. Although the cause has been linked speculatively to a need for more respiratory cells of the epidermis to be housed in the vestibule (Peypouquet, 1979), it is also likely that calcification is directly affected. Biological calcification is an oxygen-intensive process, and in ostracodes these marginal features are the last to be finished after molting.

Some part of the variability in breadth of fused zone and complexity of branching of radial pore canals that was noticed within and between populations of a species in this study might prove to be physiologically linked to such a cause. Mechanical strengthening of the ends of the carapace may be another contributing factor, because the species with most elaborate development of pore canals (chiefly *Macropyxis*) are also very elongate, whereas more equant species of *Macrocypris* and *Macromckenziea* have simple marginal structure. Because species of *Macropyxis* are especially characteristic of bathyal depths, including the oxygen-minimum zone, it is unlikely that Peypouquet's (1979) interpretation of *Krithe* can be generalized for application to Macrocyprididae.

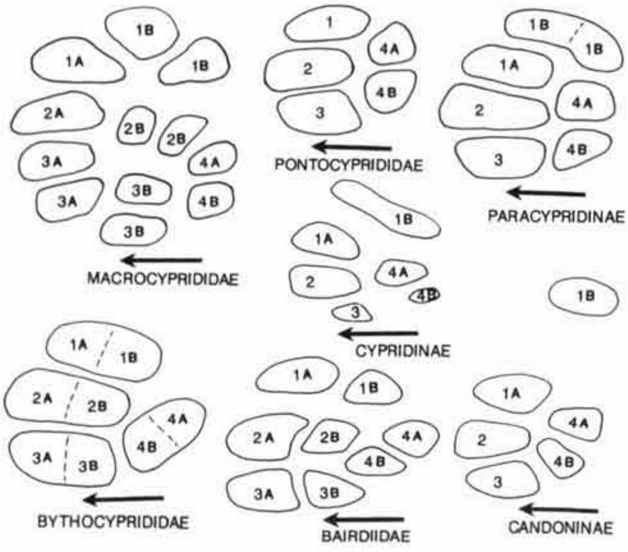
Muscle Scars.—The dorsal muscle scars are often easy to see and occupy consistent locations, especially in the larger deep-sea species. They have not been carefully studied. A pair of oval or teardrop-shaped frontal scars and a pair of elongate mandibular scars are located in front of the adductor complex. Neither show any taxonomically useful variation.

The adductor muscle scar pattern of Macrocyprididae has often been described as a rosette, but such a designation is as meaningless here as it is for the many other ostracodes, especially bairdiaceans and cypridaceans, to which this adjective has been indiscriminately applied (see also Maddocks, 1969a, 1969b). The term rosette should be reserved for the ancient, unique darwinulacean scar, in which the circular group is divided radially into angular wedge-shaped scars.

The adductor muscle scar pattern of the Macrocyprididae should be simply termed macrocypridid. It is unique to this family, nearly uniform throughout the family, and markedly distinct from bairdiacean and other cypridacean scars. The adductor scar-group is fairly large, elongate-ovate in elongate species to nearly equant in subquadrate species, and located centrally within the valves at a little below mid-height and slightly posterior to the ventral indentation, at the thickest point of the carapace. It is asymmetrical, reflecting shape differences between the right and left valves. Topographically, the individual scars are elevated bosses, separated and surrounded by narrow channels.

The adductor scars comprise two groups, which may be labeled simply the upper and lower groups, separated diagonally by an open space. The upper group always consists of three scars in an arcuate row. These three scars are almost never fused with each other or individually subdivided. The lower group consists of about nine scars arranged in a diagonally elongated oval. Of these, there are usually four fairly large, quadrate scars in an upper horizontal row, two anteroventral scars, one posteroventral scar, and two ventromedian scars. These scars may be subdivided or may fuse with adjoining scars in variable fashion. They have individual identity in the larger, thick-shelled species but are not consistently separable in the tiny species, especially of *Macrocyprina.* There does not appear to be much independent taxonomic significance to this variability.

Within this macrocypridid pattern, which is easily distinguished from those of Bairdiacea, Pontocyprididae, and



Text-fig. 1. Postulated homologies of generalized muscle-scar patterns of Macrocyprididae, Pontocyprididae (*Argilloecia*), marine Cyprididae (*Paracypridinae*), freshwater Cyprididae (*Cypridinae*, *Candoninae*), Bythocyprididae, and Bairdiidae. Individual scars and their divisions are numbered and lettered (1A,B through 4A,B) to emphasize possible homologies with Bairdiidae. See also Maddocks (1969a, fig. 3; 1969b, fig. 7, 32–35).

Cyprididae, occasional configurations of individual scars seem, perhaps accidentally, to suggest underlying homologies with bairdiacean and other cypridacean scar patterns. Maddocks (1977, fig. 3) illustrated some of these provocative individuals, and others may be seen in the plates of this volume (see especially Plates 78.12,14,27). It seems likely, for example, that the upper group or crescent of three scars is homologous with the upper scar-pair of the bairdiid pattern (scars 1A,B of Text-fig. 1), with the anterodorsal scar of the pontocypridid pattern (Text-fig. 1), and with the two anterodorsal scars (cap scar plus uppermost of the three anterior scars) of the cypridid pattern (Text-fig. 1). The two posterior scars of the lower macrocypridid group seem to correspond to the posterior scar-pair of the bairdiid pattern (scars 4A,B of Text-fig. 1) and to the two posterior scars of the pontocypridid and cypridid patterns. According to this hypothesis, the anterior and middle scars of the lower macrocypridid group, whose identities and positions are less stable, correspond to the two anteroventral scar-pairs of the bairdiid pattern (scars 2A,B and 3A,B of Text-fig. 1) or the two anteroventral scars of the pontocypridid and cypridid patterns.

An advantage of this hypothesis as compared with alternatives is that most parts of the scar pattern remain in stable configurations throughout the various Cypridacea. Most of the differentiation is localized in the cap scar (scar 1B of Text-fig. 1) of the freshwater Cyprididae. This interpretation of the cap scar as an errant member of the closing-muscle group is compatible with Kesling's (1965, fig. 9) analysis of musculature in *Candona* and with Smith's (1965) description of *Chlamydotheca*.

It should be emphasized that these speculations are based only on scar morphoseries in living species and do not necessarily represent an evolutionary hypothesis. Also, the individuality of discrete scars results merely from the distal divergence of a few of the many bundles of adductor-muscle fibers, a phenomenon in which, surely, some part of the variation is likely to be random. In most of the fossil specimens studied, only generalized macrocypridid patterns could be discerned, which were not adequate for tracking individual scars. It will be essential to test the evolutionary implications of this hypothesis by examining muscle scars of Paleozoic and better-preserved Mesozoic representatives.

The pontocypridid scar pattern dates back at least to the Jurassic, the cypridid scar pattern to the late Paleozoic, and the bairdiacean scar pattern to the early or middle Paleozoic. Although the fossil record of Macrocyprididae at present is shorter than most of these, the inherent conservatism of the macrocypridid scar pattern is such that we seem to get a glimpse of an earlier, less organized condition appropriate for some common ancestor. No homologies can be traced with the darwinulacean scar pattern, which has remained both individually variable and persistently conservative in its unique, radial-rosette configuration at least since the Carboniferous (Sohn, 1976, 1987).

APPENDAGES

Antennule.—The antennule consists of seven distinct, more or less cylindrical podomeres. Another, vestigial podomere may be represented by the chitinous framework at the attachment of the basal podomere, as interpreted by Schulz (1976). If so, the remaining podomeres ought to be renumbered II through VIII, to designate homologies with this limb in Bairdiidae and other podocopid Ostracoda (see also Maddocks, 1976).

The basal podomere (I) is broader than long and bears no setae. Podomere II articulates obliquely on a swivel-sleeve joint with podomere I; it bears two thick, rigid, long ventral setae. The joint between podomeres II and III varies from a flexible articulation in species of *Macrocypris* and *Macromckenziea*; to a more or less rigid suture in most species of *Macrosarisa, Macroscapha,* and *Macrocyprina*; to complete fusion with little or no remaining trace of a suture in *Macrocypria, Macrocyprissa,* and some species of *Macrosarisa.* Podomere III is broader than long and bears one dorsal and one ventral distal setae. The articulation between podomeres III and IV is a flexible elbow-joint, made more distinct by the abruptly smaller diameter of podomeres IV to VII. Podomere IV is relatively long and bears one dorsal and one ventral distal setae. Podomeres

V, VI, and VII diminish regularly in length and diameter. Podomere V bears one dorsal and one ventral distal setae. Podomere VI bears three dorsal distal setae, one of which is usually much shorter than the other two, and two ventral distal setae. Podomere VII bears four terminal setae, of which the most ventral seta is usually only about half as long as the longest seta. All these setae are simple, smooth, and relatively rigid.

The relative proportions of this limb vary considerably, even though its structure and setal armature are nearly invariant throughout the family. Slender, elongate podomeres with long, thin, flexible setae are characteristic of most species of *Macrosarisa, Macrocypria, Macroscapha,* and *Macrocyprina*. Species of *Macrocyprina* crawl as epifauna on surfaces, and these delicate, flexible antennules might have primarily tactile function. Short, thick podomeres with short, thick, rigid setae are found in *Macrocyprissa* and *Macromckenziea*. In some species of the latter two genera, the robust antennal proportions approach those of some other ostracodes that are known to have burrowing habits, such as *Cytherella* and *Argilloecia*. This homeomorphy, which is echoed also in carapace shape, suggests infaunal habits for these genera and a backward-pushing, upward-shoveling, burrowing function for this limb. The antennal proportions in *Macrocypris* and most *Macropyxis* are intermediate between these extremes.

Antenna.—The macrocypridid antenna is rather large and consists of six more or less flexibly jointed podomeres. The basal podomere is short, very broad, and has two ventral setae, which are frequently damaged in dissection. Podomere II is a more or less elongate cylinder bearing one long ventrodistal seta. A scale carrying three setae of graduated sizes, usually interpreted as the exopodite, arises dorsally at this joint but is actually attached to the proximal edge of podomere III. Ventrally near the proximal edge of podomere III a clump of eight sensory aesthetascs arises at a single, elongate-oval opening. Each aesthetasc has a very long, narrow, flexible, cylindrical sensory portion mounted on a slightly thicker proximal shaft; all eight are about the same length. At the ventrodistal edge of podomere III, four or five so-called **swimming setae** (admittedly, a misleading term since macrocypridids don't swim) of graduated sizes and one thicker, longer ventral seta arise. There are no dorsal setae on podomere III.

Near but not at the dorsodistal edge of podomere IV, two short setae of equal length arise together. A pair of short, thin sensory aesthetascs arise near the proximal end on the ventral surface. The ventrodistal corner of podomere IV carries one long, thick ventral seta, one or two small setae, and two dimorphic setae, which are small and inconspicuous in the female. In the male the dimorphic setae are thick, candlelike pegs with flame-shaped sensory tips.

Podomere V is short, irregularly wedge-shaped, and partly encloses podomere VI, which is much narrower and partly fused with podomere V. The distal antennal setae arise along all sides of these dog-leg joints, lying one on top of another in confusing fashion. Four clawlike setae and a smaller seta arise in an overlapping row at the dorsodistal edge of podomere V. Another thick claw and a short seta arise at the ventral joint between podomeres V and VI. Podomere VI bears four terminal setae consisting of a large claw, a smaller claw, and two setae of unequal size.

Considerable variability may be seen in the number, size, and locations of antennal setae in the drawings of this volume, in spite of time-consuming efforts at accuracy and observation of multiple specimens. Reliable renditions of antennae by other authors are few as well. An exception is the careful analysis by Danielopol (1978, fig. 21), which emphasizes homologies of the sensory aesthetascs with those of other Cypridacea. Many though not all of the apparently missing setae in drawings represent damage in dissection, while in other cases these setae are hidden from view, lying accidentally beneath some obscuring claw or thicker structure. The reader is also reminded that the width of an ink line can make a disproportionate alteration in the apparent thickness of a seta, and that the shapes and sizes of setae as shown in these drawings are not and cannot be exactly accurate at these small magnifications. Transmitted-light photographs are accurate but undiscriminating, and multiple detail-views are necessary for complete description of a single limb, again at considerable time and expense. Until more reliable techniques of documentation are routinely applicable, perhaps by microdissection and SEM, it does not seem appropriate to rely heavily on this limb for taxonomic purposes. Also to be considered is the fact that these antennal details are usually visible only after dissection, making them useless for routine sorting of specimens. Because of these practical considerations, the antenna is not given much attention in this study.

At the generic level there are characteristic differences in overall shape and proportions, even if small differences in detailed structure are ignored. Podomeres III and IV are short, thick, and nearly equant in species of *Macromckenziea* and *Macropyxis* and are only slightly more elongate in *Macrocypris*. In *Macrocyprissa* podomeres III and IV are only about half as long as broad. In *Macrosarisa, Macroscapha, Macrocyprina,* and especially in *Macrocypria* this elongation is more extreme, and podomere IV becomes especially stretched out. These trends are accompanied by tendencies toward shorter, thinner, and fewer setae, so that while *Macrocypris* and *Macropyxis* have numerous, thick, long, well-developed setae, many of which are clawlike, in *Macrocyprina* and *Macrocypria* most of these setae are much shorter and thinner, only a few are clawlike, and several may be represented only by inconspicuous, easily overlooked vestiges. This tendency is especially marked in the swimming setae but affects the terminal claws as well.

Mandible.—The macrocypridid mandible is of familiar podocopid form but robust and profusely setose. A long, triangular, heavily sclerotized dorsal blade bends mouthward to form a broad, truncate masticatory jaw armed with numerous setae and teeth. These begin with a large, smooth, conical tooth, followed by about four bicuspate to tricuspate, curved teeth, followed by several much smaller pegs or laminar processes. Approximately two slender setae originate between each pair of teeth, and several more smaller setae, accessory pegs, and laminae terminate the jaw. A single, thick, smooth seta arises on the outer corner of the base between the dorsal blade and the masticatory jaw.

No significant differences were seen in the armament of masticatory teeth of the various species and genera, except that the larger forms have more numerous setae and accessory pegs or laminae. Of course these tiny features are also easier to see in the larger species, but there is real simplification of this structure in the smaller species as well.

A large, sturdy, flexibly jointed mandibular palp of four podomeres is profusely armed with long, slender, simple, flexible setae. The elongate basal podomere carries a dorsal vibratory plate (exopodite of some interpretations) with six long, flexible, transparent, faintly feathered rays of graduated lengths, all fairly long. Three (rarely one or two) setae are located at the ventral end of the first podomere. Podomere II of the palp is short and carries about eight (five to nine) setae ventrally and along the distal edge. Podomere III is longer and possibly represents the fused remnants of two podomeres. Although no vestige of the joint is now visible, a clump of three setae is often set back from the others at a dorsodistal corner, where the joint might have been. Four or five setae originate in a ventrodistal clump and about four (two to five) more in a dorsodistal cluster. Podomere IV tapers toward a terminal row of five or six smooth, curved setae of graduated lengths and thicknesses.

The sheer number of setae and the three-dimensional form of this limb make it more difficult to see and draw accurately than some. Some part of the variability in numbers and locations of setae is related to size; larger species really do have more complex structure as well as easier visibility. This limb deserves more careful study and will prove to have taxonomic value. Careful analysis of homologies of this limb will help clarify evolutionary relationships within the Cypridacea, but so far only Danielopol (1978, fig. 23) has attempted this.

Maxillule.—The basal part of the maxillule (the maxilla of some authors, or fourth cephalic appendage) is relatively large and approximately rectangular in shape. The dorsal vibratory plate, also nearly rectangular in outline, bears a series of finely feathered, nearly transparent, tapering, flexible rays of graduated sizes along the posterior and ventral margins. Two long, rigid setae are attached at the base of the vibratory plate and directed mouthward.

The slender, jointed palp is relatively long and flexible. As Triebel (1960) pointed out, species of *Macrocyprina* and *Macroscapha* have three articulated podomeres in the palp, whereas in species of *Macrocypris, Macropyxis, Macromckenziea,* and *Macrocyprissa* podomeres I and II are fused. All degrees of intermediate condition are seen in *Macrocypria* and *Macrosarisa,* which have a partially fused joint with visible suture between the first two podomeres of the palp. Because fusion of existing joints is more common in ostracodes than subdivision of existing podomeres by the insertion of new joints, the three-segmented condition should be the more primitive. By this line of reasoning the deep-sea genera (*Macrocypris, Macropyxis, Macromckenziea, Macrocyprissa*) have the more derived state.

Podomere I of the palp has a single, simple dorsodistal seta, which may remain separate from the others after the joint between podomeres I and II is fused. Podomere II has a clump of three dorsodistal setae. The last podomere (III) of the palp has four to six terminal setae.

Three slender endites or masticatory lobes (processes) complete the maxillule. Each is armed distally with a dense double fringe of slender, simple, curved, smooth setae. In some cases all setae are about the same length and thickness. In others two or three setae of each lobe may be thickened and clawlike. The numbers of setae vary, especially in the larger species, and are not usually easy to count. As a general approximation, lobe 3 (numbering as in Müller, 1894) next to the palp has eight setae, lobe 2 has ten setae, and lobe 1 has twelve setae. A longer, simple seta originates at the base of each of these three lobes.

These masticatory lobes bend toward the mouth from either side and are aligned along a different plane from that of the palp and vibratory plate. The palp curves across the ventral part of the upper lip, and the vibratory plate streams posteriorly over the lateral body surface. Compression of this three-dimensional limb beneath the cover glass of a dissection slide causes some variability in orientation of these parts.

Female fifth limb.—The basal podomere is short, thick, poorly sclerotized, and rather formless. The posterior marginal vibratory plate of Pontocyprididae and Cyprididae, sometimes interpreted as an exopodite, is represented in Macrocyprididae at most, if at all, by a single, unremarkable, unfeathered seta. On the anterodorsal edge two setae of unequal size originate; another originates lower down, near the anterior lobe, and a fourth seta originates ventrally near the palp. A tapering, lamellar anterodistal lobe extends toward the mouth, armed usually with two dorsal, two ventral, and five or more distal setae of various sizes. This lobe projects inward somewhat, out of the plane of the rest of the limb, and so its exact shape varies according to its orientation on the dissection slide. It is comparatively robust and consistently recognizable compared to that of other Cypridacea.

A large, four-segmented, flexible, pediform palp (the endopodite of some interpretations) is always present. The first two podomeres have no setae, except in pathological individuals. The third has one ventrodistal seta, and the fourth has three terminal setae, which are often short, thick, and curved enough to be described as claws. They may be smooth or finely barbed. The dorsodistal seta is set apart from the others, which share a common distal point of origin, suggesting that the terminal podomere may include the remnant of a former fifth segment. All in all, the structure of this palp is much like the sixth limb, lacking only the ventral setae of the two proximal podomeres. This well-muscled, flexibly jointed limb is usually retracted within the carapace and extended posteriorly, although it can be flexed and projected ventrally. Exactly how it is used is not known. The right and left limbs are always symmetrical.

Male fifth limb.—The basal part and anterior lobe of the male limb are like those of the female. The palp, however, is contracted and distorted into a large, compressed, curved, hook-like clasping limb. This hook consists of a thick basal segment and a narrower, sinuously flexed terminal projection. Ventrodistally the basal segment bears a pair of short, thick, heavily sclerotized, peglike, modified setae and a thin, flexible seta. The adjacent region may be strongly sclerotized. There may also be a dorsodistal seta of variable size. The terminal hook is flexibly articulated with the basal segment and can be rotated slightly by the muscles of that segment. The exact shape, taper, and angle vary considerably from species to species and between right and left sides. In normal individuals the hook is not jointed, but vestigial cuticular seams provide evidence that it is homologous with the terminal three podomeres of the female limb. Three sensory aesthetascs are present on the hook. A ventral aesthetasc near the base, inside the curve of the hook, is delicate and sometimes hard to see. An even tinier one is located dorsally, often indicated only by a minute gap or seam in the neighboring cuticle. At the distal tip of the hook a delicate, elongated aesthetasc provides the pedestal for a terminal, circular disk. The function of this disk might be sensory, but its resemblance to a rubber suction cup also suggests an attachment function (see Plate 83.11).

The left and right male limbs are more or less asymmetrical, with the left limb being overall smaller, narrower, often more recurved, and always the more bizarre of the two. In some Caribbean species of *Macrocyprina* the left limb apparently has abandoned the clasping function and has increased its sensory role, by straightening and shrinking the former hook but enlarging the terminal aesthetasc. In *Mn. hawkae* the terminal hook has almost disappeared, and the flared, hirsute, flattened distal face of the basal segment has become the functional part of this limb.

Homologies between this grotesque clasping limb and the female leg may be traced via pathological individuals that are intermediate between the male and female conditions, such as 848M, 1358MF?, 715F, and 2385F. The basal podomere is the same unit in both sexes. So also is the first podomere of the palp (II), but the ventrodistal pegs and seta are ordinarily expressed only in the male. The terminal hook of the male corresponds to the three terminal podomeres of the female palp, with the former joints indicated by the vestigial seams and gaps in the cuticle of the hook. The sensory aesthetascs of the hook appear to be modified homologues of the female terminal setae. This hypothesis is different from that illustrated by Schornikov (1980), although similar in premise. Danielopol's (1978, fig. 37) numeration of podomeres and evolutionary hypothesis are in agreement, except that the setae designated *p* are probably not homologous.

Sixth limb.—As usual in Cypridacea, the sixth limb is a large, powerful walking leg. The protopodite or basal part of the limb may represent the fused remains of at least two podomeres, as Schulz (1976) suggested. The dividing suture is now incomplete, and the more proximal of the two segments is poorly sclerotized and easily damaged in dissection. One or two short setae arise from this more basal segment, just behind that suture. This variability is real, in that some species always have one seta, while others always have two. Because this part of the limb is easily damaged in dissection, however, for species represented by few or fragmentary specimens it has not always been possible to verify this number, and some of the absences shown in Figures 32 through 35 for such species may be due to damage. This variability in number of setae apparently has no taxonomic significance at the generic level and may merely reflect the vestigial character of this segment and suture. On the more distal part of the protopodite, another short, smooth seta arises inside the knee, and three smooth setae arise on the outside of the curve of the knee.

Four elongate, tubular to lamellar, flexibly articulated podomeres follow the knee joint. Each of the first three bears one ventrodistal seta. The penultimate podomere sometimes has a second, very tiny, vestigial seta. Three curved, clawlike, larger setae terminate the last podomere. Usually they are of graduated lengths, the middle one longest and the ventral one shortest. Their relative sizes may have taxonomic value at the species level.

Seventh limb.—By comparison with the sixth limb and with the seventh limb of other cypridaceans, the seventh limb is small and weak. Possible structural homologies with other Cypridacea were illustrated by Danielopol (1978, figs. 26, 39). As usual for cypridaceans, it is a cleaning limb, curved back and held tightly against the posterior part of the body. One of the three terminal setae is reflexed dorsally, enlarged, and pinnate. However, this leg also retains structural similarities to the fifth and sixth limbs, allowing serial homologies in these limbs to be discerned that are no longer self-evident in the Cyprididae and Pontocyprididae.

Again, the basal segment probably represents at least two fused podomeres, separated now by only a weak, incomplete suture. One seta arises behind this suture, and another originates inside the back of the knee; both may be minutely bristled. Three setae originate along the outer curve of the knee; the most ventral one is small, smooth, simple in structure, and occasionally absent.

The other two of these knee setae are specialized for some peculiar, possibly sensory function. On a slender, rigid, cylindrical shaft, each seta is flattened, bladelike, very thin, and minutely serrate or barbed on both edges. These serrations grow larger and more asymmetric distally. Each seta terminates in a flared plume of reverse-chevron barbs and a rigid, dartlike needle or a long, flexible distal filament. In *Macrocyprina,* these setae are relatively short, broad, coarsely barbed, and conspicuously plumed distally, terminating in a long, flexible filament. In *Macrocypris* and *Macropyxis* the setae are very long, almost invisibly serrate, with hardly any increase in size of barbs distally, terminating in a long, smooth, rigid, acutely pointed, dartlike needle. These serrations and barbs are mostly far too small to be drawn. A few examples are illustrated in Plates 112.12–15. All macrocypridid species have these specialized knee setae, whether or not their nature is indicated in the drawings. In life position, they are directed horizontally along the anterior-posterior axis. They are identically formed in males, females, and juveniles.

Four cylindrical to lamellar, elongate podomeres complete the leg, of which the middle two are fused along an inflexible suture, while the others have flexible articulations. The first two podomeres each bear one ventrodistal seta. The third bears two ventrodistal setae, approximately equal in size, but one may be curved out (laterally) and up (dorsally) in a different plane from the rest of the limb, explaining its variable position in drawings of dissection mounts. Of the three terminal setae, two are usually very small, smooth, tapering, and simple in structure. They vary more in size than has been supposed, however, and in *Mx. kornickeri,* for example, one of these setae is nearly as long as the reflexed, feathered seta. Such a development has been thought to characterize the cypridid genus *Paracypris,* but there is, likewise, more variability within *Paracypris* and other paracypridine genera of marine Cyprididae than has been usually recognized (Maddocks, 1988b). This shows the futility of generic and familial diagnoses based on few species and a few key characters.

The third terminal seta is very large and reflexed, with a strong shaft and a more or less coarsely feathered cleaning plume. The fine, tapering, close-set, parallel hairs or barbs on both sides of this flexible comb can only be approximately rendered in the drawings. This terminal plume is twisted or divided at about midlength, and the barbs or hairs of the distal part are set in a different plane than those of the proximal part. There may also be an abrupt change in size of barbs at this point, sometimes marked by one or a few especially conspicuous barbs. The size of this reflexed seta relative to the rest of the limb varies recognizably among species, but the high correlation of that character with overall size and other limb dimensions shows that this obvious feature may have less taxonomic value than might be supposed (Maddocks, 1988a).

Furcae.—The furcae of Macrocyprididae consist of two cylindrical, rodlike rami, fused near their base and not separately movable. One long terminal seta completes each ramus. Up to four very tiny setae originate in a clump far back on the ramus. Although they are so small as to be hardly more than secondary cuticular hairs, they are set in a large circular opening like those that mark the insertions of other setae. Their consistent number and position suggest that they are vestiges of and homologous with the proximal furcal setae found in other cypridaceans and bairdiaceans.

In *Macrocypris* and many *Macropyxis* the furcae are inconsequential in size and unlikely to have locomotory function. The terminal seta is long, flexibly tapering, and distinctly separated from the rather short ramus. The four proximal setae, though small, are generally easy to distinguish against the small, weakly sclerotized ramus. In *Macromckenziea* the terminal seta and the distal portion of the ramus have been lost, so that the furcae consist of two vestigial nubs surmounted by two to four proximal setae. In the remaining genera the furcae are very large and rigid. The terminal seta is short and swollen to the thickness of the ramus, and the dividing suture may disappear. The result is a thick, stiff, curved or straight pair of tweezerlike rods, which are not separately movable, however. By comparison, the two to four proximal setae are often hard to distinguish against the heavily sclerotized ramus, though they are probably always present. In *Macrocypria* one of the two rami is greatly reduced, and moderate asymmetry is not uncommon in certain species of other genera.

In *Macrocypris* and *Macromckenziea* the furcae are usually sexually dimorphic, those of the male being reduced in comparison to the female and sometimes drastically so. Dimorphism has not been observed in the furcae of the other genera.

The furcae of some species and genera may be highly distinctive, although the possibility of sexual dimorphism and sometimes considerable individual variability dictate caution in taxonomic use of this character. The generic diagnoses proposed in this monograph include furcal characters as an important element, though certainly only one of many criteria that should be evaluated. The visibility of the furcae, even on an undissected animal, and the ease of description are practical arguments for taxonomic reliance on this limb. As is ever the case in ostracode taxonomy, however, the macrocypridid furca is subject to homeomorphy. The asymmetry of certain species of *Macroscapha* and the *Macromckenziea*-like sexual dimorphism of *Macrocypris minna* are examples of features that have been interpreted as homeomorphic herein. *Mx. amoena* and *Mk.* sp. 19 are other examples of species that might be assigned to different genera if the furca were given more taxonomic weight. Some part of the variability apparent in Figures 46 and 47 also results from position on the dissection slide, but this rarely causes difficulties in evaluation. For example, Figures 47.39,40 show lateral and flattened posterior views of what is essentially the same configuration.

The taxonomic consistency of furcal structure suggests genetic control and a significant function in the life of the animal, but any hypothesis concerning that function must await observation of living animals. It may be significant that the size of the furcae is inversely related to the robustness of the antennae and antennules. For example, species of *Macromckenziea* have thick, muscular antennules reminiscent of those of burrowers (such as *Cytherella* and *Argilloecia*) but vestigial furcae, while species of *Macrocyprina* have delicate, possibly tactile, elongate antennules but stout, possibly propulsive furcae.

BODY AND GENITALIA

Forehead and mouth.—The head capsule of Macrocyprididae is a large, quadrate sheath with the forehead and upper lip joining at nearly right angles, with two diagonal, posterodorsal processes, but without fringes of hairs or other accessory elaboration (see also Schulz, 1976, fig. 84–87). Two rather feebly denticulate, arcuate ridges border the lower lip, which is otherwise narrow and weakly sclerotized. It is easily pulled apart, yielding two L-shaped structures that may be homologous with the rake-shaped structures of other cypridaceans. The margins of the upper lip usually bear a single row of very tiny, short cuticular hairs. This rather simple mouth structure is consistent throughout the family, suggesting uniformity of diet. There is nothing similar to the fan-shaped, tongue-in-circle chewing apparatus of the Bairdiidae, even though bairdiids are also sediment ingesters.

Two large, brown, spherical fecal balls occupy the gut. They consist of silty, sharp-edged, fragmental sedimentary detritus in a yellow-brown, amorphous matrix. Under plane transmitted and cross-polarized light, the birefringent mineral particles and biotic skeletal fragments are distinct but rarely identifiable, although coccoliths, fragmentary diatom frustrules, spicules, and both planktonic and benthic foraminiferal tests have been seen. The marine sediments inhabited by Macrocyprididae have substantial biogenic components, and the few recognizable bioskeletal fragments likely were ingested as sedimentary detritus rather than as living prey. Usually, roughly half to much more than half of the fecal ball consists of this mineral detritus. Occasional wisps, shreds, spines, and clumps of possible chitin or other organic composition were seen. Spherical cells and clumps of cells or eggs, fecal pellets, and black-walled spores or algal cysts were also noted occasionally. Large-scale inhomogeneities of color and composition within a single fecal ball suggest that macrocypridids have a variable, adventitious diet, with the animal feeding on whatever it encounters in scavenging fashion, rather than consistently selecting a particular food item. SEM examination of fecal balls might yield more information than optical analysis. Plates 82 and 83 illustrate some typical fecal balls and a few of the tantalizing, almost identifiable, biological structures seen in them.

Furcal attachment.—The framework of chitinous bands to which the furcal muscles attach is called the furcal attachment. The taxonomic value of this apparatus was first demonstrated by Rome (1969) for freshwater Cyprididae. In general in Macrocyprididae, the furcal attachment is thick and well developed in those genera that have large, rigid furcae, chiefly *Macroscapha* and *Macrocyprina*, and in males. In forms with small, delicate furcae, such as *Macrocypris* and *Macromckenziea*, and in females it may be very weakly developed or even absent. Within a genus or species, this apparatus shows sexual dimorphism in its robustness of development. It is likely that details of its morphology differ among species and genera and have taxonomic value, as Rome postulated for the Cyprididae, but these differences were not systematically studied for this monograph. Plates 110 and 111 illustrate the potential diversity and taxonomic value of this character.

The furcal attachment consists of a paired series of articulated chitinous rods that run along the posterolateral flanks of the body. The posterior branch, probably homologous with the *extrémité articulaire* and *partie médiane* of Cyprididae (Rome, 1969), articulates with the furca. Although its exact shape differs, this posterior branch is rather short, approximately straight, and runs horizontally or slightly dorsally. At its anterior end it articulates with or is fused with a second, dorsal rod, presumably homologous with the *branche dorsal*, which rises obliquely. The cuspate margins give this dorsal branch a meandering course, but no branching offshoots comparable to those of some Cyprididae have been observed. The furcal muscles attach to the posterodorsal edge of this dorsal branch.

In males only, a third, ventral pair of chitinous rods articulates at the same joint, probably homologous with the *branche ventrale* of Rome (1969). These two short, ventral branches fuse together almost immediately to form a single, very thick, broad ventral plank with expanded articulatory ends, in the shape of an I, Y, or X. This I-beam runs forward along the ventral midline of the body to articulate with the copulatory organ. The muscles that rotate the copulatory organ forward attach at the expanded anterior end of this I-beam and along the anteroventral edge of the dorsal branch. This ventral branch is absent in females, unless the muscularized, arched, chitinous loops of the genital lobes are homologues.

In species and genera that have robust, well-muscled furcae, the posterior and dorsal branches are well developed in both males and females. A sturdy ventral branch is present only in males, and the dorsal branch is thicker and more uniformly sclerotized in males than in females, probably because muscles attach to both the anterior and posterior edges of this branch in males but only to the posterior edge in females. In forms with small, weak furcae, males have well-developed dorsal and ventral branches but a thinner, poorly sclerotized posterior branch. In the corresponding females the dorsal and posterior branches are very thin or entirely absent. The degree of reduction corresponds to the decreasing size and muscularity of the furca. Conspicuous sexual dimorphism of the furca is accompanied by enhanced sexual dimorphism of this apparatus.

Male genitalia.—The testes are paired, compact, spindle-shaped, dark brown glands housed in the dorsal midsection of the body. They do not enter the vestibules or press tightly against the carapace, as is the case in Cyprididae and Pontocyprididae. The sperm have exceedingly long, sticky, finely spiral tails and very tiny, optically nondescript heads. The sperm generally are wound tightly together in looped bundles like skeins of yarn. Sperm start to form before the last molt, and sperm bundles have been seen within an A–1 male instar preparing to molt, together with poorly sclerotized but recognizable Zenker's organs and the flabby precursors of hemipenes.

The paired Zenker's organs are large, heavily sclerotized, symmetrical, located posterodorsally, and usually visible from outside the carapace. Each has a swollen anterior bulb and a heavily muscularized, dense, bristlelike, cylindrical array of numerous chitinous spikes surrounding the tubular extension of the vas deferens. A daisy-wheel pattern on the end of the anterior bulb marks the entrance for sperm, whose tiny heads are often seen tightly clumped within this bulb. There is a wide range of variability in shape of the Zenker's organ, and each configuration is characteristic of a species group (see Plates 98 to 109). The proximal portion of the vas deferens as it leaves the Zenker's organ is heavily sclerotized, relatively wide in diameter, and rather inflexible; it is usually coiled or looped in a taxonomically distinctive fashion. The distal portion of the vas deferens is a narrow, undistinguished tube running down into the hemipenis.

The hemipenes or copulatory organs are inflexibly mounted on a short, thick, heavily sclerotized, chitinous rod, which articulates with the end of the fused ventral branches of the furcal attachment. The hemipenes are not separately movable. Each hemipenis consists of a muscularized, more or less compressed, lamelliform basal capsule, with one or more distal accessory lamellae. The vas deferens enters the heavily sclerotized, short, curved, tubular copulatory tube. The accessory copulatory rod near its exit may be short, thick, and straight to long and flexibly coiled. The variety of accessory structures defies verbal description and functional interpretation. Nevertheless, each configuration is unique to a species and readily facilitates its identification. It is also possible to trace structural homologies among the hemipenes of groups of two or more species, though not yet systematically across all species of the family. Danielopol (1978, fig. 28, 40) illustrated possible homologies with other Cypridacea.

Although individual variability exists in this organ, especially in the degree of sclerotization, it is certainly the second-best source of evidence for identifying a species, after the carapace. Plates 85 to 97 illustrate several different males for each species to document the extent of the intraspecific variation and to show the taxonomic reliability of this organ. Its complexity should make it relatively easy to detect homeomorphs and to trace phylogenetic connections among closely related living species.

Female genitalia.—Unfortunately, as is generally the case with ostracodes, the corresponding female genitalia are nondescript and offer little taxonomic assistance. The ovaries are compact, spindle-shaped, dark brown glands much like the testes. The uterus and seminal receptacles are generally invisible except for their contents. Developing eggs in the uterus become dark yellow spheres, and the posterior region of the body of a mature female may contain 10 to 20 or more of these eggs. No eggs or developing young have ever been found in the domicilium, nor does the posterior part of the carapace offer enough space to make brooding likely.

The external genital lobes are low, poorly sclerotized mounds without distinctive shape, with short, thick, weakly coiled ducts. Two very large, dense, cocoon-shaped bundles or open, wheel-like coils of sperm are usually present in the seminal receptacles, which may occupy much of the posterior volume of a mature female. How long the sperm may be kept is not known.

The posterior body of the female is a weakly sclerotized, chitinous sack. The posterior and dorsal branches of the furcal attachment are more weakly developed in the female than in the corresponding male. Whereas the tapering posterior body of the male is rigid and has conspicuous furcal and copulatory muscles, the posterior body of the female is flimsy and expandable, ballooning as it is packed full of sperm and eggs.

INTERPRETIVE MORPHOLOGY

SEXUAL DIMORPHISM

The sex of adult macrocypridids is readily determinable if the carapace is gaping to reveal appendages and genitalia. If the closed carapace is transparent, the paired Zenker's organs of the male or the eggs of an ovigerous female may be visible through the dorsal region of the carapace. To determine the sex of closed, opaque adults and nearly all juvenile specimens it is necessary to open the carapace, a procedure often accompanied by damage. In this study it was possible to ascertain the sex of nearly every live adult (specimens collected living, preserved in alcohol, containing soft parts) of all but two species, *Mc.*

arcuata, which had over 900 specimens, and *Mh. atlantica,* an abundant, opaque species for which most of the borrowed specimens were returned before this question was investigated.

Secondary sexual dimorphism is visible in the carapace proportions for most species and genera of Macrocyprididae (see Graphs 1 to 76). Males are usually similar in shape to females but somewhat more elongate. In many species the males are not quite as long or as high as females, and in others they are about the same length but not as high, while in a few species the males are distinctly longer as well as lower than the females. The thickness of the carapace is difficult to measure accurately and routinely in Macrocyprididae, especially in living specimens, and has not been measured in this study. No differences in thickness or in dorsal outline between males and females were apparent by inspection.

All of this differentiation takes place in the posterior region of the carapace. If drawings of male and female valves are superposed, it will be seen that they overlap nearly identically around the whole anterior region, and that it is only the region of the carapace posterior to the adductor muscle scars that differs by being more stretched out in males. Although these differences in carapace dimensions are statistically significant, the male and female clusters commonly overlap on the length-height graphs, so that the sex of some nondescript carapaces may be in doubt according to this criterion. Even so, in sufficiently large fossil populations it should be possible to sort most adult carapaces by sex.

Incipient or precocious sexual dimorphism in the sense of Whatley and Stephens (1977) is apparent in the last and next-to-last instars, as discussed below. Its magnitude is slight, however, and there is little hope of determining the sex of juveniles from the carapace alone. Sexual dimorphism is also apparent in the structure of the antennae, fifth limbs, furcal attachment, and in some cases the furcae, as described above for those structures.

SEX RATIOS

Table 1 presents the numbers of adult males and females for each living species, determined from soft parts and pooled for all sampled populations of that species. Rare sexually indeterminate specimens and empty or fossil carapaces are not included in these tallies. These counts total 560 males and 1172 females, a male:female ratio of a little less than 1:2.

Before interpreting sex ratios, it is necessary to assess their validity. The choice of screen size for washing sediment and other sampling methods may bias sex ratio in the recovered assemblage, if one sex is larger than the other. In Macrocyprididae it is the females that are both larger and more abundant, and thus there is little doubt that the overabundance of females in nature is at least as great as that seen in these samples. Because two or more juvenile size classes were represented in the sampled populations of most species, the lesser abundance of males is real and not the result of sampling bias.

It is common in marine invertebrates for males to die younger, to be present in the population only during certain seasons, or to be smaller. Such partitioning of biomass between the sexes may promote trophic efficiency and maximum production of offspring by a food-limited population. The first two strategies would be discernable in the sex ratios of seasonal collections of living populations but not in time-averaged thanatocoenoses or fossil assemblages. Because adult ostracodes do not grow, survivorship or mortality rates for adults cannot be directly inferred from size-frequency analyses of dead or fossil assemblages.

Nearly all adult females examined had eggs in the ovaries and sperm in the seminal receptacles. This ability to stockpile sperm for future use would facilitate life histories in which males are less abundant and infrequently encountered. It is not known how long the sperm remain viable, whether either males or females copulate more than once, or whether females can produce more than one clutch of eggs from one mating. Observation of living animals will be necessary to establish the exact life history.

Parthenogenesis, the ultimate inequity of sex ratio and a common phenomenon in freshwater ostracodes, is rare to nonexistent in marine ostracodes, and there is no evidence for it in Macrocyprididae. Males are known in all except the very rarest species studied, and it seems that all Macrocyprididae are syngamic.

Van Harten (1983) explained the decreasing male:female ratio in late instars and adults of subfossil assemblages of *Cyprideis* (Podocopida, Cytheracea) as the result of intraspecific resource competition. Juvenile males of *Cyprideis* are larger in volume than corresponding females, he said, although adult males and females are approximately equal in volume. Specifically, he proposed (p. 577) "for ostracodes with intersexual size differences in their juveniles that resource competition between successive instars will lead to differential survival of the sexes and hence to a progressive shift of the sex ratio in the later phases of development. The ratio changes in favour of the sex that has the smaller larval dimorphs." Invoking Przibram's rule of ostracode growth by doubling in volume at each molt (Przibram, 1931; Kesling, 1952), van Harten interpreted this phenomenon as an extension of Hutchinson's empirical rule that noncompetitive coexistence of similar species requires a size differential of about 2× (Hutchinson, 1959; MacArthur, 1972).

In living populations of Macrocyprididae, males are both smaller and less abundant as late instars and as adults. Van Harten's mechanism of inter-instar competition (between the smaller members of one instar and the larger members of the next-younger instar) seems not to apply here. His hypothesis also does not explain why competition should exist between instars but not within instars.

Table 1. Total numbers of living adult males and females in each species and genus of Macrocyprididae. The counts do not include juveniles, empty carapaces, or sexually indeterminate individuals. The asterisk (*) indicates additional specimens too opaque to determine sex or too numerous to count. The dagger (†) indicates type specimens, not necessarily representative of sex ratios in natural populations.

Species	Males	Females
M. minna	1	30
M. maioris	9	4
M. metuenda	46	115
M. miranda	3	13
M. proclivis	—	2
M. sp. 1	—	1
Mk. siliquosa	33	39
Mk. glacierae	7	17
Mk. ligustica	—	2
Mk. sp. 3	—	1
Mk. sp. 5	—	1
Mk. sp. 6	—	1
Mk. sp. 19	1	—
Mx. sapeloensis	112	151
Mx. adrecta	1	3
Mx. adunca	2	4
Mx. amanda	3	10
Mx. amoena	2	1
Mx. antonbruunae	6	2
Mx. arta	4	1
Mx. audens	3	6
Mx. bathyalensis	4	8
Mx. eltaninae	1	3
Mx. kaesleri	1	9
Mx. kalbi	5	4
Mx. kornickeri	1	1
Mx. labutisi	139	512
Mx. similis	1	3
Mx. sp. 8	—	1
Mx. sp. 11	—	1
Mx. sp. 16	—	1
Mx. sp. 17	—	1
Mx. sp. 18	—	1
Mx. sp. 21	—	1
Mx. sp. 46	—	2
Ma. sarsi	6	31
Ma. semesa	1	1
Mc. arcuata	*	*
Ms. bensoni	1*	3*
Ms. capacis	1	8
Ms. hiulca	1	2
Ms. sp. 23	1	—
Ms. sp. 47	—	1
Mh. atlantica	25*	29*
Mh. heroica	1	1
Mh. inaequalis	2	2
Mh. inaequata	5	6
Mh. marchilensis	1*	1*
Mh. opaca	28	38
Mh. sinuata	4	4
Mh. tensa	1	8
Mh. turbida	18	13
Mh. sp. 25	1	—
Mh. sp. 30	*	*
Mn. propinqua	3†	2†
Mn. africana	1	2
Mn. barbara	5	7
Mn. bermudae	9	8
Mn. captiosa	3	1
Mn. dispar	1	2
Mn. hartmanni	1	2
Mn. hawkae	11	2
Mn. hortuli	3	1
Mn madagascarensis	11	11
Mn. moza	—	1
Mn. noharai	—	1
Mn. schmitti	5	2
Mn. skinneri	16	11
Mn. succinea	8	11
Mn. swaini	1†	2†
Mn. vargata	—	2
Mn. sp. 39	—	1
Mn. sp. 40	—	2
Mn. sp. 42	—	1
GENERA		
Macrocypris	59	165
Macromckensiea	41	61
Macropyxis	285	726
Macrocypria	7	32
Macrocyprissa	*	*
Macrosarisa	4	14
Macroscapha	86	102
Macrocyprina	78	72
Total	560	1172

Resource competition within instars would favor the larger dimorphs (females of Macrocyprididae, males of *Cyprideis*). If both within- and between-instar modes of competition exist, one may negate the effect of the other. It is hard to see why trophic competition should exist at all in populations of *Cyprideis* inhabiting food-rich estuarine and lagoonal environments, where biological productivity is so high that unutilized organic detritus accumulates in sediments to make future fossil hydrocarbons. It is also difficult to explain why intraspecific competition would be more severe than (and how it would be distinguished from) competition with other species, not only of ostracodes but of many other kinds of meiobenthos.

Van Harten's suggestion that clinally varying sex ratios of geographic populations of a species may indicate the magnitude of resource competition and, therefore, serve as paleoecologic or paleoceanographic indicators merits further study. In shallow waters where seasonal influences are likely to cause seasonal changes in population age- and sex-structure, such studies should be conducted on time-averaged, subfossil or fossil thanatocoenoses. The counts in Table 1 are of living individuals, and these sex ratios represent time-specific rather than time-averaged measures. Nonetheless, it is of interest to examine the compiled sex ratios for genera in Table 1. The greatest inequalities are found in the deep-sea genera *Macrocypris, Macromckenziea,* and *Macropyxis,* in which females average more than twice as abundant as males. Is it coincidental that these genera also exhibit the most conspicuous size dimorphism? At the other extreme, species of *Macrocyprina* and *Macroscapha,* which live in relatively shallower, food-rich environments and which show much less size dimorphism, have nearly equal sex ratios. Perhaps the sex ratio and the magnitude of size dimorphism in Macrocyprididae would provide useful paleo-indicators for the trophic regimen and thus for the depth and organic content of sediment. This hypothesis needs further testing in dead and fossil assemblages.

INTRASPECIFIC MORPHOLOGICAL VARIABILITY

Many taxonomists, impressed by the demonstrated ecophenotypic plasticity of the ostracode carapace, have wondered whether the appendages and genitalia show as much intraspecific variability. In this study, within-population variability of carapace and appendage characters was estimated subjectively by dissecting many individuals. Carapace length and height were measured for every specimen, but no other character was measured systematically. The soft-part anatomy is very consistent within species of Macrocyprididae. Individual variation does exist, but for the most part it is noticeable only in vestigial characters that are not likely to have taxonomic value. More variability is introduced into published illustrations, including those of this volume, by dissection damage, pressure of the cover glass, artistic limitations, and the author's ignorance than from true within-population sources. Occasional pathological individuals may show interesting anatomical discrepancies or distortions, but their taxonomic identity is never in question.

The carapace shows more and more subtle variation. Calcification of the carapace and sclerotization of some cuticular structures may vary among adults of a population in a manner consistent with aging of the adult following the final molt. The width of the zone of concrescence and the degree of complexity of branching of radial pore canals are especially influenced by this process and should be described for populations rather than isolated individuals. Carapace shape, especially of the posterior end, shows real differences within and between populations and sexes. To document the nature and degree of variability recognized within species, and to allow the reader to draw independent conclusions, the carapaces and male hemipenes of several different individuals are illustrated for each species in the plates of this volume.

SIZE AND BATHYMETRY

In many species, size appears to increase with depth. This common size-depth cline is not as clear-cut in Macrocyprididae as originally supposed (Maddocks, 1977), however, as the length-height plots (Graphs 1 to 76) of this volume show. This phenomenon is most conspicuous in bathyal species; see, for example, *Mk. siliquosa* (Graph 7), *Mx. bathyalensis* (Graph 22), and *Mh. turbida* (Graph 52). It is weak to nonexistent in species of *Macrocyprina,* perhaps because most of these have depth ranges of only a few tens of meters (but see *Mn. skinneri,* Graph 73). A reverse trend toward decrease of size with depth appears in some abyssal macrocypridids.

Other environmental factors also influence size, and the heterogeneous data of this study do not readily allow these separate effects to be discriminated. For some deep-sea species there is a weak trend toward increased size at higher latitude. Commonly a size difference exists between populations of the same species from adjacent geographic basins, as for example in the Sierra Leone, Angola, and Cape basins of the southeast Atlantic. Two regions that yield especially large species are the southeast Pacific Ocean off Peru and Chile and the southeast Atlantic Ocean off Angola, Namibia, and South Africa. Both regions have very high biological productivity in surface waters, which may be reflected in higher organic content of sediment and lower oxygen levels in bottom waters. It is likely that both oxygen and temperature influence size, as well as depth, and that hydrographic parameters control much of the geographic variability seen. Peypouquet (1979) suggested that increased size in *Parakrithe* is directly linked to high concentrations of dissolved phosphate, reaching a maximum in the epibathyal zone.

Macrocyprididae do not show the bimodal size-frequency distributions within populations (apart from sexual dimorphism) that have been demonstrated for *Krithe* (Kaesler and Lohmann, 1976) and other ostracodes.

SIZE AND SYMPATRY

Hutchinson's empirical rule predicts that similar, sympatric species must differ in size by a factor of about 2× in order to coexist (Hutchinson, 1959; MacArthur, 1972). Przibram's rule states that ostracode instars double in volume and increase in linear measures of size by a factor of about 1.26 with each molt. Van Harten (1983) pointed out that both of these empirical generalizations may result from competition for food or other resources. This idea has been expanded to govern competition between instars and sexes as well as species (Angel, 1977; van Harten, 1983). Angel (1977) suggested that competition between sibling species of halocyprid ostracodes is responsible for maintaining discrete size-clusters of instars as well as for the phenomenon he called (p. 54) "interdigitating instar sizes," in which instars of two coexisting species alternate in size, one instar-cluster falling within the gap between adjacent clusters of the other species.

Macrocyprididae show discrete size clusters at any one station, if only one sex is plotted, and in practice the blurring of these clusters is often the first sign that two species are mixed in the material being studied. The best example in the material studied is provided by *Mx. sapeloensis* and *Mx. labutisi*, which caused considerable confusion and labor in separation. These two species are fairly similar in external appearance and nearly always occur together. Adults of the smaller species, *Mx. labutisi*, are approximately the same size as or slightly larger than the A–1 instar of the larger species. Superposing Graphs 13 (*Mx. sapeloensis*) and 28 (*Mx. labutisi*) produces an amorphous swarm of points. If just one sex is plotted, however, it can then be seen that the interdigitation is not exact and may be fortuitous. The exact cause of this interdigitation, if it requires one, must be regarded as yet undetermined. It seems unlikely that food would be a limiting resource for sediment-ingesting animals such as macrocyprids. Food balls in the gut of many species of Macrocyprididae have been examined during this project without finding any consistent compositional differences that would be evidence for selectivity of diet.

The relatively small number of species (usually one, two, or three) found at one locality also suggests that species of Macrocyprididae may compete with one another, but whether any of the discrepancies in size between geographic populations of the same species can be attributed to competition with co-occurring species is another matter. Inspection of the length-height graphs for those few species whose geographic and bathymetric ranges are fairly well established shows no effect attributable to presence or absence of another species. A real test of this hypothesis will require more detailed sampling, control of bathymetric and hydrographic effects, and statistical evaluation.

MORPHOLOGY AND BATHYMETRY

Neale (1988) speculated that deep-sea ostracodes of many taxa develop longer, thinner walking legs and greatly expanded, hirsute, tactile sensory setae on appendages. There is little evidence for such trends in Macrocyprididae. The only walking leg is the sixth limb (see Figures 32 to 35), which is exceptionally conservative in its proportions and setal development. R-mode principal component analysis (Maddocks, 1988a) showed that the dimensions of this limb are strongly and nearly equally controlled by overall size. In fact, the first eigenvector, interpretable as the effect of general size, explained 73 percent of the total variance and had very high loadings on nearly every dimension. The second and only other significant eigenvector explained only nine percent of the variance and had its highest loadings on two or three of the terminal setae, highlighting different setal configurations. Neither eigenvector discriminated podomere lengths from podomere widths, as would be necessary if there were systematic changes in podomere proportions. Neale (1988) suggested possible tactile function for the carrot-seta on the ventral margin of the basal podomere of the walking legs in deep-sea cytheraceans, which is especially conspicuous in Trachyleberididae. The homologous seta in Macrocyprididae arises under the knee of the sixth leg, is small and simple, never hirsute, and shows no variation of taxonomic or bathymetric value.

Hartmann and Hartmann-Schröder (1988) reviewed a list of morphological attributes thought to typify deep-sea dwellers (thin carapace wall, ventral flattening, ventrolateral wings, reduced number of marginal bristles and spines) and concluded that none is restricted to this habitat. Some of these characters are not found in any Macrocyprididae, while others occur equally in shallow and deep residents. Diminution of reticulate and costate ornament obviously is never seen in Macrocyprididae, which do not have any trace of reticulate or cryptoreticulate ornament. Reversal of valve overlap and hingement, said by Peypouquet (1979, 1980) to typify lower bathyal species of *Krithe* and *Parakrithe*, does not appear in Macrocyprididae. The deepest known Macrocyprididae are species of *Macropyxis*, but that genus is also well represented by bathyal species, including live records as shallow as 49 m (*Mx. labutisi*).

CARAPACE SHAPE ANALYSIS

With smooth, nearly featureless ostracodes such as the Macrocyprididae, the lateral outline of the carapace perforce assumes extra importance. Most of the species in this monograph present distinctive lateral outlines, and even though they vary in outline among individuals, sexes, and geographic populations, it is not hard to sort specimens into species. To describe and communicate the exact nature of these differences is more difficult, however. Harmonic analysis was applied to outlines of Macrocyprididae by Kaesler and Maddocks (1988) with some success. Multivariate morphometric techniques of shape analysis have been found effective with other smooth ostracodes (Lohmann, 1983; Kaesler and Foster, 1988; Foster and Kaesler, 1988). Roger Kaesler is applying these methods to the species in this monograph.

GENERAL COMMENTS ON CHAETOTAXY

Macrocypridid limbs consist basically of a series of tubular, rigidly sclerotized podomeres, articulated at flexible joints. Movement at these joints is usually restricted to two dimensions and to a few tens of degrees of arc. Cylindrical setae arise at socketlike, round perforations through the sclerotized cuticle of the podomere, mostly at the distal margin. These sockets may testify to the former presence of a seta at a particular location in damaged individuals or in taxa in which the seta has become reduced or vestigial. Terminology for describing setae has not been standardized for Ostracoda (but see Broodbaker and Danielopol, 1982).

All setae are hollow, with a thickened, rigid proximal shaft and a narrower, tapering distal part. The rigidity of the seta is determined by the thickness of its cuticle and the ratio of diameter to length. Such somewhat redundant descriptions as robust claw or slender, flexible seta merely label extremes of setal development. The tip of the seta may taper symmetrically or obliquely to a needlelike point or slender whip, or it may be flattened and taper symmetrically to a bladelike, angulate, or spatulate hook. A thick example of the latter is likely to be termed a chela or claw. In many species the antennal claws end in flared, slightly spatulate tips with sinuous outlines, resembling a ballet dancer's foot on point, except that the heel is anterior. The exquisite detail of these varied setal terminations is difficult to render in line drawings except for the largest species and setae, but fortunately the character of a seta is markedly uniform across most species and genera of the family.

The proximal part of a seta may be smooth (often termed simple), or it may carry numerous, tiny, secondary cuticular setules (hairs or scales). Depending on the number, size, and arrangement of setules, such setae may be described as barbed, serrate, or plumed setae or as bristles. Setules are solid rather than hollow and do not contain nerves or other soft-tissue elements. They probably do not have discrete identities in the sense of homology. These setules are mostly too small to be drawn to scale, and they have generally been omitted from the line drawings in this paper. Their development on a particular seta is a very consistent taxonomic character, hardly varying at all throughout the species of a genus or the genera of this family. Most variation is strictly a function of size, so that the setules are more easily seen and illustrated for a large species than a small one—another reason why they have been indicated only sporadically and perfunctorily in these illustrations.

Setae with inferred chemosensory function (**aesthetascs** of Danielopol, 1971, 1978; Broodbakker and Danielopol, 1982) have a very thin, transparent, slightly granular-textured cuticle. Beyond the stout proximal shaft, the distal portion may flare to a balloonlike vesicle or a flambent tongue, or may be flattened into an ovate disk, or may be extended as an elongate, sausagelike lobe or flattened ribbon. The location and development of these chemosensory setae, likewise, is extremely consistent throughout the family, although the differentiating details are more easily seen and more readily illustrated for the larger species.

In fact, in spite of the proliferation of terminology (e.g., feather, claw, *griffe*, balloon) to describe these setal forms and inferred functions, it appears that all these types of setae are basically elaborations of a single structure. Many cases are known in which the same, homologous seta has different aspects in two sexes or taxa. The insertion or point of origin of a seta is a highly reliable clue to its identity and rarely changes throughout the family, while details of the form, inferred function, and appearance of the seta may vary. Danielopol's (1978) analyses suggest that these homologies persist in very conservative fashion across all families of the Cypridacea. Taxonomically, each seta may be treated as a unit character, while its form is a character state (as asserted on less evidence by Maddocks, 1976). This distinction is more than semantic, inasmuch as careful recognition of homologies is a necessary prerequisite to morphometric evaluation of taxonomic distance and to reconstruction of cladistic sequences in evolution.

NUMERICAL ANALYSIS OF APPENDAGE STRUCTURES

Historically, the appendage anatomy of ostracodes has been evaluated and communicated largely by intuitive, descriptive, nonquantitative means, and the systematic descriptions and illustrations of this monograph do not depart from that tradition. However, considerable effort in this study has been devoted to ascertaining homologies, on which future numerical taxonomic analysis must depend. Maddocks (1988a) presented a preliminary R-mode multivariate analysis of macrocypridid appendages, exploring the potential taxonomic usefulness of 104 dimensions of the female fifth limb, male right and left fifth limbs, sixth limb, seventh limb, and male and female furcae (measured on Figures 25 to 47) of 71 species. The interpreted results emphasized the relative independence and consequent potential taxonomic significance of individual characters as well as possible nonlinear relationships among certain characters. Certain characters, such as the reflexed seta of the seventh limb, were shown to be so strongly dependent on general size as to have much less independent taxonomic information than hitherto supposed. The next step is to use these insights to compile a matrix of selected characters versus species for Q-mode multivariate analysis of phenetic relationships among species and to develop cladistic models. This analysis will be published separately.

DEVELOPMENTAL BIOLOGY

To study ontogenetic development, the carapace, posterior appendages, and furcae were emphasized. These have relatively simple structure and may often be recognized without dissecting the animal, a practical convenience. The results show that the maturational stage of an individual of any species may be readily ascertained by examining the development of the fifth, sixth, and seventh limbs and furcae. The developmental trends illustrated by Müller (1894) for *Mn. succinea* are shown to be accurate and to be generally valid for other species and genera of Macrocyprididae as well. The four cephalic appendages also show systematic, interesting ontogenetic changes, but because of their morphologic complexity and relative inaccessibility they are less well suited to routine determination, and these changes were not analyzed in detail. Juvenile antennules, antennae, mandibles, and maxillules, however, should be compared carefully and would yield many valuable insights concerning homologies and phylogenetic relationships.

In the past, macrocypridid juveniles have often been mistaken for adults. In this study, the presence of a rather wide calcified inner lamella and deep vestibules in juvenile carapaces was confirmed, and the subtle changes in late instars are illustrated. It is relatively simple to recognize an isolated valve as adult or juvenile, but it is not easy to determine which instar is represented unless a population growth series is available. The length-height graphs showing growth series for each species will facilitate future identification of instars of these species.

Occasional pathological individuals have adult size, carapace structure, and nondimorphic appendage anatomy but have poorly developed genitalia and ambivalent secondary dimorphic characters, especially of the fifth limb. A few such specimens appear to be males in which, for some reason, the heteromorphic, male characteristics failed to emerge during the last molt. More are females with normal genital lobes and antennae but with partially masculinized fifth limbs. Such specimens are useful to trace the probable homologies between male and female configurations of the fifth limb.

MOLTING

A juvenile preparing to molt may be recognized by a milkiness of the normally translucent carapace, as the new cuticle inside withdraws from contact. The old carapace splits around the inner margin, and an opalescent white band in this position is another external sign that withdrawal has begun. The anterior and posterior edge of the new carapace, with setae and pores, may be seen within the vestibules of the old carapace as withdrawal takes place. The old carapace does not separate along the hinge, and the valves remain attached.

Both living and subfossil populations include an occasional specimen of adult size and shape but with a narrower zone of concrescence and shorter radial pore canals than the others. It is hypothesized that such a specimen has not yet finished calcification following the last molt (see also Maddocks, 1979). The appendages of such a specimen show more conspicuous cell structure in the epidermis of carapace and appendages, with less well-defined bands of striated muscle. The cuticle also may be lighter in color, and some places that will later be heavily sclerotized may be still quite thin. The calcified parts of the carapace may be thin and brittle. The interior surface of incompletely calcified specimens is smooth, however, rather than hummocky as in some cytheraceans.

No evidence has been found for postmaturational molting. In some subfossil assemblages there may be an occasional valve that is much larger than the other adults, but all such cases have turned out to be separate species. Although it is not uncommon for the larger of two or more sympatric species to be also the rarer, the reverse is somewhat more common, perhaps because of sampling methods. No adult specimen preparing to molt was ever seen, in spite of the fact that adults outnumber juveniles in the collections studied, and numerous molting juveniles were seen. It is likely that the calcification and sclerotization that take place immediately after the final molt would physically prevent a successful subsequent molt.

DEVELOPMENT OF JUVENILES

Carapace.—The juvenile carapace resembles that of the adult in the anterior region, but the posterior region may be shortened or undeveloped, producing a characteristically hunchbacked or foreshortened look in many cases. The calcified inner lamella of late instars is very broad, as broad as adults of some other taxa of Cypridacea, though not quite as broad as that of the macrocypridid adult will be. For this reason, juveniles have rather frequently been mistaken for adults in the past. The differences in shape and course of inner margin are subtle but real and readily apparent if a growth series is examined. The juvenile fused zone is narrow with short, straight radial pore canals. The hinge and muscle scars are like those of the adult. Instars of *Macrocyprina* have fewer, smaller opaque spots than the corresponding adult. Growth series for as many as four (for live animals) to six (empty carapaces) instars are presented in Figures 48 to 55. The absence of very early instars probably is an artifact of sampling procedures for most collections studied.

Fifth limb.—Sexual dimorphism is visible in the last instar (A–1), not only in the carapace dimensions but in the fifth limbs. The male palp is swollen but usually retains faint sutures that help to establish structural homologies with the corresponding female limb. One or two ventral pegs and one or more terminal and other setae may be represented by tiny precursors or *anlagen*. The exact configuration is variable, however, even among individuals of the same species, showing that such details must not be relied upon too heavily either for taxonomic identification of a species or for developmental evidences of homologies. The corresponding female fifth limb has the four-segmented palp of the adult and *anlagen* of the four setae, although these are not invariably present.

In the penultimate stage (A–2), sexual dimorphism is weaker and not always reliable. Usually there are two morphs, of which the more inflated, unsutured palp probably represents the male, while the female-to-be usually has only three rather than four podomeres and may or may not still have retained the long terminal seta of the earlier stages.

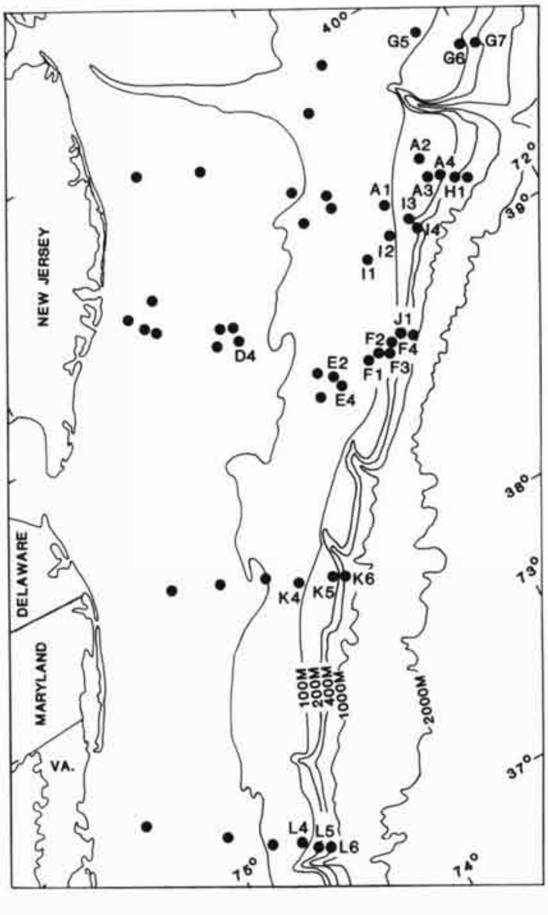
The A–3 juvenile has a three-segmented palp with four long terminal and ventrodistal setae. Males and females cannot be distinguished. The structure is obviously homologous with that of the adult female, even though it will be obliterated in the coming molt only to take form again in the next two molts. This shows that in these metamorphoses it is the male that will be transformed, while the female remains ontogenetically conservative.

The A–4 instar has a very similar three-segmented palp and up to four setae, although in small species the sutures may be indistinct and the whole limb is flexible.

Sixth limb.—The sixth limb of the last (A–1) instar is adult in its structure and setal configuration. The A–2 instar differs only in the occasional rigidity of the suture between podomeres III and IV, which was just formed in the last molt. The A–3 instar has only three podomeres after the knee, and the additional suture and seta are yet to form within the penultimate podomere. In the A–4 instar the sixth limb is represented only by a weakly two-segmented, nearly formless *anlage*.

Seventh limb.—The seventh limb of the last (A–1) instar is adult in all details. The suture between the penultimate and antepenultimate podomeres (III and IV) is rigid but complete, as it will remain in the adult. It forms in the preceding molt from the A–2 instar, which has no suture or seta at that location and has only three podomeres after the knee. The ventrodistal seta of podomere II is also missing, giving the A–2 limb a setal configuration similar to the adult female fifth limb and, correspondingly, an ontogenetically generalized or archaic aspect. The A–3 instar has a weakly two-segmented, nearly formless *anlage* without setae. In the A–4 instar there is no recognizable precursor of this limb.

Furca.—The furca of the A–1 instar is generally like that of the adult in all but size, including sexual dimorphism or reduction of the terminal portion, if such conditions prevail in the adult. The furca of the A–2 instar is rather short but foreshadows the adult structure. The A–3 instar has a tiny, rather nondescript furca with a weakly developed terminal seta. In the A–4 instar no furcal rudiment or precursor could be recognized.



Text-fig. 2. Locations of BLM collecting stations on the middle Atlantic outer continental shelf. Dots without labels show stations that did not yield Macrocyprididae.

BIOGEOGRAPHY

NORTH ATLANTIC OCEAN

M. minna ranges from the Norwegian Sea to the Bay of Biscay and west to Iceland and the Azores (see Graph 1). Also within parts of this range are found the rarer *M. nimia* (see Graph 5), *Ma. sarsi* (see Graph 33), and *Ms.* sp. 24 (see Graph 76). Records off the coast of Morocco may belong to *M. minna* or a related species, but those in the western Atlantic off Greenland, Canada, and New England belong to *Mx. bathyalensis* (see Graph 22). On the shelf edge of the middle and southern Atlantic coast of the United States *Mx. labutisi, Mx. sapeloensis,* and *Mh. atlantica* occur in abundance (see Graphs 13, 28, 43). *Mx. tenuicauda* (see Graph 32) is recorded in epibathyal depths near the U.S. Virgin Islands and on the Florida–Hatteras continental slope. The genera *Macrocypris* and *Macrocypria* are not restricted to a boreal North Atlantic distribution, as supposed by McKenzie (1967a), but are represented in other oceans as well. There appears to be a curious segregation of *Macrocypris* to the east and *Macropyxis* to the west in the Atlantic Ocean, but sampling is still too sparse to speculate on causes.

Macrocyprididae have not been reported from the Greenland Sea, Davis Strait, Baffin Bay, the Gulf of St. Lawrence, the circum-Arctic Shelf, or the Arctic Ocean basin. Joy and Clark (1977) remarked on the total absence of Cypridacea in their bathyal and abyssal sediment cores from the Arctic Ocean and pointed out that the deep-water ostracode fauna of the Arctic is not the psychrospheric fauna found at these depths elsewhere. Benson, DelGrosso, and Steineck (1983) suggested that changes in thermohaline circulation with the onset of Pleistocene glaciation caused and still maintain this difference. The northernmost record of Macrocyprididae in the eastern North Atlantic is Sars's record of *M. minna* off the Lofoten Islands of central Norway, about 68°N. *M. minna* and *Ma. sarsi* reach at least to Ingolf station 85 at 63°21'N in the central Atlantic. The northernmost record in the western North Atlantic is the holotype of *Mx. bathyalensis* at V-17-118, at only 55°50'N.

MEDITERRANEAN SEA

At least three species of Macrocyprididae are living in the western Mediterranean basin, and several more are known or suspected in Quaternary deposits. The genus *Macrocypris* is not included, however, and the exceptionally broad reported bathymetric ranges result partly from taxonomic confusion, as van Harten (1986b) suggested. *Mn. succinea* is common in the sublittoral fringe of the entire Mediterranean, while *Mk. ligustica* and *Mx. adriatica* have broad bathyal distributions in the western Mediterranean. The dearth of live sampling programs makes it difficult to confirm the supposed "autochthonous" occurrences (e.g., Peypouquet and Nachite, 1984). In the upper Neogene and Pleistocene these are joined by *Mc. arcuata*, by a species very closely related to *Ms. bensoni*, and by several unnamed species of *Macropyxis*.

MIDDLE ATLANTIC OUTER CONTINENTAL SHELF

From 1975 to 1977 the U.S. Bureau of Land Management sponsored an environmental study of the middle Atlantic outer continental shelf. This seasonal collecting program sampled bottom sediments and live macrofauna at 51 stations between 15 m and 760 m depth on the continental shelf and upper slope off New Jersey, Delaware, Maryland, and Virginia (Text-fig. 2; data supplied by Marcia Bowen, correspondance 1978–1979). All stations were sampled in February and August of 1976 and 1977, and about half, in the northern part of this area, were also sampled in November 1975 and 1976 and in June 1976 and 1977. Voluminous physical, chemical, sedimentary, and biological data are on file at Virginia Institute of Marine Sciences for this project.

Table 2. Total number of specimens of three species of Macrocyprididae at BLM stations on the middle Atlantic continental shelf for all seasons. Stations are arranged in order of increasing water depth.

Station	Depth (m)	*Mx. sapeloensis*	*Mx. labutisi*	*Mh. atlantica*
D4	49	–	1	–
E2	64	1	–	1
E4	77	1	–	28
I1	78	–	–	10
F1	85	–	–	28
G5	90	11	58	3
A1	91	183	173	64
I2	94	1	1	26
L4	94	–	–	3
K4	105	42	25	40
F2	113	32	21	142
A2	128	17	153	51
A3	136	3	23	1
K5	151	–	1	–
F3	152	–	7	1
G6	167	2	31	–
I3	180	7	4	–
F4	183	16	11	1
L5	180–200	1	4	4
A4	196	1	7	–
G7	310–350	–	13	5
J1	342	–	5	–
K6	340–360	4	6	–
L6	350	1	3	–
H1	350–400	1	–	8
I4	460	–	–	2
Total all stations		324	547	418

Three species, *Mx. sapeloensis*, *Mx. labutisi*, and *Mh. atlantica*, were common at the deeper stations of this array,

Table 3. Total number of specimens of three species of Macrocyprididae at BLM stations A1 through G7 on the middle Atlantic continental shelf for each of the eight collecting seasons.

	Mx. sapeloensis			*Mx. labutisi*			*Mh. atlantica*
	male	female	juvenile	male	female	juvenile	
November 1975	14	13	4	4	40	–	87
March 1976	4	4	7	8	54	14	70
June 1976	7	14	8	7	28	8	33
August 1976	9	12	8	13	63	2	37
November 1976	7	18	18	5	40	2	24
March 1977	11	11	8	14	60	3	8
June 1977	21	21	7	8	42	2	56
August 1977	17	19	5	13	66	2	10
Total	90	112	65	72	393	33	325

Table 4. Total number of specimens of three species of Macrocyprididae at BLM stations H1 through L6 on the middle Atlantic continental shelf for each of the four collecting seasons.

	Mx. sapeloensis			*Mx. labutisi*			*Mh. atlantica*
	male	female	juvenile	male	female	juvenile	
March 1976	8	12	4	3	7	1	42
August 1976	2	3	1	2	7	3	10
March 1977	4	2	4	1	5	–	18
August 1977	2	12	3	7	8	3	22
Total	16	29	12	13	27	7	92

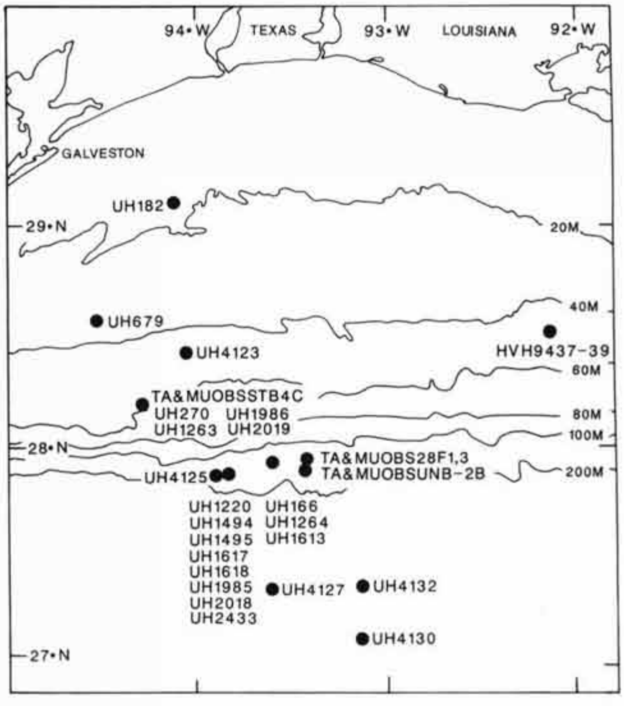
along the outer shelf, shelf break, and upper slope, on sediments containing at least two percent silt and clay (Table 2). They generally did not occur in central shelf swales with fine muds nor on inner and central shelf sands. The patterns of station occurrence are very similar for all three species, with depth ranges of 64 to 400 m for *Mx. sapeloensis,* 49 to 400 m for *Mx. labutisi,* and 64 to 460 m for *Mh. atlantica.* High abundances at stations A1, A2, F2, and K4 suggest distributional acmes at the shelf break between 90 and 130 m. High variability between replicates of the same sample indicates patchy distributions, and, therefore, no statistically significant seasonal trends in abundance could be discerned. Males were less common than females in *Mx. labutisi* and equally common in *Mx. sapeloensis,* but there was no significant seasonal pattern in sex ratio. Males, females, and juveniles were present during all four seasons for all three species (Tables 3, 4). Overall, *Mx. labutisi* was most abundant and *Mx. sapeloensis* least abundant, but at any particular station and season any one of the three species could predominate.

NORTHWESTERN GULF OF MEXICO

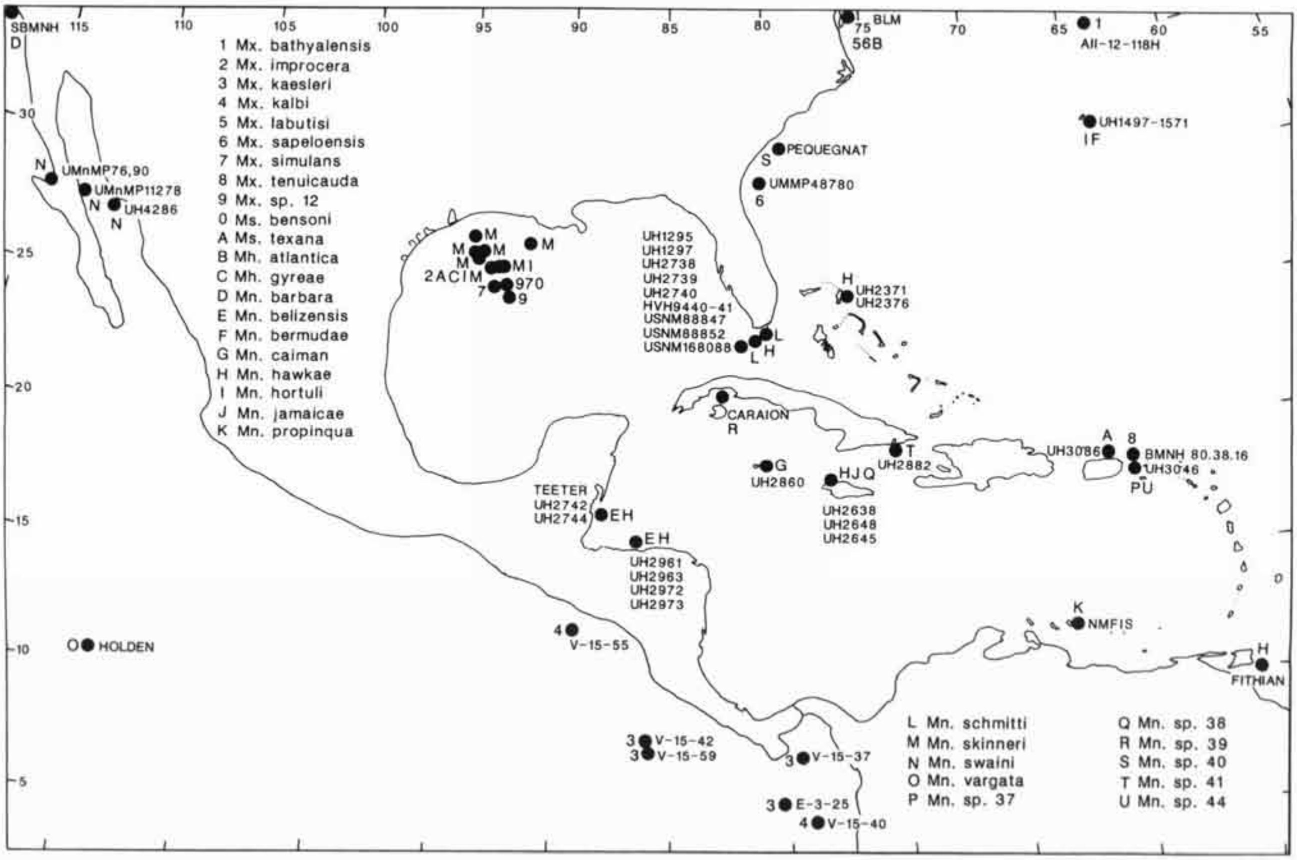
The most common species in the terrigenous clastics on the continental shelf off eastern Texas and Louisiana (Text-fig. 3) is *Mn. skinneri,* with a live depth range of 50 to 101 m (empty valves as shallow as 18 m). On the outer Texas shelf and shelf edge, elevated prominences formed by subsurface salt diapirs have been colonized by reef corals. These coralline banks and pinnacles, such as the Flower Gardens, support outliers of the Caribbean–West Indian tropical reef fauna. On the shelly gravels and algal hardgrounds of these carbonate banks *Mn. hortuli* is abundant. Nearby shelf-edge sediments yield *Ms. texana* and *Mh. gyreae.* The calcareous *Globigerina* oozes of the upper continental slope yield *Mx. improcera, Mx. simulans,* and *Ms. bensoni.*

CARIBBEAN–WEST INDIAN REGION

A complex mosaic of diverse species of *Macrocyprina* characterizes the shallow-water, coral-reef sands of this region (Text-fig. 4). In general, only one or two species are found at any one locality, and many species appear to be geographically restricted. Sometimes it seems that almost every island of the West Indies has its own endemic species of *Macrocyprina.* In some instances there is also a small degree of geographic shape variation among different populations of the same species. Although soft parts were not available for all of these species, in those cases for which they were available they confirmed the separate species identities inferred from carapace evidence. Therefore, corresponding variation in carapace features has been interpreted to indicate species rank for some populations lacking soft-part control. Although the resulting species concepts are narrow, they are consistent with the available evidence. For example, some of the species most similar to *Mn. hawkae* in carapace features, such as *Mn. belizensis,* are



Text-fig. 3. Locations of collecting stations in the northwestern Gulf of Mexico.



Text-fig. 4. Collecting stations and geographic distributions of species in the western Atlantic, Caribbean, Gulf of Mexico, and central eastern Pacific oceans.

known to be sympatric with *Mn. hawkae,* which is further evidence for their separate species rank.

The most widespread, virtually ubiquitous species is *Mn. hawkae,* which has been found so far in the Florida Keys, the Bahamas, Jamaica, Belize, Honduras, and the Gulf of Paria. The carbonate platform off Belize and Honduras also supports the more restricted species *Mn. belizensis,* Jamaican samples yield *Mn. jamaicae,* and the Florida Keys yield *Mn. schmitti. Mn. propinqua* has not yet been found away from the type locality off Bonaire. Bermuda, which is a far-flung outpost of this biogeographic province, supports an endemic species, *Mn. bermudae,* as well as *Mn. hortuli.* The latter also turns up on the shelf-edge coralline banks of the northwestern Gulf of Mexico. In addition, there are enough rare species, here left in open nomenclature, to show that additional sampling will yield more species and a complex fabric of geographic distributions.

SOUTHEASTERN ATLANTIC OCEAN

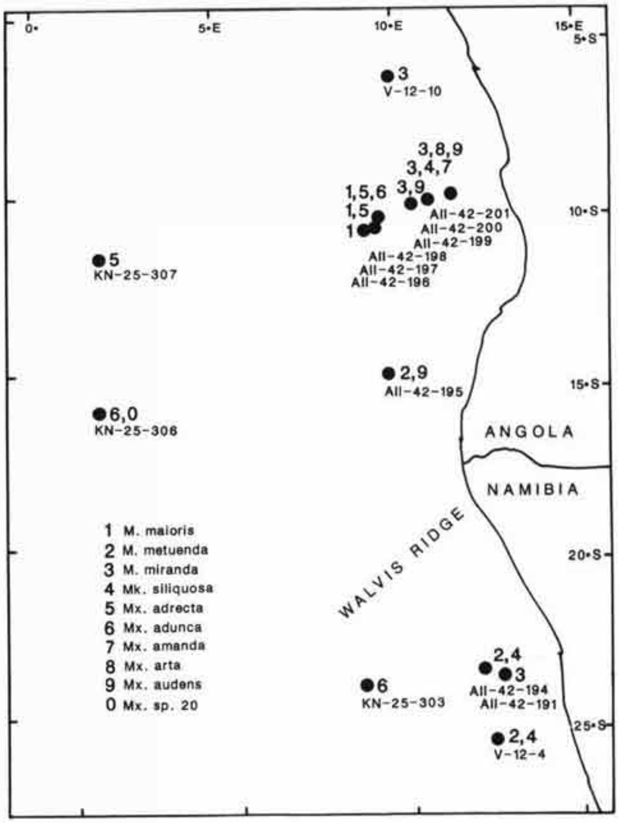
Nine species of *Macrocypris, Macromckenziea,* and *Macropyxis* were found living at 16 stations in the eastern basins of the South Atlantic Ocean (Table 5, Text-fig. 5). *M. miranda* occurs in the Sierra Leone, Angola, and Cape basins, having a latitudinal range of more than 35° and a known depth range of 706 to 3779 m (see Graph 4). *M. maioris* occurred at 2185 m in the Sierra Leone Basin but between 4559 and 4630 m in the Angola Basin. It also was found near the Romanche fracture zone of the Mid-Atlantic Ridge, the most western occurrence of any species of *Macrocypris* (see Graph 2). *Mk. siliquosa* ranges from off Morocco to south of the Cape of Good Hope, having a latitudinal range of more than 65° and a known depth range of 97 to 3111 m (see Graph 7). The inclusion of slightly dissimilar forms (*Mk.* sp. 2 and *Mk.* sp. 7) would extend the range of this species-group to the Mozambique Channel and the southwest Atlantic. *Mx. adunca* has been found at three stations in the Angola and Cape basins and one in the southwest Atlantic, west of the Rio Grande Plateau, the westernmost occurrence of any species in this fauna. *Mx. adrecta, Mx. amanda, Mx. arta,* and *Mx. audens* occur in the Angola Basin but apparently not in the others, on the evidence of present sampling.

Peypouquet and Benson (1980) reported the distributions of other ostracode genera at some of these same

Table 5. Total number of living specimens of 10 species at stations in the southeastern Atlantic Ocean, arranged by depth within each basin. 1 = *M. maioris*, 2 = *M. metuenda*, 3 = *M. miranda*, 4 = *Mk. siliquosa*, 5 = *Mx. adrecta*, 6 = *Mx. adunca*, 7 = *Mx. amanda*, 8 = *Mx. arta*, 9 = *Mx. audens*, 10 = *Mx.* sp. 20.

Station	Depth (m)	Species									
		1	2	3	4	5	6	7	8	9	10
Sierra Leone Basin:											
AII-31-142	1624–1796			8							
AII-31-145	2185	1		8	10						
Angola Basin:											
AII-42-201	1964–2031			16					9	3	
AII-42-200	2644–2754			13	12			15			
V-12-10	2997			1							
AII-42-199	3764–3779			12						10	
AII-42-195	3797		4							4	
AII-42-198	4559–4566	10				4	6				
AII-42-197	4597–4595	15				2					
AII-42-196	4612–4630	2									
KN-25-306	5550						8				1
KN-25-307	5631					2					
Cape Basin:											
V-14-33	706		16	9	1						
AII-42-191	1540–1549			2							
AII-42-194	2864		171		113						
V-12-4	2970		6		1						
KN-25-303	4637						5				

stations. They pointed out that at all depths these faunas are more diverse and have larger individuals than those of comparable basins in the northeastern Atlantic, a fact that is true also of Macrocyprididae. They explained this by the higher dissolved oxygen and phosphate levels of these bottom waters. However, because most ostracodes and all Macrocyprididae are detritus-feeders, it seems likely that the proximate cause is the resulting higher organic content of the sediments, especially in the northern Cape Basin, where intermittent upwelling causes very high biological productivity in surface waters. They also emphasized that the Walvis Ridge hinders access by Antarctic Bottom Water to the Angola Basin and by North Atlantic Deep Water to the Cape Basin. This hydrologic barrier does not constitute a biogeographic boundary for Macrocyprididae, however, as many species are known to occur both north and south of the Walvis Ridge (Table 5, Text-fig. 5). Peypouquet and Benson (1980, fig. 2) reported significant differences in the generic percent-composition of ostracode microfaunas at equivalent depths north and south of the Walvis Ridge, but they did not distinguish species, except of *Krithe*. There is no corresponding geographic segregation of macrocypridid genera.



Text-fig. 5. Collecting stations and geographic distributions of species in the southeastern Atlantic Ocean.

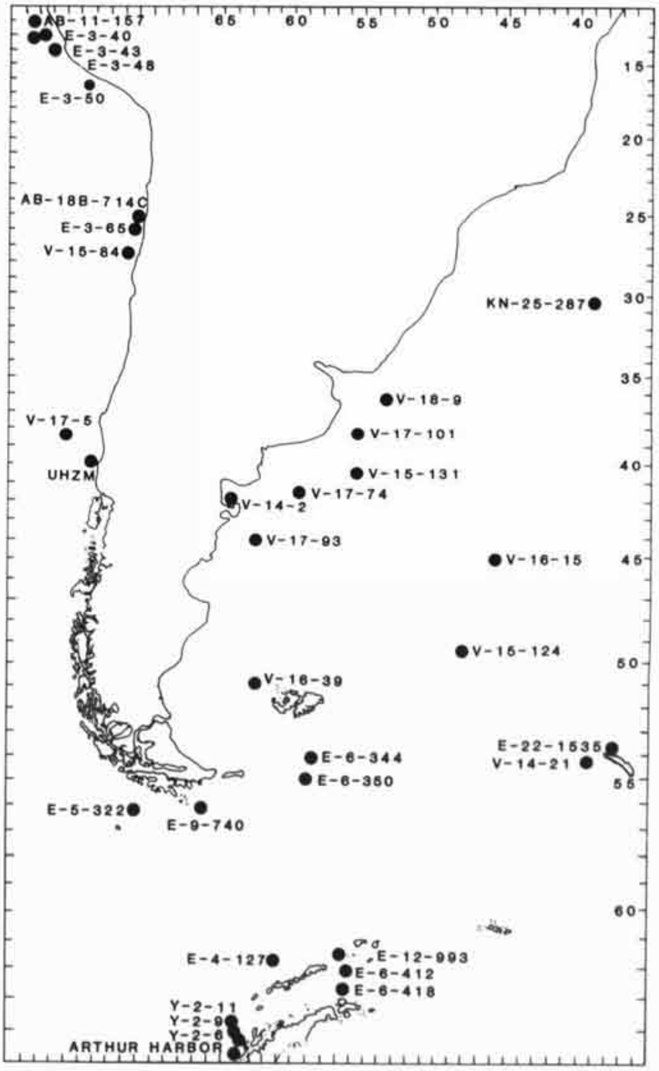
SOUTHWESTERN ATLANTIC OCEAN

Few abyssal samples were available in the southwest Atlantic (Text-fig. 6, 7). *Mx. kornickeri, Mx. similis, Ms. bensoni*, and *Mh.* sp. 30 are recorded at three stations in the northern Brazil Basin (587 to 1007 m, empty valves to 1235 m). *Mx. adunca,* which is widespread in the southeast Atlantic, was also found at one station west of the Rio Grande Plateau. An unnamed species of *Macropyxis* (*Mx.* sp. 21) is all that is known in the Argentine Basin.

The bathyal fauna is dominated by one species. *Mh. opaca* is widely distributed throughout the Argentine continental shelf-edge and slope, the Falkland Plateau, Burdwood Bank, South Georgia, Cape Horn, and even the Palmer Peninsula of Antarctica, with a known live depth range of 95 to 2738 m and a latitudinal range of almost 30° (Text-fig. 7). The Antarctic species association, including especially *Mh. turbida* and *Mh. inaequata,* becomes established around 55°S at Cape Horn, Burdwood Bank, and South Georgia.

ANTARCTIC REGION

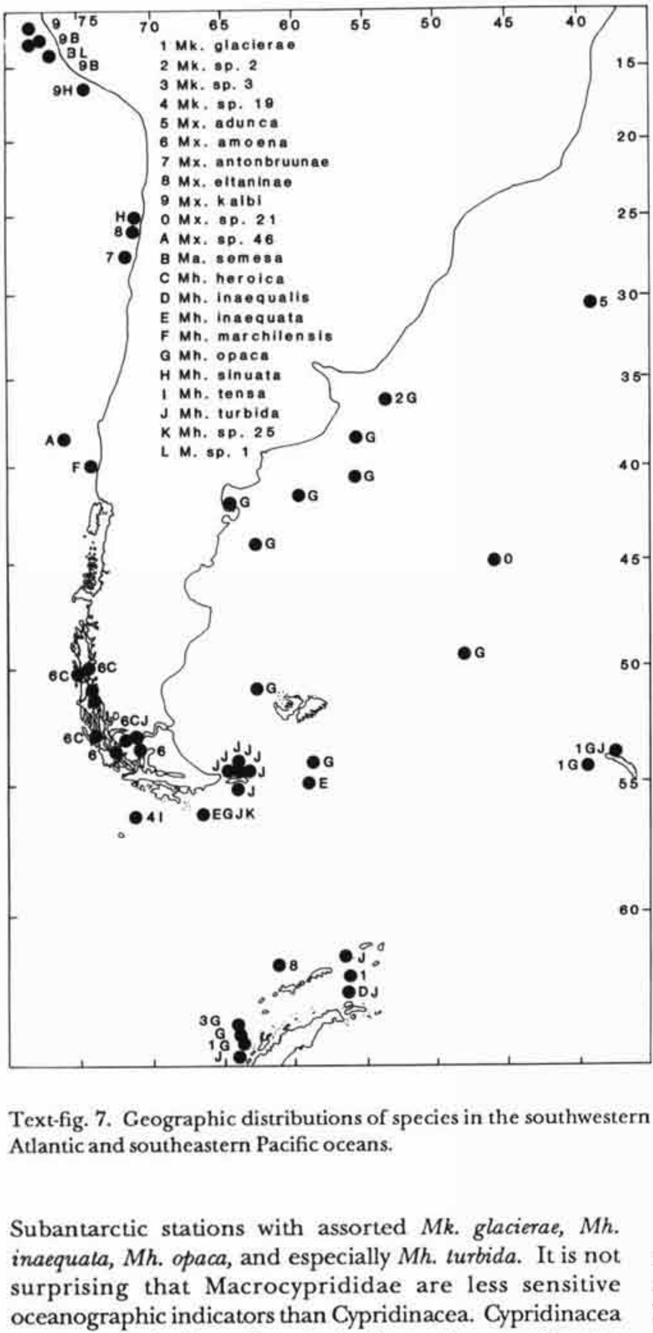
The Antarctic macrocypridid fauna is characterized by a swarm of species of *Macroscapha* plus a few of *Macromckenziea* (Text-fig. 8). *Mh. turbida* is ubiquitous, abundant all around Antarctica but also reaching north to the Strait of Magellan, Cape Horn, South Georgia, and Macquarie Island, with a depth range of 16 to 494 m. *Mh. inaequata,* likewise, is found in the Weddell and Ross seas of Antarctica, off Cape Horn and Burdwood Bank, and on the Bellingshausen abyssal plain in the far South Pacific, with a spectacular depth range of 311 to 3694 m. *Mh. tensa* also occurs north of the Drake Passage near Cape Horn as well as around Antarctica, while *Mh. inaequalis* appears to be confined to Antarctic waters. *Mk. glacierae* is abundant in the Weddell Sea and South Shetland Islands and also occurs near South Georgia Island. It has not yet been found around Cape Horn or eastern Antarctica.



Text-fig. 6. Collecting stations in the southwestern Atlantic and southeastern Pacific oceans.

The Antarctic convergence, which coincides with an important biogeographic boundary between the Antarctic and Subantarctic provinces for most planktonic and many benthic invertebrates, apparently has little effect on Macrocyprididae in the far South Atlantic. The abyssal Scotia Basin, likewise, does not constitute the barrier that it does for benthic foraminifera (Herb, 1971), as six of the ten Antarctic mainland species of Macrocyprididae also occur around Cape Horn, Burdwood Bank, and South Georgia (Text-fig. 7, 8). Of the 19 Antarctic and Subantarctic species of Macrocyprididae, 10 species occur at just one station, nine occur north of the Antarctic convergence, five to the south of this line, and five occur both north and south of this line (see Text-fig. 7, 8). Of the nine species that recur at two or more stations, two occur only to the north, two only to the south, and five both to the north and south of this line.

Kaesler et al. (1977) delineated the effect of the Antarctic convergence on myodocopine (cypridinacean) ostracode distribution by cluster analysis and ordination of part of Kornicker's (1975) data (six of 88 species occurring at five or more of 64 stations). Kornicker's data set is qualitatively similar to, though more comprehensive than, the data base for this monograph and, in fact, includes many of the same stations. A comparable selection of data for Macrocyprididae comprises six species recurring at 56 stations. The resulting nexus of similarities distinguishes very sharply a compact cluster of inland Magellanic stations with *Mx. amoena* and *Mh. heroica* from a larger, rather diffuse constellation of intermingled Antarctic and



Text-fig. 7. Geographic distributions of species in the southwestern Atlantic and southeastern Pacific oceans.

Subantarctic stations with assorted *Mk. glacierae*, *Mh. inaequata*, *Mh. opaca*, and especially *Mh. turbida*. It is not surprising that Macrocyprididae are less sensitive oceanographic indicators than Cypridinacea. Cypridinacea are taxonomically and ecologically much more diverse, with many tens of genera and several hundred living species, with abundances averaging half of the total ostracode standing crop at any locality, with varied life habits ranging from actively swimming predators to infaunal filter-feeders, and with diverse life histories that may include an epipelagic mating stage or brooding the young. Hence, they participate in more trophic levels of oceanic communities than do the rarer, benthic, detritus-feeding Macrocyprididae.

There is a little evidence for depth zonation of macrocypridid species in Antarctic and Subantarctic waters but none for submergence. Indeed, the data plotted in Text-fig. 9 for stations within the depth range and geographic range of *Mh. turbida*, the most common Antarctic species, seem to show, very roughly, a reverse phenomenon. Occurrences of *Mh. turbida* are concentrated in the shallow parts of its depth range in lower latitudes and at deeper levels in higher latitudes. This trend may be spurious, to the extent that fewer shallow samples were available in Antarctic coastal waters. Yet, it is likely that the ice cover and influx of glacial detritus render nearshore Antarctic benthic habitats even less suitable for Macrocyprididae than those of other continents, while the usual population acme at the shelf-slope break occurs at a greater depth than usual because of glacial loading of the Antarctic crust.

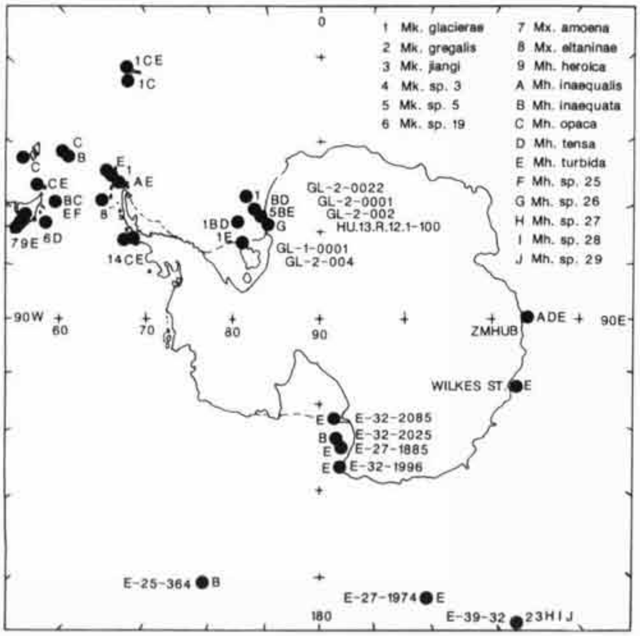
MOZAMBIQUE CHANNEL

The available samples are insufficient to do more than hint at the species diversity and geographic ranges (Text-fig. 10). The intensive shallow-water sampling around Nosy Be, Madagascar (Text-fig. 11), produced three species of *Macrocyprina*, two of which are very rare. The low specimen counts for other species elsewhere in this region result from small sample size, however.

EASTERN PACIFIC OCEAN

On the southern California shelf off Santa Barbara and La Jolla, *Mn. barbara* provides the northernmost occurrence of *Macrocyprina* known on the Pacific coast of North America (Text-fig. 4). Swain (1969) and Swain and Gilby (1974) found no Macrocyprididae in their collections from the shelf off northern California, Oregon, and Washington. Valentine (1976) did not include any Cypridacea in his comprehensive biogeographic analysis of Holocene Ostracoda of the West Coast. *Mn. swaini* is recorded from Scammon Lagoon in Baja California and the Gulf of California. *Mn. vargata* is endemic to Clipperton Island reefs.

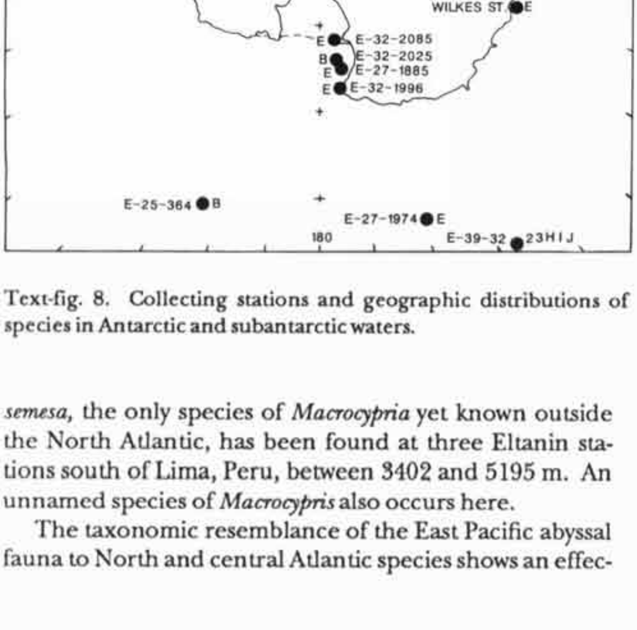
Bathyal, abyssal, and even hadal stations west of Central and South America yield many very large species of *Macropyxis* (Text-fig. 4, 7). *Mx. kalbi*, the largest of all, is known to range from approximately 13°N to 10°S latitude and from 2599 to 6134 m in depth. *Mx. kaesleri* ranges from approximately 8°N to 17°S and from 1749 to 6134 m. *Mx. antonbruunae* is known from roughly 5°S to 28°S and 4332 to 6134 m. The co-occurrence of all three of these species at AB-11-113, 5986–6134 m depth, on the edge of the Peru–Chile trench, marks the deepest occurrence of Macrocyprididae and, indeed, the deepest occurrence of living cypridacean Ostracoda yet recorded. Equally dramatic is the latitudinal range of *Mx. eltaninae* from 10°S on the edge of the Peru–Chile Trench to almost 62°S in the South Shetland Islands and from 3149 to 5666 m. *Ma.*



Text-fig. 8. Collecting stations and geographic distributions of species in Antarctic and subantarctic waters.

semesa, the only species of *Macrocypria* yet known outside the North Atlantic, has been found at three Eltanin stations south of Lima, Peru, between 3402 and 5195 m. An unnamed species of *Macrocypris* also occurs here.

The taxonomic resemblance of the East Pacific abyssal fauna to North and central Atlantic species shows an effective trans-isthmian corridor and a conservative pace of Cenozoic divergence. The large size of these East Pacific species may reflect food-rich sediments generated by high biological productivity in cool surface waters.

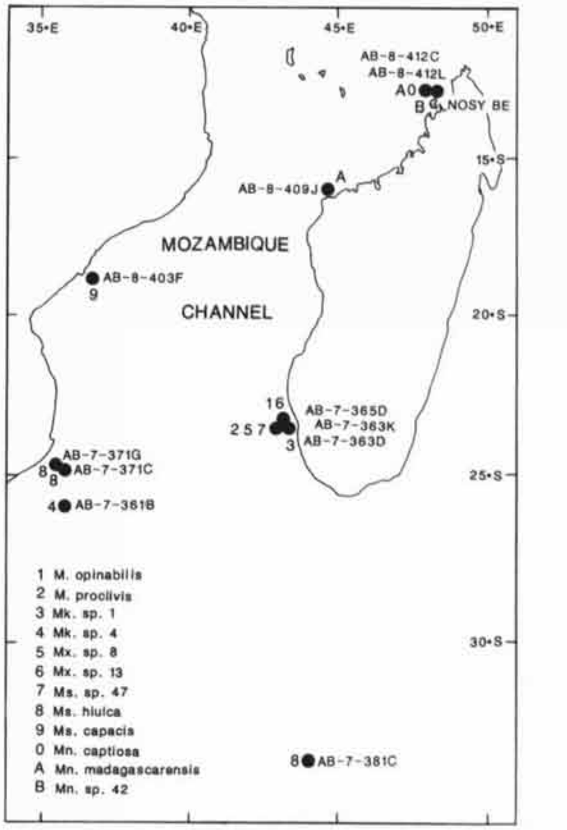


Text-fig. 9. Occurrences of *Macroscapha turbida* at stations within its bathymetric and latitudinal range. Vertical scale shows depth in meters; horizontal scale indicates south latitude; closed circles represent 28 stations yielding *Mh. turbida*; open circles represent 23 other stations without *Mh. turbida* but yielding other species of Macrocyprididae. Occurrence data taken from this study (see Appendix III) and from Hartmann (1986, 1987).

The northernmost representative of the southern swarm of *Macroscapha* species is *Mh. sinuata,* which ranges roughly 16° to 25°S and 1025 to 2858 m (Text-fig. 7, 12). *Mh. marchilensis* is known only in relatively shallow waters near central Chile. The Strait of Magellan and associated fjords and channels of southern Chile are abundantly populated by *Mx. amoena* and *Mh. heroica.* Here also the northernmost occurrences of characteristic Antarctic species begin, first *Mh. turbida,* and then, south of Cape Horn, *Mh. tensa, Mh. inaequata,* and *Mh. opaca.* The much higher species diversity of Macrocyprididae in the southeast Pacific than in the southwest Atlantic is not an artifact of sampling. Again, it probably results from the food-rich sediments and higher biological productivity in these cold, nutrient-rich waters.

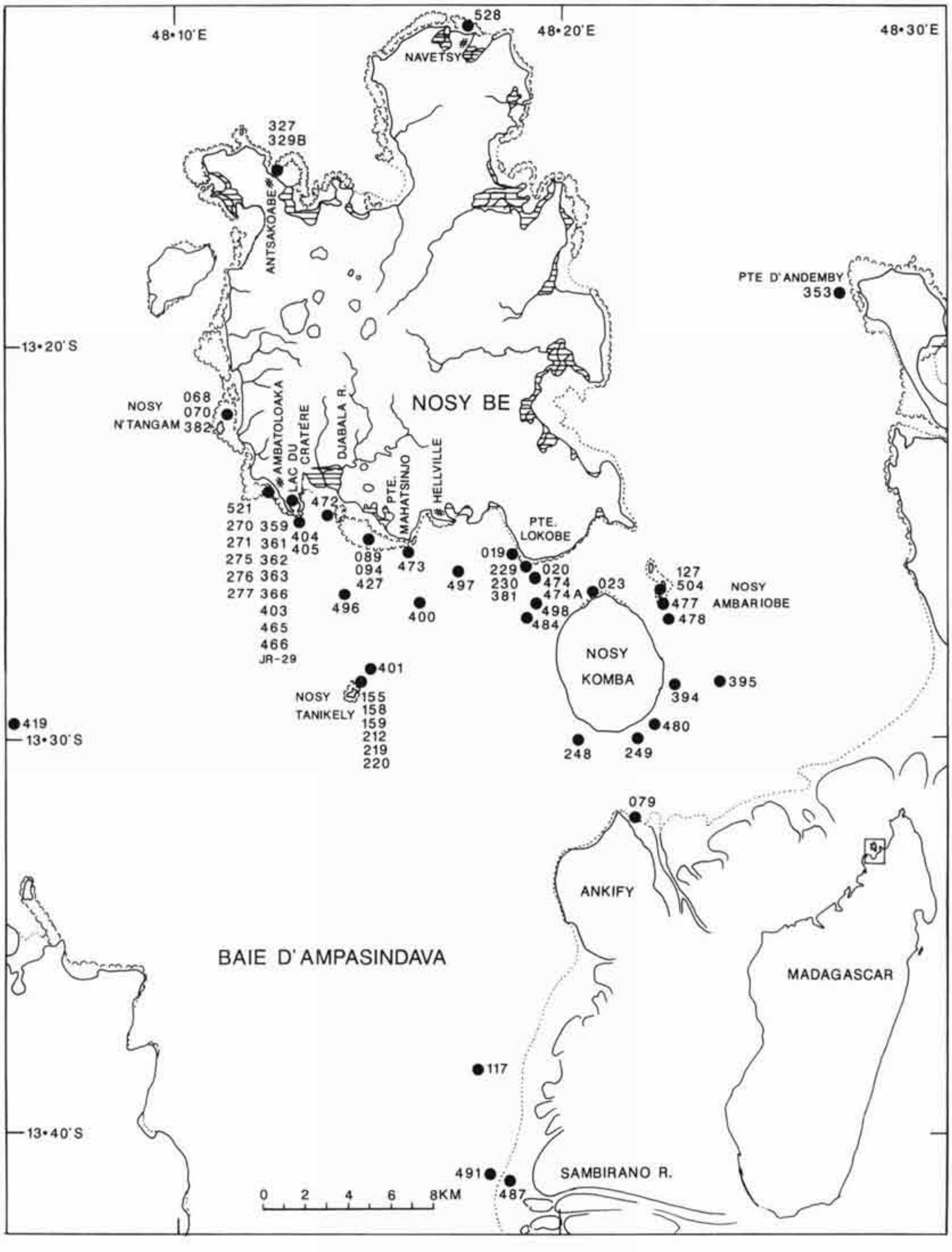
AUSTRALIA AND NEW ZEALAND

The seas around Australia and New Zealand appear to be rich in species of Macrocyprididae, but available

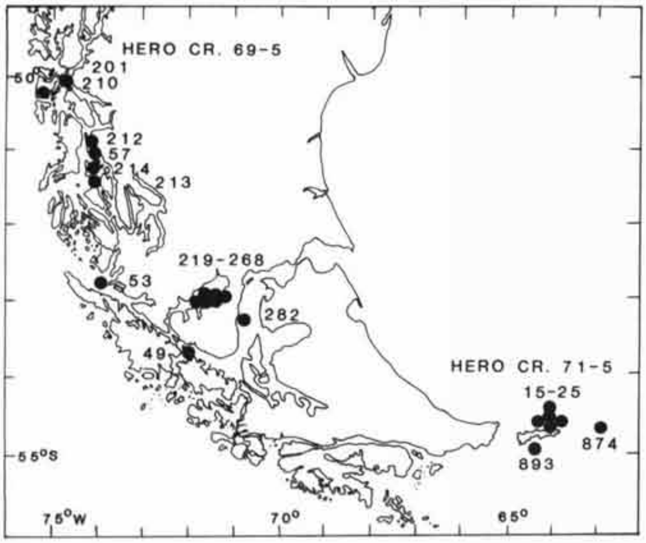


Text-fig. 10. Collecting stations and geographic distributions of species in the Mozambique Channel and western Indian Ocean.

collections were insufficient to analyze their distributions (Text-fig. 13). Whatley (1983) indicated the presence of one Miocene bathyal species of "*Macrocypria*" (including *Macrosarisa*) and three Quaternary abyssal species of "*Macrocypris*" (probably including Macromckenziea and *Macropyxis*) in drilling sites of the Deep Sea Drilling Program in the southwestern Pacific. He stated that during this time many bathyal stocks invaded abyssal depths, causing in-



Text-fig. 11. Collecting stations around Nosy Be, northwestern Madagascar.



Text-fig. 12. Collecting stations in the Strait of Magellan and nearby region.

creased species diversity in abyssal faunas, decrease in species restricted to bathyal depths, and increase in species ranging from bathyal into abyssal depths. It is certainly true that many of the macrocypridid species in this region are atypical representatives of the genera to which they are assigned, and that normally shallow-water morphotypes seem to occur in deeper locations than is usual elsewhere. Whether this represents a second, late Cenozoic invasion of deeper habitats by Macrocyprididae or whether it simply shows the inadequate sampling and lack of soft-part control cannot yet be determined.

Only two genera are common in the bathyal materials studied, *Macromckenziea* and *Macroscapha*. *Mk. gregalis* dominates a single sample on the Tasman Ridge that is unusually rich in Macrocyprididae, yielding also *Mh. jiangi* and three other species. Curiously, other stations of this transect have yielded no Macrocyprididae. Exceptionally abundant barnacles, attached foraminifera, echinoderm fragments, and bryozoans suggest the proximity of hard substrate and an unusual community for the 960 m depth of this station. *Mk. swansoni* is common in the Tasman Sea, accompanied by five rare, unnamed, and sometimes perplexing species of *Macromckenziea, Macropyxis,* and *Macroscapha*. *Mn. hartmanni* occurs near Albany, southwestern Australia, and *Mn. quadrimaculata* on the southern part of the Great Barrier Reef. Several unnamed species of *Macrocyprina* show the likelihood that many others await discovery.

CENTRAL AND NORTH PACIFIC AND INDIAN OCEANS

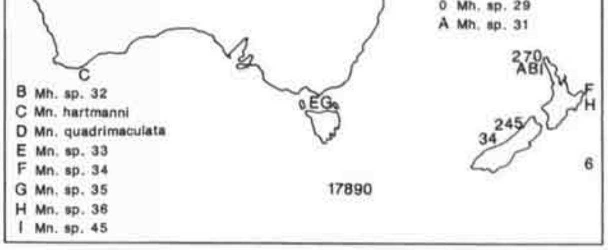
Regrettably, no deep-water collections were available from most of the Indian Ocean and the Central and North Pacific Ocean, and the relatively few South Pacific samples did not happen to yield Macrocyprididae. The published record of Macrocyprididae from these regions is also meager, reflecting the lower intensity of oceanographic exploration. Abyssal species of *Macropyxis* ought to be fairly numerous, although the relatively low biological productivity and great depths over much of this region suggest that standing crops will be low and difficult to sample adequately.

It is likely that a swarm of *Macrocyprina* species infests Indo-Pacific island reefs in the same fashion as in the Caribbean. Two species are described here from Okinawa, and many others have been noted in collections from Indonesia, the Philippines, the Hawaiian Islands, and elsewhere. Most are not described here, because specimens were few and soft parts were not widely available for taxonomic control.

TAXONOMIC ASPECTS OF GEOGRAPHIC VARIABILITY

Morphological differences between geographic populations are present but generally slight, so far as soft parts and most carapace features are concerned. The ventral margin and posterior angle of the carapace seem especially liable to subtle variation, and as these parts of the carapace are also the sites of most sexual dimorphism and intra-population variability, the geographic component of this variability may not be easy to isolate.

Far more conspicuous are the size differences among populations, which might allometrically determine these minor shape differences, although this has not been analyzed. Size consistently increases with depth for bathyal species, although some of the abyssal and hadal species



Text-fig. 13. Collecting stations and geographic distributions of species around Australia and New Zealand.

show a reversal of this trend, and shallower species are inconsistent. Because samples from different depths often represent geographically distant populations from ocean basins with distinct hydrographic parameters as well, it is not always possible to discriminate the separate effects of these factors on size and shape. The length-height graphs analyze these bathymetric trends for the species described in this volume, and the plates illustrate selected specimens from different geographic populations of each species. The differences are not usually a source of taxonomic difficulty, except in the case of single juvenile or female specimens from isolated geographic localities.

For the most part in this monograph, geographically isolated single specimens are treated as separate species in open nomenclature, especially if their inclusion in another species would greatly enlarge the morphologic, geographic, or bathymetric scope of that species. This may seem excessively cautious, but in fact so-called splitting and lumping in practical taxonomy are much like Type I and Type II error in statistics: both are undesirable, yet one is inevitable, and to minimize one necessarily increases the risk of the other. Only if the associated costs are asymmetrical can a choice be made *a priori* between these types of error. Hitherto, the species concepts applied to the Macrocyprididae have been so broad as to be worthless for biogeographic or biostratigraphic interpretation, so it is appropriate to test the efficacy of much stricter definitions here.

SUPERSPECIES IN THE DEEP SEA?

It is a common misconception that stable physical conditions in the abyss should cause deep-sea species to have very broad or even cosmopolitan geographic ranges. Lacking the extensive collections and soft-part anatomy necessary to discriminate deep-sea species, many workers have opted to treat them as global in range and broadly inclusive in morphologic scope—truly a self-fulfilling prophecy. Brady's (1880) overly conservative taxonomic disposition of *Challenger* ostracodes generated a century of misidentification of these classic species.

Of course, the smooth, cypridiform taxa have suffered most under this view. Even Hartmann and Hartmann-Schröder (1988), arguing emphatically and accurately that very few, if any, deep-sea ostracodes have especially broad geographic ranges, paused to cite "*Macrocypris similis*," *Argilloecia pusilla*, and "*Aglaiocypris meridionalis*" as evidence that Cypridacea are exceptions to this rule! This they are not! The eight listed species of deep-sea "*Macrocypris*" (Hartmann, 1985; Hartmann and Hartmann-Schröder, 1988) have grown to a minimum of 60 species in three genera in the present monograph, while large tracts of the world ocean with their presumptive macrocypridid inhabitants remain uncensused. Not one of the eight cited species, it should be repeated, has a global or even hemispheric distribution on present evidence. The real *Mx. similis*, in particular, remains so elusive as to be, in all probability, confined to an unusually small sector of the central-western Atlantic Ocean.

Whatley and Ayress (1988), in a stupendous synthesis of global Quaternary deep-sea ostracodes, asserted that a very large proportion of deep-sea species have pandemic distributions. The validity of this allegation must await thorough taxonomic analysis of many families. It is of interest, however, that their tables show Macrocyprididae to be an exception, with no species listed in common among the Atlantic, Indian, or Pacific oceans. That endemism is in accord with the findings of the present study and signals caution in the interpretation of other taxa.

The geographic and genetic structure of population variability in deep-sea Ostracoda has been a matter for puzzlement, conjecture, and controversy ever since Brady (1880) first marveled at the heterogeneity of carapace ornament in his "*Cythere dictyon*." However, Sylvester-Bradley (1976, p. 36) pointed out that, this variability is not random; rather, it is systematic and directional, that is, clinal:

> The pattern of speciation found in psychrospheric ostracods seems to differ from that found in shallow-water faunas. Most of the species are cosmopolitan. They show some geographic variation, but this variation seems not to be discontinuous. Where the data are sufficient to indicate a pattern, it seems that *clines* are established between one area and another. One hypothesis would suggest that this pattern is controlled by the same genetic mechanism that produces "ecotypes" in plants.

Maddocks (1977) attempted to apply the superspecies concept of Mayr (1969) to Macrocyprididae. Although the species concepts of that paper turned out to be too broad, too plastic, and not accurate, the superspecies, defined as an array of geographically contiguous species of close evolutionary affinities, remains a very attractive principle. Such sequences of species may mark the routes taken by stocks migrating from one ocean basin into another, or one bathymetric realm into another. Unsequenced or randomly juxtaposed constellations of species might represent vicarience events, speciation in parts of formerly far-flung ancestral populations. Macrocyprididae would be a suitable taxon on which to test such hypotheses.

Given the difficulties of distinguishing fossil species of cypridiform Ostracoda accurately, it may be that in the future the most useful unit for analyzing global paleobiogeographic and biostratigraphic trends of deep-sea ostracodes will be the superspecies. The results of this taxonomic revision show that, contrary to previous reports, no species of Macrocyprididae has a worldwide distribution. In like manner, the two- and three-ocean distributions of some other Cenozoic deep-sea ostracodes, such as those reported by Whatley and Ayress (1988), may prove to represent superspecies as well.

Table 6. Numbers of species of Macrocyprididae found in 479 living and dead (but not fossil) samples.

Number of Species	Number of Samples
0	1000+
1	355
2	84
3	32
4	5
5	3
Total	479

DIVERSITY AND SYMPATRY

Much has been made of the apparent species poverty of deep-sea faunas and of their characteristic smooth-shelled genera. Of course, the inability to distinguish macrocypridid species has contributed to the reputed monotony of abyssal assemblages. Difficulties in obtaining and processing sufficiently large samples, whether measured by volume, area, or number of specimens, have hampered assessment of true abyssal diversity. Whatley and Coles (1987) and Whatley and Ayress (1988) have emphasized that when very large samples are picked, including the tiniest fractions, the number of species recovered rises dramatically. For Macrocyprididae one should add that, because of their large size, nondescript juveniles, and relative rarity, recognition of species requires much larger volumes of relatively coarse grain-sizes than are normally retained for micropaleontological study.

Sampling considerations aside, it remains true that the within-sample diversity of Macrocyprididae is always low. Of 479 Holocene (subfossil and living) samples listed in Appendix I, fully 355 (74 percent) produced only one species. Another 84 yielded two species, but only 32 yielded three species, only five yielded four species, and only three yielded five species (see Table 6). It must be remembered that more than twice this number of samples were searched but did not yield any Macrocyprididae and are not included in Appendix I. This nearly Poisson distribution of species per sample contrasts with the log-normal frequency distributions of Kornicker (1977) for Myodocopina-Cypridinacea, which average three or more species per sample. Of course, Cypridinacea are of higher taxonomic rank and greater global diversity, with 400 to 500 living species (Kornicker, 1977) compared to the 123 living species of Macrocyprididae described here, and are ecologically more varied.

Steineck et al. (1984) speculated that the low incidence of sympatry of congeneric species in the deep sea results from the monotonous substrate. This premise seems especially valid for the bottom-crawling, sediment-eating Macrocyprididae. By contrast, ostracode genera suspected of trophic dependence on other invertebrates, such as *Propontocypris* and *Xylocythere* in deep-sea wood-fall communities, regularly present up to three coexisting species (Maddocks and Steineck, 1987). Unlike many other invertebrates, Macrocyprididae show low levels of sympatry in shallow waters as well, for which the constancy of diet and substrate preference may be equally responsible. It is instructive that, of the eight samples yielding four or five species of Macrocyprididae, four were taken at a depth of 96 m on the Flower Gardens, which are shelf-edge coral banks in the northwestern Gulf of Mexico where reefal and clastic-shelf species mingle in an ecotone assemblage. Another sample (E-39-32 at 960 m depth) in which two distinct but adjacent habitats are recorded is a planktonic foraminifer-pteropod ooze rich in barnacles, brachiopods, bryozoans, attached foraminifera, serpulids, echinoderm plates, and other indicators of a nearby deep-water biotic reef or hardground.

BATHYMETRY

Table 7 shows the depth distribution of 207 stations yielding live Macrocyprididae for this study. The distribution is greatly influenced by the provenance of samples. For example, the Nosy Be collections yield 23 of the 59 samples shallower than 51 m. Even so, it is apparent that Macrocyprididae are represented at all depths in the world ocean, from euhaline coastal waters to hadal depths.

Many workers have recognized that Macrocyprididae are especially abundant in and characteristic of deep-sea assemblages. Though always less numerous than Krithidae, various Bairdiacea, and ornate Cytheracea, Macrocyprididae are typical members of bathyal and abyssal faunas. Neale (1985) summarized the percent contributions of this family to living deep-sea faunas of the Bay of Biscay: 14.5 percent between 1000 and 2000 m, 1.2 percent between 2000 and 3000 m, 17.2 percent between 3000 and

Table 7. Bathymetric distribution of 207 samples yielding live Macrocyprididae for this study.

Depth (m)	Stations
0–50	59
51–100	18
101–200	24
201–500	26
501–1000	11
1001–2000	15
2001–3000	14
3001–4000	18
4001–5000	10
5001–6000	6
6001+	1
Total	202

4000 m, and 3 percent between 4000 and 5000. McKenzie and Peypouquet's (1984, p. 294) characterization of the sea floor below 4500 m as "virtually an azoic zone" is misleading; taxonomically diverse Ostracoda including Macrocyprididae are represented at depths exceeding 6000 m, although population densities may be very low. The record depth for any ostracode is held by two pelagic forms (Myodocopida, Halocypridacea), *Metaconchoecia abyssalis* Rudjakov, 1962, and *Paraconchoecia vitjazi* Rudjakov, 1962, at 9000 m in the northwest Pacific, according to Hartmann's (1985) compilation. Among the benthic Podocopida, both Bairdiacea and Cytheracea have been reported from hadal depths: *Zabythocypris helicina* Maddocks, 1969b, at 6134 m in the Peru–Chile Trench, *Krithe setosa* Rudjakov, 1961, at 6487 m in the Java Trench, and *Vitjasiella belyaevi* Schornikov, 1976, at 5100 m in the Kamtchatka Trench. The co-occurrence of *Mx. kalbi*, *Mx. antonbruunae*, and *Mx. kaesleri* at AB-11-113, depth 5986-6134 m, in the Peru–Chile Trench marks the deepest record of Cypridacea to date.

EVOLUTION

SYSTEMATIC POSITION

Macrocypris was initially classified by Brady (1868a, 1868b) in the family Cypridae of Sars's (1866) classification, which also included *Bairdia* and *Pontocypris*. After the separation of the family Bairdiidae by Sars (1887), Brady and Norman (1889) referred the genus to that family. Müller (1912) established the Macrocyprinae parallel with Pontocyprinae and three other subfamilies within the family Cypridae. Since then, its systematic position has continued to oscillate, although nearly all authors agree that it has affinities to both the cypridaceans and bairdiaceans.

Alm (1915) and Sars (1922–1928) ranked Macrocyprinae as one of five subfamilies of Cypridae, along with Bairdiinae and Darwinulinae. Sylvester-Bradley (1948) elevated it to the family Macrocyprididae within the superfamily Bairdiacea. Pokorný (1958) ranked Macrocyprididae as one of five branches of the suborder Podocopa, parallel with Bairdiidae, Cyprididae (including Pontocypridinae), Cytheridae, and Darwinulidae, in a classification without superfamilies. Sylvester-Bradley (1961) included the Macrocyprididae with Beecherellidae and Bairdiidae in the Bairdiacea. Triebel (1960) analyzed the supposed similarities between macrocypridid and bairdiacean muscle-scar patterns and emphasized the cypridacean affinities of the appendages and genitalia, reassigning the Macrocypridinae to the Cyprididae. Morkhoven (1962, 1963) and Hartmann (1964b) also ranked the Macrocypridinae as one of seven or eight subfamilies (including Pontocypridinae) within the family Cyprididae. This placement was followed by Hartmann (1966). Reluctantly accepting the higher ranks of Sylvester-Bradley (1961), Hartmann and Puri (1974) placed Macrocyprididae as one of six families of Cypridacea. Similar arrangements have been adopted by Pokorný (1978) and De Deckker (1979). Meanwhile, Maddocks (1969a, 1976, 1977, and herein) and Danielopol (1976) have attempted to revive Alm's tripartite division of Cypridacea into families Macrocyprididae, Pontocyprididae, and Cyprididae.

Gründel (1967) again elevated the classification, proposing the suborder Bairdiocopina with superfamilies Bairdiacea, Darwinulacea, and Cypridacea. He included Macrocyprididae in Cypridacea but emphasized the bairdiid aspect of its scars. Kozur (1971) likewise retained Macrocyprididae in Cypridacea but transferred the subfamily Acratiinae Gründel, 1962, from Bairdiidae to Macrocyprididae to accommodate supposed late Paleozoic and Triassic ancestors of Macrocypridinae (Jurassic to Holocene). Kozur (1972) resurrected the suborder Cypridocopina of Jones (1901), parallel with Bairdiocopina and Cytherocopina, to contain Cypridacea, Darwinulacea, Macrocypridacea, Bairdiocypridacea, and three metacopine superfamilies. Raising the taxon to a superfamily, he stated (p. 14) that the "Macrocypridacea" ought to exhibit equally close soft-part relationships to Healdiacea (including the living *Saipanetta*), Cytheracea (especially Bythocytheridae), Bairdiacea (especially Bythocypridinae), and Cypridacea. That prediction is not upheld by the results of this study. They originated, he said, either directly from the Bairdiocypridacea but distinctly earlier than the Cypridacea, or else from a side branch of the Bairdiocypridacea that also produced the common ancestor of the Cytherocopina and Bairdiacea (Kozur, 1972).

Hartmann and Puri (1974, p. 56) warned somewhat ambiguously that "the Macrocyprididae are the most original group of Cypridacea, but they include in their organization a series of characters of Candonidae *s. l.*" By this, they probably meant that Macrocyprididae are more primitive than other Cypridacea, and that they may be closely related to the ancestral stock of that superfamily. In "Candoninae *s. l.*" they included all the marine and brackish Cyprididae, that is, the Candoninae, Cyclocypridinae, Paracypridinae, and Thalassocypridinae. While some similarities exist between Macrocyprididae and *Paracypris*, for example, many of these may be the result of convergence in life habits.

W. A. van den Bold (1974) suggested that Macrocyprididae do not belong in either Bairdiacea or Cypridacea but should be placed in a new, unnamed superfamily together with Saipanettidae as the modern descendants of Healdiidae. These he tentatively placed in Podocopina, leaving *Darwinula* in Metacopina, while stressing affinities between *Darwinula* and *Macrocypris* and admitting that the boundary between Metacopina and Podocopina remains unclear. These and other contradictory definitions of the contentious taxon Metacopina were briefly analyzed by Maddocks (1982) (but see McKenzie, 1975, for an opposing view). Maddocks's (1976) numerical phenetic and cladistic analyses of antennule and antenna characters repeatedly separated Macrocyprididae from other Cypridacea and from Bairdiidae, but the closest connection was usually to Bythocyprididae rather than to *Saipanetta*. Again, the present study shows no close resemblances of Macrocyprididae to Darwinulacea.

Gründel (1978) classified the Macrocypridacea in the Bairdiocopina again, citing bairdiacean affinities for the muscle scars and stating that early representatives (not identified or described) are very close to the Bairdiidae, even though living representatives have cypridacean soft parts. His figure 1 derived both Macrocypridacea and Bairdiacea from Beecherellacea but derived Cypridacea from Bairdiocyprididae (both classified in Cypridocopina). He warned that the ever-changing combinations of bairdiacean, cypridacean, and healdiacean hard- and soft-part characters show both the futility of any classification based on only a few key hard-part characters and also the close phylogenetic relationships of these three lineages. He also stressed that an evolutionary classification must be based on the phylogenetic relationships of the ancestors rather than on phenetic similarities of the living descendants and deplored the ambiguous nature of the Paleozoic evidence at present (Gründel, 1978).

In this monograph, the family Macrocyprididae is classified with Pontocyprididae and Cyprididae in the superfamily Cypridacea. It contains eight genera, all living, but no subfamilies are delineated. While it would be possible to represent the close relationships of *Macrocypris* with *Macropyxis* and *Macromckenziea*, of *Macrocypria* with *Macro-cyprissa* and *Macrosarisa*, and of *Macroscapha* with *Macrocyprina* by naming three subfamilies or tribes, there would be no benefit and some risk in doing so. The eight genera studied have Cenozoic, Cretaceous, and probably Jurassic species (see Appendix I). The Triassic and Paleozoic forebears, whatever they may be, have not been well studied; and taxonomic flexibility should be left within the family to accommodate them as necessary. Appendix I lists other species, not studied, that appear from their published descriptions and illustrations to be valid Macrocyprididae. Appendix II presents a much longer list of species that probably ought not to be classified in Macrocyprididae on the basis of present information. For the purpose of compiling these appendices the diagnostic characters of modern Macrocyprididae were the arbitrary standard.

The appendages and genitalia of Macrocyprididae are indubitably cypridacean in character. By comparison with those of Pontocyprididae and Cyprididae, they have a conservative, generalized, possibly archaic aspect. In turn, it is somewhat easier to trace structural homologies of these parts through the Macrocyprididae to other Podocopida than would be the case with the other families of Cypridacea. The muscle scar pattern is unique, neither bairdiid, pontocypridid, nor cypridid, although occasional, possibly spurious homologies with all three suggest themselves. The hinge and dentiform corner are unique specializations, while the right-valve overlap, broad calcification of the juvenile inner lamella, and distinctive pores and setae emphasize the separate identity of the macrocypridid carapace. In short, the family Macrocyprididae stands firmly within the superfamily Cypridacea but perhaps near the ancestral stock. There are almost no detailed similarities to Bairdiacea, Cytheracea, Darwinulacea, or Sigilliacea (*Saipanetta*).

FOSSIL RECORD

Gründel (1962) established the subfamily Acratiinae within the Bairdiidae for the genera *Acratia* Delo, 1930, *Bohlenatia* Gründel, 1962, *Camdenidea* Swain, 1953, and (with reservations) *Bairdianella* Harlton, 1929. Sohn (1960) dismissed *Bairdianella* as based on a steinkern. Kozur (1971) left *Bohlenatia* in the Bairdiidae, interpreting resemblances to *Acratina* as homeomorphic. He transferred the remaining two genera of Acratiinae to the family Macrocyprididae in the superfamily Cypridacea, adding *Acratina* Egorov, 1953, and *Praemacrocypris* Kozur, 1971. Kozur's argument depends on Swain's (1953, p. 279) verbal description of the muscle scar pattern of *Camdenidea*: "Muscle scar a large medially placed spot, bordered by a shallow groove and consisting of numerous smaller slightly elevated spots; accessory spots occur anteroventrally of the main spot." Swain did not illustrate the scar, and the description would fit nearly all cypridacean and bairdiacean patterns. Copeland (1977) stated that "the position within the Cypridacea of *Camdenidea* and related Paleozoic forms is unknown." Sohn (1975) reillustrated the holotype of the type species of *Acratia* and provided a new diagnosis, emphasizing the rostrate shape. He considered *Acratina* to be a synonym of *Acratia* and queried the validity of *Acratia* (*Cooperuna*) Gründel, 1962, and of *Egorovia*. Sohn assigned *Acratia* and the Acratiinae to the Bairdiidae without discussion.

Kozur (1971) postulated the evolutionary series *Camdenidea* (Devonian) to *Acratina* (Devonian–Upper Triassic) to *Praemacrocypris* (Triassic) to "*Macrocypris*" (Jurassic–Holocene). Triassic species of *Acratina*, he said, already have acquired a broad duplicature (but he failed to state whether this is true of juveniles as well as adults), while the transition from left-valve to right-valve overlap may have occurred in either *Praemacrocypris* or "*Macrocypris*." *Praemacrocypris* supposedly differs from "*Macrocypris*" only in having a smooth hinge, but its valve overlap is unknown, and Kozur (1971) did not illustrate this hinge or describe any muscle scars. He further stated that, if the muscle scars of *Acratia* turned out to be macrocypridid, and the hinge of *Macrocypria* turned out to be smooth, then *Macrocypria* should be transferred to the Acratiinae as a living descendant of *Acratina*.

The medially inflated, ventrally flattened, anteriorly and posteriorly acuminate shapes of species of *Acratia* do, indeed, resemble living *Macrocypria* and also several

Cretaceous species of *Macrosarisa*. However, homeomorphy of shape is so common in ostracodes that much additional evidence is needed. If right-valve overlap were to be demonstrated in *Praemacrocypris*, this would support Kozur's hypothesis; but left-valve overlap would not contradict it, because reversal of valve overlap is known at many times and taxonomic levels in the history of Ostracoda. Although right-valve overlap today uniformly characterizes living Macrocyprididae, the existence of even one pathological individual with left-valve overlap (specimen 1999F of *Ma. sarsi*) demonstrates that the genetic or developmental mechanism is simple and still exists. Obviously, the muscle scars of the Paleozoic and Triassic representatives should be examined, because the nearly perfect conformity of younger Macrocyprididae to a single pattern gives hope of great antiquity for this key character. Hinges also need more systematic investigation; the five-part macrocypridid hinge is probably not homologous with the hinges of other Cypridacea or Bairdiacea, and detecting its origin would clarify these relationships. The broad, well calcified duplicatures of instars and sexual dimorphism of adults are other diagnostic attributes of modern Macrocyprididae that might be recognized, but it will be necessary to collect much larger fossil populations for these species than has normally been the case. The most promising line of investigation would be to determine whether the rostrum and ventral indentation of *Acratia* include homologues of the dentiform corner of *Macrocypria, Macrocyprissa,* and *Macrosarisa*. The prevalence of the dentiform corner in Cretaceous macrocypridids makes it likely that this is an archaic character. Incidentally, demonstrating this homology would overturn a common misconception: *Macrocypria* would become an ancient, conservative stock rather than a modern aberration, while the nominotypical *Macrocypris* would be a relative newcomer. The known stratigraphic ranges of these genera support this interpretation.

No confirmation of this or conflicting phylogenies is offered, because only Cretaceous and Cenozoic species were studied. Macrocyprididae presumably originated in the late Paleozoic or early Mesozoic, but most published descriptions and illustrations of possible relatives for this age are not detailed enough to compare them with the taxa described here. This monograph will not add another speculative phylogeny to the chimerical hypotheses that already outnumber the species placed in evidence. Rather, the taxonomic diversity and morphological attributes documented here for younger Macrocyprididae will provide a more accurate and comprehensive standard of reference against which the ancient representatives may later be interpreted.

SYSTEMATIC DESCRIPTIONS

Order PODOCOPIDA Müller, 1894
Superfamily CYPRIDACEA Baird, 1845

Family MACROCYPRIDIDAE Müller, 1912

Macrocyprinae Muller, 1912, p. 120; Alm, 1915, p. 28; Sars, 1923, p. 57.

Macrocypridinae Müller Kozur, 1971, p. 10.

Macrocyprididae Müller Sylvester-Bradley, 1948, p. 67; Pokorny, 1958, p. 123; Sylvester-Bradley, 1961, p. 207; Hartmann and Puri, 1974, p. 56; Pokorny, 1978, p. 138.

Type genus.—*Macrocypris* Brady, 1868b.

Genera included.—The eight genera are listed in the following sequence in the systematic descriptions and illustrations of this monograph:

Macrocypris Brady, 1868b
Macromckenziea n. gen.
Macropyxis n. gen.
Macrocypria Sars, 1923
Macrocyprissa Triebel, 1960
Macrosarisa n. gen.
Macroscapha n. gen.
Macrocyprina Triebel, 1960

Three of these have previously been ranked as subgenera, and it may become desirable later to reestablish a hierarchial arrangement of subgenera within larger genera after more is known of their origins. Obviously, *Macropyxis* and *Macromckenziea* are related to *Macrocypris*, *Macrocyprissa* and *Macrosarisa* to *Macrocypria*, and *Macroscapha* to *Macrocyprina*. However, the more narrowly defined genera show ecological and perhaps geographic unities that would disappear if they were combined. Little would be gained except longer names. As one purpose of this monograph is to test and clarify specific and generic concepts, they are treated here simply as eight separate genera.

Genera excluded.—On the basis of published information, the following genera probably do not belong to the family Macrocyprididae as here revised: *Acratia* Delo, 1930; *Acratina* Egorov, 1953; *Camdenidea* Swain, 1953; *Novocypris* Ducasse, 1967; *Praemacrocypris* Kozur, 1971; and *Pseudomacrocypris* Michaelsen, 1975. In addition, *Paramacrocypris* Colalongo and Pasini, 1980, is a junior subjective synonym of *Macrocyprissa*.

The four genera (*Acratia*, *Acratina*, *Camdenidea*, *Praemacrocypris*) that Kozur assigned to the subfamily Acratiinae within the family Macrocyprididae do not show the diagnostic characters of modern Macrocyprididae, and the postulated ancestral relationship remains tenuous on present evidence. See discussion under "Evolution" above. Delineation of subfamilies is deferred until the early evolution of this family is better known.

Pseudomacrocypris has right over left valve overlap but in all other ways lacks the diagnostic characters of Macrocyprididae, contrary to statements by Michaelsen (1975). It is very close to and perhaps synonymous with *Propontocypris* and is here reassigned to the family Pontocyprididae. The "rosette of 5–6 spots" described (p. 130) and illustrated by Michaelsen (1975, pl. 2, fig. 21) for the type species, *Pseudomacrocypris subtriangularis* Michaelsen, and the "central rosette of 5 scars" specified (p. 75) by Kaye (1965, pl. 41, fig. 578–579) for *Pseudomacrocypris parva* (Kaye) (see also Plate 113.6) prove to be the diagnostic muscle-scar pattern of *Propontocypris*. The hinge, described by Michaelsen (1975, p. 130) as "dentate" and "tripartite," is unusual for Pontocyprididae chiefly in being very robust and finely striated. Such features are liable to convergence. Careful comparison of this hinge with those of other early Mesozoic Pontocyprididae and Macrocyprididae, however, might show whether any homologies can be traced between the hinges of these two cypridacean families. The laterally compressed carapace, subtriangular to subovate lateral outline, tiny size (L = 0.41 mm), smooth exterior with numerous tiny normal pore canals, right valve overlap, straight dorsal valve-contact line, and deep vestibules are all typical characteristics of *Propontocypris*. The unusual development of the hinge and the age (Early Jurassic to Early Cretaceous) of *Pseudomacrocypris* justify retaining it as a genus separate from but closely related to *Propontocypris* within the Pontocyprididae, at least for the time being.

Novocypris, described by Ducasse (1967) from the Eocene of France and correctly assigned to the Cyprididae, has left valve overlap and a paracypridine muscle scar pattern. The robust, taxodont hinge consists of a uniform row of rounded denticles and sockets without division into three or five hinge elements. It is not homologous with the macrocypridid hinge. The carapace shape is similar to that of several other paracypridine genera, especially *Tasmanocypris* McKenzie, 1979, and *Triangulocypris* Teeter, 1975, but the hinge is unique. See Plate 114 and the discussion of *N. eocaenana* in Appendix II.

Diagnosis.—A cypridacean family with relatively large, elongate, smooth carapace; right valve larger than and overlapping left anterodorsally, posterodorsally, and ventrally; macrocypridid hinge and muscle scar pattern; deep anterior and posterior vestibules, juveniles with broad calcified inner lamella; sensillum pores small, infrequent, funnel-shaped, with simple sensillum setae and a few tassel-setae.

Female fifth limb pediform, with four-segmented palp and no vibratory plate; male limb transformed into asymmetrical hooks. Sixth limb pediform, with one long and two shorter setae. Seventh limb with a long, reflexed, feathered cleaning seta and two other smaller setae. Furcae rod-shaped, with one long terminal seta but only vestiges of proximal setae, very large to very small, may be sexually dimorphic. Hemipenes morphologically diverse but less complex than those of Cyprididae. Zenker's organ with enlarged anterior bulb and numerous chitinous spikes, not arranged in rosettes; proximal part of vas deferens differentiated, coiled or looped in distinctive fashion.

Genus MACROCYPRIS Brady, 1868

Macrocypris Brady, 1868a, p. 119 [*part.*]; Brady, 1868b, p. 391 [*part.*]; Müller, 1912, p. 120 [*part.*]; Triebel, 1960, p. 115 [*part.*]; Sylvester-Bradley, 1948, p. 67 [*part.*]; Sylvester-Bradley, 1961, p. Q207 [*part.*]; Morkhoven, 1963, p. 85 [*part.*]; Sars, 1923, p. 58 [*part.*]; Maddocks, 1977, p. 153 [*part.*].

Type species.—*Cythere minna* Baird, 1850.

Species included.—Listed by original binomen:

Cythere minna Baird, 1850; Holocene, northeastern Atlantic.

Macrocypris maioris n. sp.; Holocene, equatorial and eastern Atlantic.

Macrocypris metuenda n. sp.; Holocene, southeastern Atlantic.

Macrocypris miranda n. sp.; Holocene, equatorial and southeastern Atlantic.

Macrocypris nimia n. sp.; Holocene, northeastern Atlantic.

Macrocypris opinabilis n. sp.; Holocene, southwestern Indian Ocean.

Macrocypris proclivis n. sp.; Holocene, southwestern Indian Ocean.

Macrocypris sp. 1; Holocene, southeastern Pacific.

Geologic range.—Holocene.

Geographic range.—Known species are restricted to the eastern side of the Atlantic Ocean and adjacent regions of the Indian and Pacific oceans, but this may be an artifact of sampling. The known composite depth range is 54 to 4630 m.

Diagnosis.—Carapace large, smooth; right valve rounded-subtriangular in lateral outline; anterior margin broadly rounded; dorsal margin more or less angulate and high-arched, with or without distinct posterodorsal angulation; posteroventral angle sharply acute; ventral margin straight to gently indented, rarely slightly sinuate. Moderately inflated in dorsal view, with greatest thickness located anterior to midlength, posterior margins converging, anterior and posterior ends bluntly rounded. Zone of concrescence fairly narrow, with numerous short, straight to weakly branching radial pore canals, no dentiform corner. Few, small, funnel-shaped sensillum pores with smooth, thick, unbranched setae.

Antennule robust, tapering, with short podomeres and fairly short, thick setae; podomeres II and III flexibly articulated. Antenna robust, with numerous, fairly long, thick, bladelike terminal claws; very long sensory aesthetascs on podomere II; with four fairly long swimming setae on podomere III; anterodorsal setae of podomere IV very long. Podomeres I and II of maxillule palp completely fused without suture; the anterodistal setae of the two podomeres remain distinct.

Palp of male fifth limb forms a right-angled hook on the right side, somewhat more recurved on the left, with a well-developed sensory seta near its base and sensory disk at its tip, two tapering ventral pegs of approximately equal size, and a ventral seta but no dorsal seta. Female fifth limb robust, having the three distal setae graduated in length with the ventral one the longest or with the middle and ventral setae nearly equal in length. Sixth limb large, with the longest distal seta slightly longer than half again as long as the next-longest distal seta. Seventh limb moderately large, with conspicuously feathered, reflexed cleaning seta; one of the two distal setae is much longer than the other and may be nearly as long as the reflexed seta. Furcae quite small, symmetrical; each half consists of a cylindrical rod, which bears a cluster of four proximal setae midway along the ventral surface and a slender, elongate, flexible terminal seta. In several species the furca is dimorphic, with much larger proximal setae in the male or with the terminal seta and distal part of the rod entirely missing in the male, but in other species sexual dimorphism is not obvious. Zenker's organ with a moderately slender, elongate muscular segment and a distinctly broader anterior bulb; vas deferens tightly coiled into four or five circular loops. Hemipenis subtriangular to subrhomboidal to oblong in lateral outline, anterior segment longer or much longer than basal segment; copulatory rod small to medium-sized, slightly curved.

Affinities.—It is ironic that the nominal and most-cited genus of this family turns out to have the fewest species and the most restricted geographic distribution. It is also of interest that, so far, most reported fossil species of *Macrocypris* turn out to belong to other genera, usually *Macropyxis*. The species described here comprise a south to north succession along the east side of the bathyal and abyssal Atlantic Ocean, with the smallest, shallowest, and northernmost species being *M. minna*. The existence of three species in adjacent regions of the Pacific and Indian oceans must restrain any temptation to equate this geographic succession with an evolutionary or migrational sequence, however, at least until comparable sampling has been carried out in other oceans.

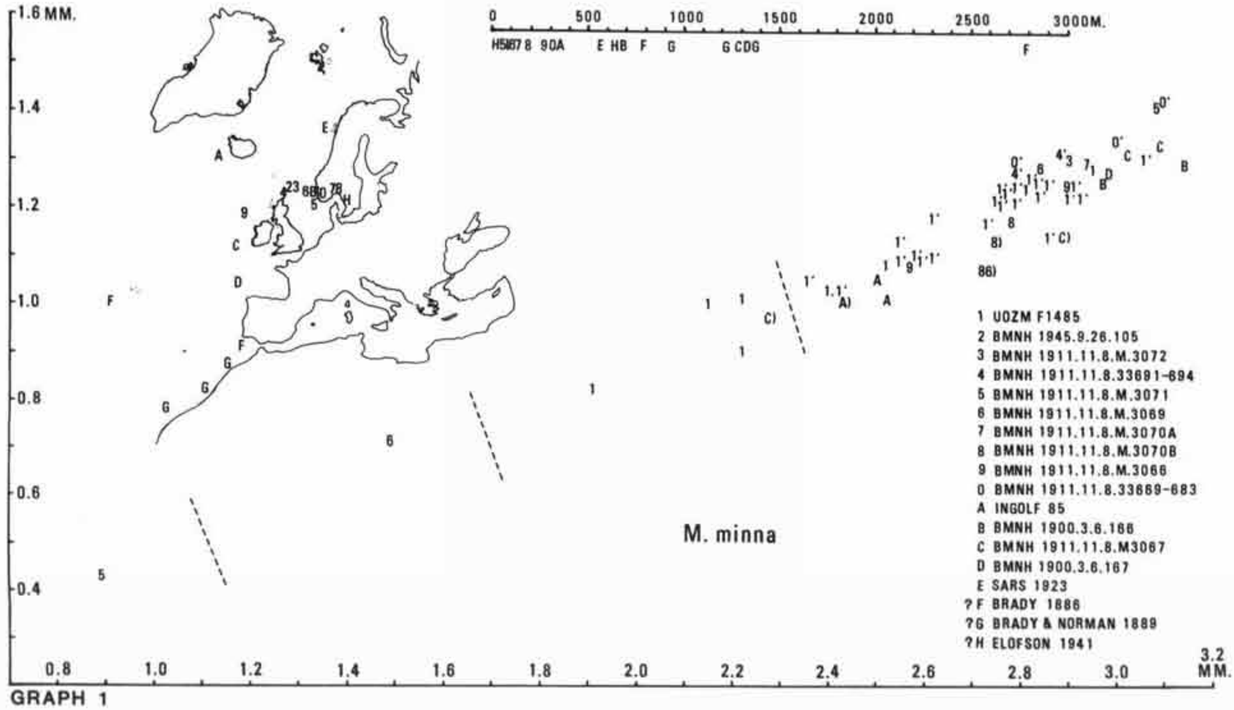
MACROCYPRIS MINNA (Baird, 1850)

Graph 1; Figures 2.1–3, 3.1–3, 18.4, 24.1, 25.1,2, 29.14,16,17, 32.3,9, 36–37.3, 39.4, 46.1–4, 65.7, 70.2, 75.3,4, 78.2; Plates 2.1–4, 3.1–4, 63.18, 64.1,2, 78.1,2, 81.21, 82.1,2,5,6,11,12, 85.1, 98.1,2, 110.1

Cythere minna Baird, 1850, p. 171, pl. 20, fig. 4A–D; Sars, 1863, p. 251.

Bairdia minna (Baird) Sars, 1866, p. 21.

Macrocypris minna (Baird) Brady, 1868a, p. 119; Brady, 1868b, p. 392, pl. 27, fig. 5–8, pl. 38, fig. 4; Norman, 1869, p. 290; Brady and Robertson, 1872, p. 65; Brady, 1886 (1881–1887), p. 164; Brady and Norman, 1889, p. 117, 243; Ostenfeld, 1906, p. 97; Ostenfeld and Wesenberg-Lund, 1909, p. 114; Müller, 1912, p. 122; Sars, 1923, p. 59, pl. 24, 25; Soot-Ryen, 1927, p. 19 (*fide* Elofson, 1941, p. 30); Klie, 1929, p. 11; Elofson, 1941, p. 30, map 12, 13; Elofson, 1943, p. 3; Sylvester-



GRAPH 1

BRADLEY, 1948, p. 70; TRIEBEL, 1960, pl. 18, fig. 34; KESLING in HOWE et al., 1961, fig. 6 (after Sars, 1922–1928); NEALE, 1964, p. 264; KORNICKER, 1969, table I, II; ?DANIELOPOL, 1971, p. 596, fig. 1A–C, 2A; MADDOCKS, 1977, fig. 1, 9 [*part.*]; DANIELOPOL, 1978, fig. 21A–E, 26G, 27A–E, 28.

?*Macrocypris* sp. ROSENFELD and BEIN, 1978, p. 18, pl. 1, fig. 14.

Not *Macrocypris minna* (Baird) TRESSLER, 1941, p. 98, pl. 19, fig. 26; SEGUENZA, 1880, p. 191; SEGUENZA, 1883–1886, p. 10; MCKENZIE et al., 1979, p. 12.

Not *Macrocypris* sp. cf. *M. minna* (Baird) WHATLEY and COLES, 1987, pl. 1, fig. 7.

Material.—Thirty-eight specimens in alcohol, including 1 male, 30 females, 4 juveniles, and 3 valves; and 31 subfossil specimens; for a total of 69 specimens.

Types.—In the British Museum (Natural History), catalog number 1945.9.26.105, labeled "*Cythere minna* Baird. 114. Zetland, R.," is a round cardboard box containing a smaller pill box. On the floor of the smaller box, glue shows where a specimen was formerly attached. Loose in this box are a paper label (quoted above), a straight pin, and a small black square of paper labeled "*Cythere minna.* Zetland. n. m. a. 50–60." in old-fashioned handwriting. Glued on this paper is a tiny fragment of the mid-ventral region of a left valve, which is apparently all that now remains of Baird's type specimen.

Fortunately, there has never been any doubt about the identity of Baird's species, and there is no need to select a neotype. The concept here described is based on Norwegian specimens identified by Sars and on British, Norwegian, and North Atlantic specimens identified by Norman and restudied by Sylvester-Bradley (1948).

Type locality.—"Dredged in from eighty to ninety fathoms of sand, twenty miles east of the Noss in the Shetland Isles, R. M'Andrew, Esq." (Baird, 1850, p. 172).

Occurrence.—In BMNH 1945.9.26.105, one fragment; in BMNH 1900.3.6.166, 2 specimens; in BMNH 1900.3.6.167, 1 specimen; in BMNH 1911.11.8.M.3066, 4 specimens; in BMNH 1911.11.8.M.3067, 4 specimens plus fragments; in BMNH 1911.11.8.M.3069, 4 specimens; in BMNH 1911.11.8.M.3070A, 5 specimens; in BMNH 1911.11.8.M.3070B, 3 specimens; in BMNH 1911.11.8.M.3071, 2 specimens; in BMNH 1911.11.8.M.3072, 1 specimen; in BMNH 1911.11.8.33669–683, 3 live specimens (3F); in BMNH 1911.11.8.33691–694, 2 live specimens (2F); at Ingolf 85, 1 live plus 4 specimens (1F); in UOZM F1485, 29 live plus 3 specimens (1M, 24F, 4J–1).

Distribution.—Holocene; northeastern Atlantic Ocean on the continental shelf and slope, known live depth range in the material studied 247 to 324 m, known dead depth range 54 to 1326 m.

Brady and Norman (1889) reported *M. minna* from four additional *Talisman* dredgings off the west coast of Morocco. This material was not studied, and the identifications have not been verified here. The stations are plotted on Graph 1 to show how their inclusion would extend the known geographic range of *M. minna* southward and would increase the depth range to 2792 m. Kornicker (1969, table II) provided corrected station data for those stations as follows: *Talisman* station 55, 22 June

1883, 28°35'N, 13°16'W, depth 1238 m, bottom temperature 7.2°C, yellow mud. *Talisman* station 34, 17 June 1883, 32°31'N, 9°48'W, depth 1350 m, reddish mud. *Talisman* station 85, 12 July 1883, 23°00'N, 17°30'W, depth 932 m, bottom temperature 7.0°C, green muddy sand. No further information was provided by Kornicker for "636–1200 m, off West Coast Morocco, June 1883" of Brady and Norman (1889).

Brady (1881–1887) reported *M. minna* from two additional stations, for which Kornicker (1969) gave the following information: *Travailleur* station 58, 25 July 1882, 36°40'0"N, 8°11'30"W, 770 m, mud. *Talisman* station 127, 11 August 1883, 36°12'N, 31°54'W, 2792 m, sand and rocky hard ground, bottom temperature 3.5°C. These specimens were not seen, and the identifications have not been verified. The stations are plotted on Graph 1 to show how far south and west their inclusion would extend the range of *M. minna*.

Sars (1923) reported *M. minna* to be common on the Norwegian coast from Christiania Fjord to the Lofoten Islands, in water depths of 50 to 300 fathoms (92 to 549 m). Elofson (1941) stated that it lives on all types of soft sediments but not on substrates containing hard materials, in a depth range of 53 to 680 m, a temperature range of 4° to 9°C., and nearly always in salinities above 34‰.

Dimensions.—Male 2002M, RVL 2.41 mm, RVH 1.00 mm, LVL 2.39 mm, LVH 0.94 mm. See also Graph 1. The single male is one of the smallest adult specimens and not quite as high in proportion to length as the females. There is a definite tendency for size to increase with water depth. Sylvester-Bradley (1948) reported a range of length for North Atlantic forms of 2.5 to 3.0 mm.

Diagnosis.—Right valve elongate-subtriangular in lateral view, ventral margin nearly straight and weakly indented, posteroventral angle acute, 55° to 60°. Narrow zone of concrescence with short, straight radial pore canals.

Palp of male fifth limb relatively small and elongate. Distal setae of female fifth limb relatively short, clawlike, of graduated lengths, and finely hispid. Furcae of male reduced, consisting of 2 short nubs, each with 4 large proximal setae at the end; the distal portion of each rod and the terminal setae are absent. The female furca is normal for the genus. Male copulatory organ lamellar, rounded-subtriangular in outline, with bluntly rounded distal termination.

Comparisons.—The carapace of *M. minna* is smaller than that of *M. metuenda, M. maioris, M. nimia,* and *M.* sp. 1; is much larger than *M. opinabilis*; has a more subtriangular lateral outline than *M. miranda* and *M. opinabilis*; is not as high in proportion to length as *M. maioris* and *M. metuenda*; lacks the posterodorsal angle of *M. maioris, M. metuenda, M. proclivis,* and *M.* sp. 1; lacks the tendency toward irregularly branching radial pore canals of *M. proclivis, M. nimia,* and *M.* sp. 1, and lacks the terminal spine of *M. miranda.*

Remarks.—The reduction of the male furcae is unique in the genus, although a comparable reduction is seen in males of *Macropyxis labutisi.* The male and female soft anatomy of *M. minna* was well illustrated by both Brady (1868b) and Sars (1923). Danielopol (1971) illustrated only the antenna and its sensory aesthetascs of material identified as *M. minna* in the Museum of Natural History, Stockholm.

The specimens reported by Tressler (1941) from two shallow sediment cores in the North Atlantic belong to *Macropyxis bathyalensis* (USNM 153744) and to *Krithe* spp. (USNM 153745).

M. minna was reported from the Quaternary of Italy by Seguenza (1880, 1883–1886), but this identification cannot be confirmed (see also Ruggieri, 1973).

The specimen illustrated by Rosenfeld and Bein (1978) from off North Africa appears to be a juvenile, very similar to juveniles of *M. minna.* By itself it is not sufficient evidence to extend the range of *M. minna* this far south. The posterior region of juveniles is shortened, although the anterior region generally resembles in shape that of the adult species. This gives juveniles a characteristically high-arched, posteriorly truncate, foreshortened appearance. Juveniles of *M. minna* would be difficult to distinguish from those of *M. nimia, M. metuenda,* or *M. maioris,* unless large populations and a growth-series of each were available. In fact, Brady (1881–1887) reported having mistaken *Mk. siliquosa* at first for a juvenile of *M. minna.*

MACROCYPRIS MAIORIS new species

Graph 2; Figures 2.7,8, 3.7,8, 18.2, 22.18, 24.3, 25.3,4, 29.12, 32.10, 36–37.9, 46.9,11, 48.1–4, 49.1–4, 56.1,20,35, 58.2, 59.13,35, 60.2, 63.12, 64.3, 66.4, 71.2, 80.1; Plates 2.8–12, 3.8–12, 58.8, 59.10, 64.3,4, 78.3–5, 82.8–10, 83.9, 84.6, 85.2,3,6, 99.5–9, 112.11

Macrocypris minna (Baird) *s.l.* MADDOCKS, 1977, p. 153, fig. 1, 9 [*part.*].

Macrocypris n. sp. 4 MADDOCKS, 1979, pl. 1, fig. 22, 23, pl. 2, fig. 14.

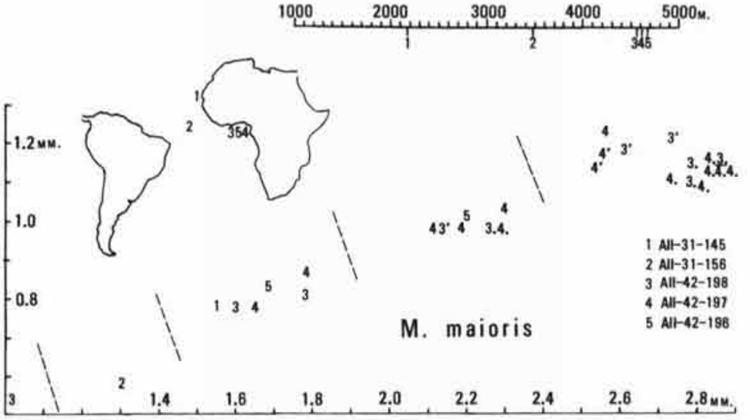
Derivation of name.—Latin *maior, -oris,* larger, the comparative of *magnus,* large; because it is smaller than *M. metuenda* and larger than *M. miranda,* with which it often occurs.

Material.—Twenty-nine specimens in alcohol, including 9 males, 4 females, 15 juveniles belonging to 4 instars, and 1 empty carapace.

Types.—Holotype male 1774M USNM 240258, paratypes USNM 240259–240273.

Type locality.—*Atlantis II* cruise 42 station 198, 10°24'S, 9°09'E, depth 4559–4566 m.

Occurrence.—At AII-31-145, 1 live specimen (1J–2); at AII-31-156, 1 live specimen (1J–3); at AII-42-196, 2 live specimens (1J–1, 1J–2); at AII-42-197, 14 live plus 1 specimens (6M, 2F, 1MJ–1, 3J–1, 2J–2); at AII-42-198, 10 live specimens (3M, 2F, 1MJ–1, 1FJ–1, 2J–2, 1J–4).



GRAPH 2

Distribution.—Holocene; equatorial eastern Atlantic Ocean, on the continental slope and abyssal plain off North Africa, known live depth range 2185–4630 m.

Dimensions.—Holotype male 1774M, RVL 2.87 mm, RVH 1.16 mm, LVL 2.78 mm, LVH 1.06 mm. See also Graph 2. Males are longer but proportionally less high than females.

Diagnosis.—Right valve angulate-subtriangular in lateral outline with more or less distinct dorsal angle located above muscle scar pattern; posterodorsal angle indistinct; posterior angle sharp, acute, 50° to 65°; ventral margin nearly straight to obscurely sinuate, with weak anteroventral indentation and slight medial convexity; zone of concrescence fairly broad, up to 25 percent of width of anterior inner lamella; anterior radial pore canals mostly straight, a few weakly and irregularly branching.

Male fifth limb has large, tightly recurved hook, with long ventral sensory seta; upper peg longer than lower one. The middle and ventral distal setae of the female fifth limb are of equal length, the dorsal seta only about half that length. Seventh leg has a long reflexed seta, feathered portion abruptly divided into two segments with different sizes of barbs; the longer of the two distal seta is about as long as podomeres V plus VI. Furcae well developed, with long terminal setae and large proximal setae in both sexes. Hemipenis swollen, subrhomboidal in lateral outline with acute distal angle, lateral surface flat, medial surface pyramidal with four flat to concave, triangular to crescentic facets sloping away from a median crest.

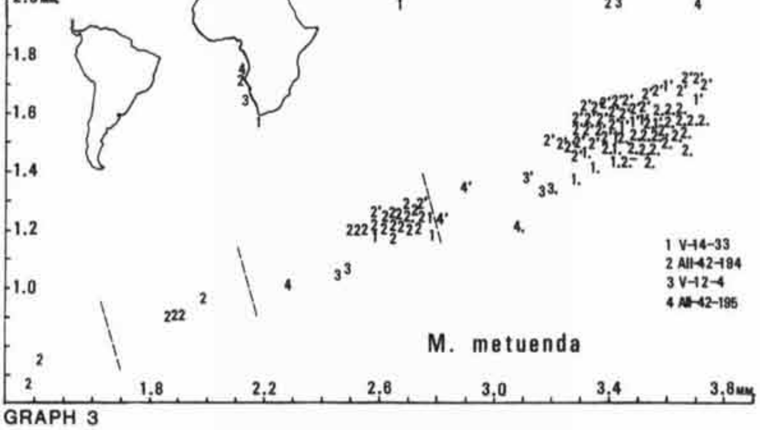
Comparisons.—*M. maioris* is smaller than *M. metuenda, M. nimia,* and *M.* sp. 1; is larger than *M. minna* and *M. proclivis*; is proportionally higher with a more pronounced dorsal angle than *M. minna, M. miranda, M. nimia,* and *M. opinabilis*; lacks the irregularly branching radial pore canals of *M. proclivis, M. nimia,* and *M.* sp. 1; and lacks the terminal spine of *M. miranda.*

MACROCYPRIS METUENDA new species

Graph 3; Figures 1.1–4, 18.1, 22.19, 24.4, 25.13,14, 29.15, 32.13, 36–37.4, 46.5,6, 48.6–9, 49.6–9, 56.1,14, 57.2,29, 58.3, 59.11,27, 60.5, 63.15,23, 64.1,43,52,53, 65.5, 70.1, 75.2, 78.1; Plates 4.1–6, 5.1–6, 58.7, 78.6,7, 83.11, 85.4,5, 7–9, 98.8–11, 99.1–4, 110.4, 112.12

Macrocypris minna (Baird) *s.l.* MADDOCKS, 1977, p. 153, fig. 1, 9 [*part.*].

Macrocypris n. sp. 6 MADDOCKS, 1979, pl. 2, fig. 7, 17.



GRAPH 3

Derivation of name.—Latin *metuendus,* fearful, terrible, dreadful; for its enormous size.

Material.—198 specimens in alcohol, including 46 males, 115 females, 1 of indeterminate sex, 1 empty valve, and 35 juveniles belonging to 3 instars.

Types.—Holotype male 1405M USNM 240274, paratypes USNM 240275–240293.

Type locality.—*Atlantis II* cruise 42 station 194, 22°54'S, 11°55'E, 2864 m.

Occurrence.—At AII-42-194, 172 live specimens (37M, 106F, 2FJ–1, 1MJ–1, 20J–1, 4J–2, 2J–3); at AII-42-195, 4 live specimens (1M, 2F, 1J–1); at V-12-4, 5 live plus 1 specimens (2M, 1F, 2J–1); at V-14-33, 16 live specimens (6M, 6F, 1MF?, 3J–1).

Distribution.—Holocene; southeastern Atlantic Ocean, on continental slope and abyssal plain off southern Africa, known live depth range 706 to 3797 m.

Dimensions.—Holotype male 1405M, RVL 3.50 mm, RVH 1.49 mm, LVL 3.38 mm, LVH 1.40 mm. See also Graph 3. Males may be shorter or longer than females but are never as high proportional to length. Size appears to decrease markedly with depth. This is the largest known species of Macrocyprididae.

Diagnosis.—Carapace gigantic, ranging from 2.8 mm to nearly 3.8 mm in length. Right valve angulate-subtriangular in lateral view, with dorsal angle and greatest height located near midlength; anterodorsal and posterodorsal margins nearly straight and sloping; posterodorsal angle fairly distinct, located just posterior to midlength; posteroventral angle acute, variable, 45° to 70°; ventral margin rather sinuate, with a shallow posteroventral indentation in addition to the anteroventral indentation. Radial pore canals short, straight, simple or weakly branching.

Female fifth limb robust, with the mediodistal seta slightly longer than the others. Male furca with smaller proximal setae than female. Male hemipenis elongate-ovate in outline, with a slender, inwardly curved, hook-shaped distal process; contraction of muscles causes elongation of the main lobe and outward rotation and extension of this distal process (see Plate 85.7).

Comparisons.—*M. metuenda* is much larger, with a proportionally higher, more angulate dorsal margin and less elongate posterior region than most other species. It has a more sinuate ventral margin than *M. nimia,* a larger posterior angle than *M. maioris,* and lacks the tiny spine of *M. miranda.*

Remarks.—This is the largest macrocyprid species known and probably the largest living marine podocopid ostracode.

One female fifth limb (1402F, illustrated in Figure 29.15) is pathological, with two setae instead of one on the second podomere.

MACROCYPRIS MIRANDA new species

Graph 4; Figures 2.5,6, 3.5,6, 18.3, 22.17, 24.2, 25.11,12, 29.13, 32.11, 38.3, 46.7,8, 48.10–13, 49.10–13, 56.17,36, 57.1,31, 58.1, 59.12,29,34, 60.3, 63.13,22, 64.2, 65.1, 80.2; Plates 4.7–12, 5.7–12, 58.1,2,9–15, 59.1,2,11, 64.5–8, 78.8–10, 82.13,14, 83.5,6, 85.10–12, 98.3–7, 110.2,3

Macrocypris minna (Baird) *s.l.* MADDOCKS, 1977, p. 153, fig. 1, 9 [*part.*].

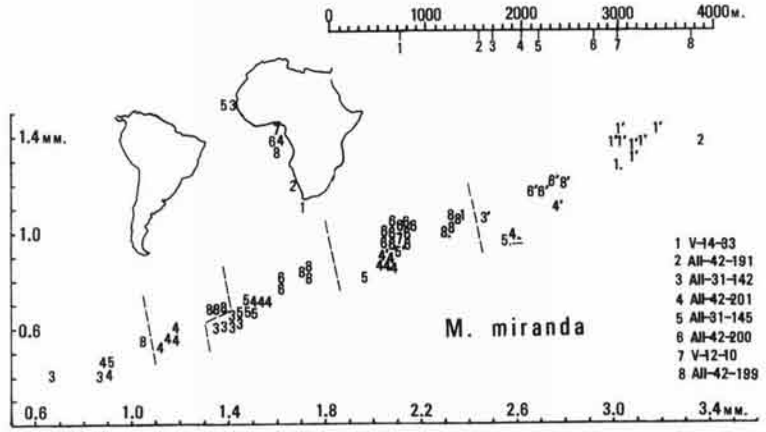
Derivation of name.—Latin *mirandus,* wonderful, strange; for the consistently recognizable spine in spite of the variable carapace shape.

Material.—Sixty-nine specimens in alcohol, including 3 males, 13 females, 51 juveniles belonging to 4 instars, and 2 valves.

Types.—Holotype 1419M USNM 240294, paratypes USNM 240295–240318.

Type locality.—*Atlantis II* cruise 42 station 201, 9°29'–9°25'S, 11°34'–11°35'E, depth 1964–2031 m.

Occurrence.—At AII-31-142, 8 live specimens (1F, 5J–2, 2J–4); at AII-31-145, 8 live specimens (1M, 1FJ–1, 1J–1, 4J–2, 1J–4); at AII-42-191, 2 specimens; at AII-42-199, 12 live specimens (1F, 1MJ–1, 3J–1, 3J–2, 3J–3, 1J–4); at AII-42-200, 13 live specimens (3F, 8J–1, 2J–2); at AII-42-201, 16 live specimens (1M, 1F, 1FJ–1, 4J–1, 3J–2, 4J–3, 2J–4); at



GRAPH 4

V-12-10, 1 live specimen (1J–1); at V-14-33, 9 live specimens (1M, 7F, 1J–1).

Distribution.—Holocene; east-central and southeastern Atlantic Ocean, on the continental slope and abyssal plain off Africa, known live depth range 706 to 3779 m.

Dimensions.—Holotype male 1419M, RVL 2.59 mm, RVH 0.99 mm, LVL 2.55 mm, LVH 0.95 mm. See also Graph 4. Males are the same length but not as high as females. Size is variable but not directly related to depth. Graph 4 gives some indication of both an inverse relationship with depth and a direct relationship with latitude, but neither is conclusive.

Diagnosis.—Right valve elongate-subtriangular, with broadly arched dorsal margin and weakly expressed posterodorsal angle; venter straight to slightly sinuate; posteroventral angle variably acute, from 50° to 75°. Radial pore canals short, straight to weakly branching. A single, very tiny, short spine is invariably present at the posteroventral angle of each valve and is especially conspicuous in juveniles.

Female fifth limb with rather short, graduated, clawlike terminal setae. Male furca with larger proximal setae than female. Male hemipenis subrectangular in outline, with right-angled, blunt distal termination.

Comparisons.—*M. miranda* is larger than *M. opinabilis*; is smaller than *M. metuenda*, *M. maioris*, *M. nimia*, and *M.* sp. 1; and is not as high and lacks the dorsal angle of *M. maioris*, *M. metuenda*, *M. proclivis*, and *M.* sp. 1. Although the carapace shape and size are somewhat variable, this species may be reliably recognized by the very tiny posteroventral spine, which is consistently present in adults, prominent in all juveniles, and never seen in other species.

MACROCYPRIS NIMIA new species

Graph 5; Figures 2.4, 3.4, 48.5, 49.5; Plates 2.6, 3.6

Macrocypris minna (Baird) *s.l.* MADDOCKS, 1977, p. 153, fig. 1, 9 [*part.*].

?*Macrocypris* sp. 1 BONADUCE and SPROVIERI, 1985, p. 134, pl. 2, fig. 5.

Derivation of name.—Latin *nimius*, beyond measure, excessive, too great, too much; because it is much larger than its geographic neighbor, *M. minna*.

Material.—Ten empty valves and carapaces.

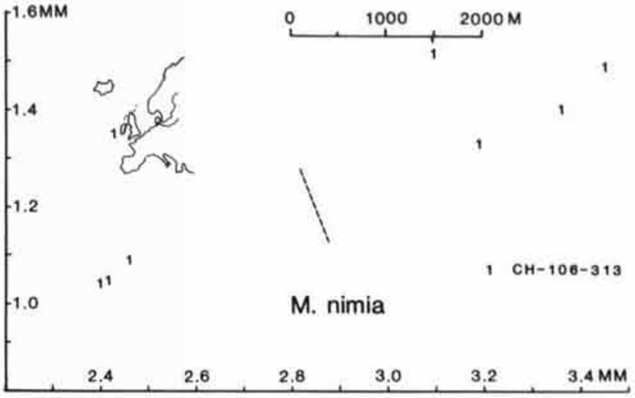
Types.—Holotype 1524RV USNM 240319, paratypes USNM 240320–240322.

Type locality.—*Chain* cruise 106 station 313, 51°32.2'N, 12°35.9'W, 1500–1491 m.

Occurrence.—At C-106-313, 10 specimens.

Distribution.—Holocene; known only as subfossil specimens at one station in the North Atlantic, southwest of Ireland, depth 1500–1491 m. A left valve that is strikingly similar in shape was illustrated from the Pliocene of Sicily (Bonaduce and Sprovieri, 1985).

Dimensions.—Specimen 1524, RVL 3.45 mm, RVH 1.39 mm. Specimen 1738, LVL 3.23 mm, LVH 1.35 mm. See also Graph 5.



GRAPH 5

Diagnosis.—Carapace large, thick-shelled; right valve with high, broadly arched dorsal margin, indistinct dorsal angle and distinct, rounded posterodorsal angle; posterior angle 58°, located ventrally; ventral margin straight, fused zone narrow.

Comparisons.—*M. nimia* is much larger than all other species known except *M. metuenda*, from which it differs by a less pronounced posterodorsal angle and a straight rather than swollen or sinuate ventral margin. It may be distinguished from *M. minna* by the more prominent, curved posterodorsal angle, slightly upswung posterior angle, and much larger size.

Remarks.—Although *M. minna* has been identified at a nearby *Porcupine* station (BMNH 1911.11.8.M.3067), *M. nimia* and *M. minna* have not been found together in the material studied.

MACROCYPRIS OPINABILIS new species

Graph 6; Figures 4.2, 5.2; Plates 58.3, 59.3

Macrocypris minna (Baird) *s.l.* MADDOCKS, 1977, p. 153, fig. 1, 9 [*part.*].

Derivation of name.—Latin, *opinabilis, -e*, conjectural, imaginary; because its affinities are uncertain.

Material.—Ten empty valves.

Types.—Holotype 2404RV USNM 240323, paratypes USNM 240324–240325.

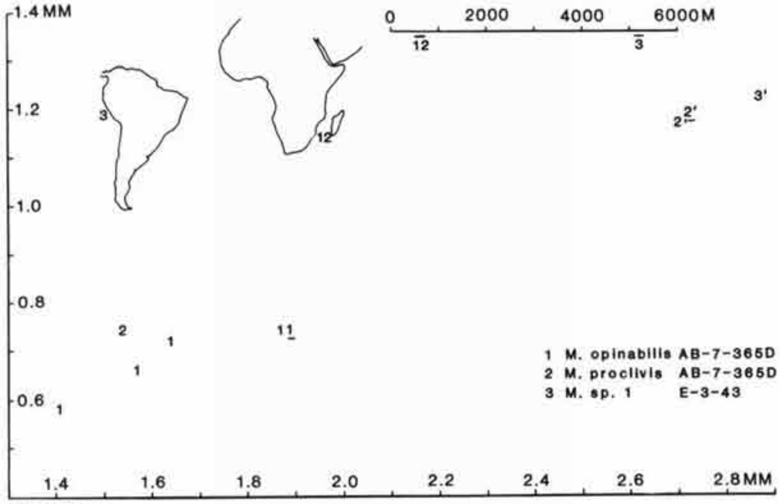
Type locality.—*Anton Bruun* cruise 7 station 365D, 23°20'S, 43°32'E, 695–475 m.

Occurrence.—At AB-7-365D, 10 specimens.

Distribution.—Holocene; found only as subfossil specimens at one station in the southwestern Indian Ocean, south of Madagascar, depth 695–475 m.

Dimensions.—Holotype 2404, RVL 1.89 mm, RVH 0.74 mm. Paratype 2405, LVL 1.98 mm, LVH 0.80 mm. See also Graph 6.

Diagnosis.—Carapace small, siliquose; right valve with



GRAPH 6

broadly arched dorsal margin and nearly straight ventral margin, without dorsal or posterodorsal angle; posterior angle rounded, about 60°, ventral margin straight; anterior radial pore canals short and straight.

Comparisons.—*M. opinabilis* is the smallest and proportionally the most elongate of the species assigned to *Macrocypris.* The shape of the carapace is intermediate between *Macrocypris* and *Macropyxis,* but the even width of the zone of concrescence, the regularly arranged, straight radial pore canals, and the straight ventral margin suggest assignment to *Macrocypris.*

MACROCYPRIS PROCLIVIS new species

Graph 6; Figures 4.3–5, 5.3–5, 18.9, 29.19, 32.12, 38.2, 46.10; Plates 2.5, 3.5, 59.9, 64.9

Derivation of name.—Latin *proclivis, -e,* sloping, steep, going downward; for the sloping posterior margin.

Material.—Five specimens in alcohol, including 2 females and 3 valves.

Types.—Holotype female 361F USNM 240326, paratypes USNM 240327–240328.

Type locality.—*Anton Bruun* cruise 7 station 363D, 23°45'S, 43°11'E, 1605 m.

Occurrence.—At AB-7-363D, 2 live specimens (2F); at AB-7-365D, 3 specimens.

Distribution.—Holocene; southwestern Indian Ocean south of Madagascar, known live at depth 1605 m, empty valves at 475–695 m.

Dimensions.—Holotype female 361F, RVL 2.72 mm, RVH 1.19 mm. See also Graph 6.

Diagnosis.—Right valve elongate-subtriangular in lateral view with arched dorsum and nearly straight venter; anterior radial pore canals long and branching.

Female fifth limb of average proportions with graduated distal setae. Furcae short with short, thick terminal setae.

Comparisons.—*M. proclivis* is distinguished from *M. minna* by larger size, prominent posteroventral angle, and branching radial pore canals. It is very similar to *M. maioris* in size and shape, differing in the more narrowly rounded anterior margin, more steeply sloping anterodorsal and posterodorsal margins, and more acute posterior angle.

MACROCYPRIS sp. 1

Graph 6; Figures 4.6, 5.6, 29.18, 32.8, 36–37.2, 46.37; Plates 2.7, 3.7, 78.11

Macrocypris minna (Baird) *s.l.* MADDOCKS, 1977, p. 153, fig. 1, 9 [*part.*].

Material.—One female in alcohol, USNM 240329.

Occurrence.—At E-3-43, one live specimen (1F).

Distribution.—Holocene; known live at only one station in the eastern Pacific Ocean, on the continental slope off Peru, depth 3494–3402 m.

Dimensions.—Female 858F, RVL 2.87 mm, RVH 1.22 mm. See also Graph 6.

Comparisons.—*M.* sp. 1 is very similar to *M. proclivis* but has a slightly up-curved posteroventral margin, and the posterior angle is located slightly above the venter. It is distinguished from most other species by the smoothly arching dorsal margin with indistinct dorsal angle and no posterodorsal angle, the slightly sinuate venter, and the weakly branching anterior radial pore canals.

Remarks.—The female fifth limb is slender with long, flexible setae of graduated sizes. The female furca is very large, with inflated lobes but tiny proximal setae.

Genus MACROMCKENZIEA new genus

Derivation of name.—For Kenneth G. McKenzie, in recognition of his contributions to our knowledge of the Cypridacea.

Type species.—*Macrocypris siliquosa* BRADY, 1887.

Species included.—Listed by original binomen:

Macrocypris siliquosa Brady, 1887; Holocene, eastern Atlantic Ocean.

Macrocypris australiana Neale, 1975; Cretaceous, Australia.

Macromckenziea glacierae n. sp.; Holocene, Drake Passage and Weddell Sea.

Macromckenziea gregalis n. sp.; Holocene, south of Tasmania.

Macrocypris ligustica Bonaduce, Masoli, and Pugliese, 1977; Plio-Pleistocene to Holocene, Mediterranean region.

Macrocypris porcelanica Whatley and Downing, 1983; Miocene, Australia.

Macromckenziea swansoni n. sp.; Holocene, Tasman Sea.

Macromckenziea sp. 2; Holocene, southwestern Atlantic Ocean.

Macromckenziea sp. 3; Holocene, Drake Passage.

Macromckenziea sp. 4; Holocene, Mozambique Channel.

Macromckenziea sp. 5; Holocene, Weddell Sea.

Macromckenziea sp. 6; Holocene, Tasman Sea.

Macromckenziea sp. 7; Holocene, Mozambique Channel.

Macromckenziea sp. 19; Holocene, Drake Passage.

Geologic range.—Cretaceous to Holocene.

Geographic distribution.—Atlantic, Indian, and Southern oceans; known composite live depth range 97 to 3111 m, dead from 95 to 3829 m.

Diagnosis.—Carapace smooth, thick-walled, small to medium-sized, often cream to light tan in color, sometimes with a visible layer of brown chitinous endocuticle lining the inner margin, selvage, and interior of valves. Carapace shape elongate-oblong, asymmetrical; right valve subquadrate to subhemispherical in lateral view; anterior margin broadly rounded; dorsal margin straight to gently arching; posterior margin truncate or rounded ending in nearly right-angled posteroventral angle; ventral margin nearly straight to gently sinuate. Carapace elongate-ovate in dorsal view with very slight anterior and posterior taper; sides nearly straight, parallel or gently curving; greatest thickness located medially; lines of dorsal and ventral overlap gently sinuate, not exaggerated. Hinge normal for the family, thick and easily seen. Zone of concrescence narrow, vestibules open, radial pore canals mostly short and straight, no dentiform corner. Adductor muscle scar pattern relatively large with numerous discrete scars, occupying as much as one quarter of the height; within the lower group of adductor scars the upper and posterior scars often are arranged compactly in a single curved line, with the anteroventral scars being segregated as a separate spot; the result being a scar pattern with possible homologies to Bairdiidae.

Antennule robust, thick, tapering, with nearly equant podomeres and thick, short setae; podomeres II and III flexibly articulated. Antenna compact, thick-proportioned, tightly curled, with numerous, thick, long, clawlike terminal setae; very long sensory aesthetascs on podomere II; 4 or 5 rather long swimming setae on podomere III; anterodistal setae of podomere IV very long. Podomeres I and II of maxillule palp completely fused without suture or with very faint, partial, vestigial suture; the anterodistal seta of podomere I may remain separate or may migrate distally to join the three setae of podomere II.

Palp of male fifth limb forms a robust right-angled hook on right side, somewhat more recurved on left, with ventral seta, two slender pegs, and sensory seta but with no dorsal seta. Palp of female fifth limb slender; either the mediodistal or ventrodistal seta may be the longest. Sixth limb small, with the two distal setae equal or nearly equal in length. Seventh limb small, with rather short cleaning seta, one distal seta much longer than the other. Furca may be similar to that of *Macrocypris,* or it may be vestigial, lacking the terminal seta and the distal portions of the cylindrical rods, with the proximal regions fused into a single, very small, inflexible shaft or nub terminated by two pairs of tiny proximal setae. Male hemipenis rounded-subtriangular in lateral outline, with anterior segment very small; copulatory rod short and straight or long and coiled. Zenker's organ with large, elongate bulb and short muscular segment; proximal part of vas deferens greatly enlarged, coiled into three or four tight coils.

Affinities.—Some species of *Macromckenziea* are easily confused with *Argilloecia* and related genera, which have very similar carapace shape and overlap. They may be distinguished externally by the greater sinuosity of the dorsal and ventral overlap, by the muscle scar pattern, and by the macrocypridid rather than argilloeciine pores and setae. Some species of *Abyssocypris, Bythocypris,* and *Krithe* also show striking resemblances in external carapace morphology to *Macromckenziea.* Some life habit or adaptation common to the deep-sea representatives of these unrelated lineages may be responsible for this pronounced evolutionary convergence.

In soft-part characters, *Macromckenziea* is closest to *Macrocypris.* There may be at least two species-groups within the genus, the *siliquosa*-group and the *glacierae*-group, as shown by the existence of both a normal and a reduced furca and by the two different kinds of hemipenis. Alternatively, two or more different stocks of Macrocyprididae may have independently adopted this small, robust, oblong carapace shape, just as so many other deep-sea podocopids have done. In the latter case, the similarities would be due to convergence, and the genus would be polyphyletic. Not enough species with good soft parts are available yet to distinguish between these possibilities.

When both carapace and soft-part characters vary independently within a taxon, contradictory interpretations may be possible, depending on which set of characters is given more weight. The generic classification proposed here groups all species with similar carapaces into *Macromckenziea,* even though this produces heterogeneity in some soft-part characters. It has the practical advantage of being applicable to fossils and, therefore, potentially testable as an evolutionary hypothesis. The type species, *Mk. siliquosa,* is regarded as morphologically typical, and *Mk.*

ligustica appears to be very closely related to it. *Mk. glacierae, Mk. gregalis, Mk. porcelanica,* and perhaps *Mk. swansoni* represent a second species-group. Several additional species in open nomenclature show the potential diversity of this new genus, and *Mk. australiana* demonstrates its antiquity.

Remarks.—Kenneth G. McKenzie also suspected that *Mk. ligustica* and *Mk. siliquosa* might need to be classified together in a new genus (personal communication, letter of 18 May 1979).

MACROMCKENZIEA SILIQUOSA (Brady, 1887)

Graph 7; Figures 4.12,13, 5.11,12, 18.5, 24.23, 25.5,6, 29.6, 32.7, 36–37.5, 46.29–34, 54.39–43, 55.32–36, 56.11,28, 57.15,33, 58.6, 59.17,32,36, 60.6, 63.10,18, 64.28–30, 66.9, 70.3, 75.5, 78.4; Plates 6.1–6, 7.1–6, 60.1–4, 61.1–4, 65.1–6, 78.12–14, 81.22, 84.4, 86.1–4,10,11, 100.7–9, 11,12,14, 110.8,9

Macrocypris siliquosa Brady, 1887, p. 164, 194, pl. 14, fig. 1–3; Brady and Norman, 1889, p. 118, 243, fig. 143; Müller, 1912, p. 122; Kornicker, 1969, tables I, II; Maddocks, 1977, fig. 1, 3, 4 [*part.*]; Maddocks, 1979, pl. 2, fig. 9, 16, 21, 22, 24, 25.

Material.—139 specimens in alcohol, including 33 males, 39 females, 64 juveniles belonging to 4 instars, and 3 carapaces; and 14 dry specimens, including Brady's syntypes; for a total of 153 specimens.

Types.—Four slides labelled *Macrocypris siliquosa* Brady are in the G. S. Brady cabinet in the Hancock Museum, Newcastle-upon-Tyne. Only one slide corresponds to a locality mentioned by Brady in the original description. That slide HM 1.45.29 is labelled "Talisman, 932 m, Lat. 23°N, Long. 19°50'W, 11/7/83." This is probably *Talisman* station 85, according to the corrected station data provided by Kornicker (1969). Brady and Norman (1889, p. 119) stated that the types of this species came from this *Talisman* dredging. On this slide, "*Argilloecia*" has been crossed out and replaced by "*Macrocypris,*" with "*siliquosa*" unchanged. Also crossed out but still readable is "=*Macrocypris minna,* juv." Brady (1887) mentioned having taken *Mk. siliquosa* for a juvenile of *M. minna* at first, and in fact the early juveniles of the two species are much alike. This slide contains six whole dry carapaces and one right valve. One of the whole carapaces is here designated the lectotype and has been removed to a new slide HM 1.45.28, labelled with my specimen number 1949. The lectotype specimen, probably a female, shows a good muscle scar pattern and corresponds well to the original illustration by Brady, although it cannot now be determined which specimen was actually illustrated by Brady.

The other three slides correspond to localities reported by Brady and Norman (1889, p. 243) and are not primary types. One slide, HM 1.45.30, is labelled "Arguin Bank, Africa, 20°N, 15 July 1883, 2333 m, M. de Folin." This is probably *Talisman* station 99, according to Kornicker (1969). In another handwriting the words "SYNTYPES B122" have been added, but because this is not a "Fonds de la Mer" station, these cannot be syntypes. The slide contains a well preserved whole specimen, my specimen number 1950, which corresponds well with the illustration given by Brady and Norman (1889). There are also a right valve with dry female body and a left valve, probably halves of the same carapace, in this slide.

Another slide, HM 1.45.31, is labelled "West Coast of Morocco (*Travailleur*), 630 m, 30/7/82." It contains one whole carapace in poor condition.

The fourth slide is labelled "West Coast of Morocco, 832 mètres, (Talisman), 17/5/83." This is probably *Talisman* station 35, according to Kornicker (1969). It contains two whole carapaces, a left valve, and a right valve of *Mk. siliquosa,* together with one whole carapace and one left valve of *Bythocypris bosquetiana.* Both species names are written on the label.

The new material for this species is catalogued as USNM 240330–240348.

Type locality.—The original label on the slide with the lectotype and paralectotypes reads "Talisman, 932 m, Lat. 23°N, Long. 19°50'W, 11/7/83." Kornicker (1969) provided the following corrected station data (Table I, line 3): 12 July 1883, depth 932 m, 23°00'N. Lat., 17°30'W Long., greenish muddy sand, temperature 7°, *Talisman* station 85.

Occurrence.—In HM 1.45.28 and HM 1.45.29, *Talisman* station 85, 7 specimens; in HM 1.45.30, 2 specimens; in HM 1.45.31, 1 specimen; at HM *Talisman* station 35, 4 specimens; at AII-31-145, 10 live specimens (5F, 1FJ–1, 1FJ–2, 2J–2, 1F–3); at AII-42-194, 114 live plus 1 specimens (31M, 30F, 1MJ–1, 2FJ–1, 45J–1, 1FJ–2, 3J–2, 1J–4); at AII-42-200, 10 live plus 2 specimens (2M, 2F, 1FJ–1, 5J–1); at V-12-4, 1 live specimen (1F); at V-14-33, 1 live specimen (1F).

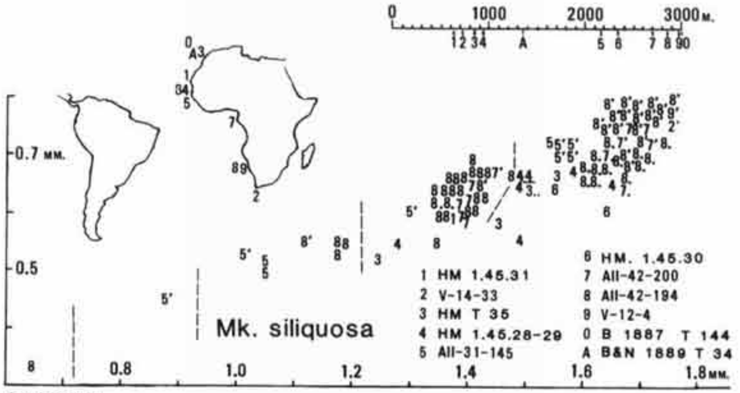
Distribution.—Holocene; eastern Atlantic Ocean, continental slope and abyssal plains off North, Central, and South Africa, known live depth range 706 to 2864 m, dead from 630 to 2995 m.

Brady (1887) also reported the species from *Talisman* station 144, 22 August 1883, 38°38'N, 25°06'W, depth 2995 m, soft white sand, temperature 3.4°C (station data by Kornicker, 1969); this material was not located.

Brady and Norman (1889) reported the species from *Talisman* station 34, 17 June 1883, 32°31'N, 9°48'W, depth 1350 m, reddish mud (station data according to Kornicker, 1969); this material was not located.

Dimensions.—Lectotype specimen 1949W, RVL 1.50 mm, RVH 0.67 mm. See also Graph 7. Females are distinctly higher than males and perhaps slightly longer on average, as well as higher in proportion to length. Size appears to increase both with depth and toward the southern end of the geographic range.

Diagnosis.—Right valve oblong to subquadrate in lateral view; anterior margin broadly rounded; ventral margin straight to gently sinuate; dorsal margin gently arched to



GRAPH 7

nearly straight with greatest height located medially; posterior margin gently curved, truncate, joining dorsal margin at broadly rounded posteroventral curve; posteroventral angle rounded, indistinct, less than 90°. The adductor muscle scar pattern of many specimens has the scars clumped in four groups to form a pattern approaching that of *Bythocypris* (Fig. 24.23; see also Text-fig. 1).

Palp of male fifth limb slender, with slender pegs of nearly equal size; right hook right-angled, left hook only slightly more recurved. Palp of female fifth limb robust with clawlike distal setae of graduated lengths. Mediodistal claw of sixth limb about 25 percent longer than dorsodistal claw. Reflexed seta of seventh limb short, lined with tiny hairs too fine to draw; mediodistal seta exceptionally long. Furca vestigial in both sexes, larger in female than in male, distal portions and terminal setae missing, proximal regions fused into a single blade-shaped process capped by two pairs of tiny proximal setae. Hemipenis rounded-subtriangular, nearly equilateral in lateral view, with small, lobate anterior segment; copulatory tube small, nearly straight. Anterior bulb of Zenker's organ very much enlarged, ovate; muscular segment rather short; vas deferens enlarged, thicker than outside diameter of the muscular segment, very tightly coiled into about three irregular loops.

Comparisons.—*Mk. siliquosa* is larger and thicker-shelled than *Mk. ligustica*, with a more rounded, usually acute posteroventral angle. Several rather similar species in distant parts of the world are represented in this material only by scattered specimens, without soft parts or information about sexual dimorphism. These species, here designated as *Mk.* 2 through 7, cannot yet be diagnosed unambiguously from *Mk. siliquosa*. Species of the *Mk. glacierae* group have a more subtriangular lateral outline with higher-arched dorsal margin.

MACROMCKENZIEA AUSTRALIANA (Neale, 1975)

Graph 42; Figure 6.9; Plates 6.7, 7.7, 78.15

Macrocypris australiana NEALE, 1975, p. 11, pl. 1, fig. 11. *Macrocypris simplex* var. *africana* CHAPMAN, 1917, p. 53, pl. 13, fig. 4; HOWE and LAURENCICH, 1958, p. 394; DE DECKKER and JONES, 1978, p. 57.

Material.—A single fossil left valve.

Types.—Chapman's holotype right valve (not seen) is in the Canberra Bureau of Mineral Resources Collection, No. CPC 7134 (*fide* Neale, 1975). An external view by SEM was figured by Neale (1975).

Type locality.—Upper Cretaceous (Santonian), Gingin Chalk, One Tree Hill, Australia.

Occurrence.—In HU.65.C.6.60, one left valve.

Distribution.—Cretaceous, western Australia.

Dimensions.—HU.65.C.6.60, LVL 1.12 mm, LVH 0.50 mm. See also Graph 42.

Diagnosis.—Carapace elongate-oblong; right valve with very gently arched dorsal margin in lateral view, obliquely rounded anterior margin, nearly straight ventral margin, rounded posteroventral angle of about 70° located at venter, obscurely rounded posterodorsal angle, and slightly truncate posterior margin.

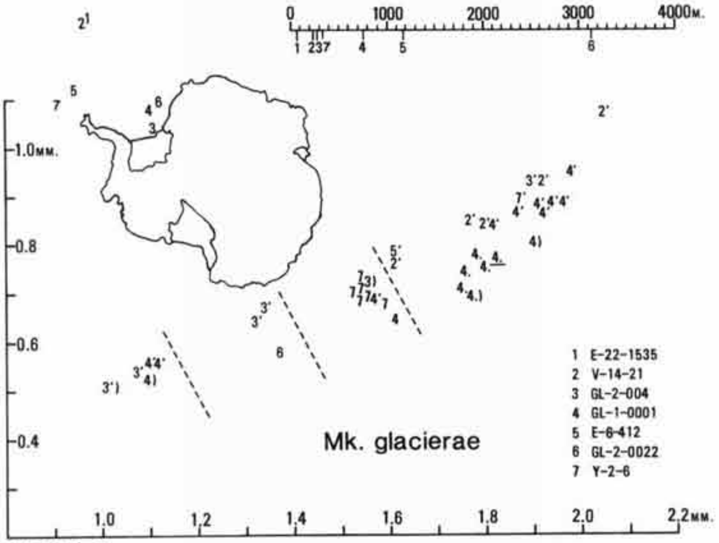
Comparisons.—*Mk. australiana* is more elongate than any other species known.

Remarks.—The diagnosis above is based on the illustration of the holotype right valve by Neale (1975) (see also Figure 6.9). The very well preserved adductor muscle scars (Pl. 78.15), what can be seen of the hinge, the general shape, and the right valve overlap support the assignment to *Macromckenziea*. As well as being a "potential source of confusion" (Neale, 1975, p. 11), *Macrocypris simplex africana* Chapman, 1917, is a junior primary homonym of *Macrocypris africana* Müller, 1908.

MACROMCKENZIEA GLACIERAE new species

Graph 8; Figures 4.14,15, 5.13,14, 18.13, 24.19, 25.7,8, 29.1, 32.2, 36–37.8, 46.20–25, 54.44–46, 55.38–40, 56.25,31, 57.26,34, 58.5, 59.16,30, 60.1, 63.9, 64.48–50, 66.2, 71.1, 75.1, 78.3; Plates 8.3–6, 9.3–6, 65.7–10, 78.16,17, 83.3, 86.5–9, 100.1–6, 110.5,7

Macrocypris n. sp. (OTU 18) MADDOCKS, 1976, p. 42. "aff. *Macrocypris* spec." HARTMANN, 1987, p. 132, fig. 78–90.



GRAPH 8

Derivation of name.—For the U.S. Coast Guard Ship *Glacier.*

Material.—Forty-two specimens in alcohol, including 7 males, 17 females, 14 juveniles belonging to 3 instars, and 4 carapaces and valves.

Types.—Holotype male 880M USNM 240349, paratypes USNM 240350–240370.

Type locality.—*Glacier* cruise 1 station 0001, 74°06'–07'S, 39°38'W, depth 400 fathoms (732 m).

Occurrence.—At GL-1-0001, 17 live plus 3 specimens (6M, 7F, 1FJ–1, 1MJ–2, 2FJ–3); at GL-2-004, 5 live plus 1 specimens (1F, 2FJ–2, 2FJ–3); at GL-2-0022, 1 live specimen (1F); at E-6-412, 2 live specimens (2F); at E-22-1535, 1 live specimen (1M); at Y-2-6, 7 live specimens (1F, 6J–1); at V-14-21, 5 live specimens (5F).

Distribution.—Holocene; Drake Passage and Weddell Sea, Antarctica, known live depth range 97 to 3111 m. Hartmann (1987) reported it living at eight stations in the South Shetland Islands and the Palmer Archipelago at depths between 140 and 180 m.

Dimensions.—Holotype male 880M, RVL 1.82 mm, RVH 0.77 mm, LVL 1.78 mm, LVH 0.73 mm. Females longer, higher, and proportionally higher than males. See also Graph 8.

Diagnosis.—Right valve elongate-subtriangular in outline, with broadly arched dorsal margin and without distinct dorsal or posterodorsal angles; greatest height located medially, sloping smoothly to narrowly but evenly rounded anterior margin and steep posterior margin; ventral margin nearly straight; posteroventral angle distinct, located ventrally, about 70° to 80°.

Palp of male fifth limb robust with prominent sensory seta and slender pegs of unequal size; left hook strongly recurved. Palp of female fifth limb with extremely long middle distal seta. Sixth limb has two distal claws of equal length. Reflexed seta of seventh limb very short but conspicuously feathered; mediodistal seta very long. Furca vestigial in both sexes; distal region and terminal seta entirely missing; proximal region reduced to a very tiny nub with four tiny proximal setae. Hemipenis rounded-subtriangular in lateral view, higher than long, without conspicuous anterior lobe; copulatory tube very long and coiled. Anterior bulb of Zenker's organ enlarged, muscular segment fairly long; vas deferens regularly coiled in circular disk of about four loops.

Comparisons.—In shape *Mk. glacierae* is most similar to *Mk. gregalis,* but it is very much smaller and more elongate. The reduced furca and other soft-part characters support its classification in *Macromckenziea.*

MACROMCKENZIEA GREGALIS new species

Graph 9; Figures 4.10,11, 5.9,10, 24.20, 54.31–36, 55.26–31; Plates 8.10–12, 9.10–12, 78.18

Derivation of name.—Latin *gregalis, -e,* of a flock, of the same flock; for its abundance at the type locality.

Material.—More than 355 carapaces and valves.

Types.—Holotype specimen 1912 USNM 240371, paratypes USNM 240372–240381, KUMIP 1,123,136–1,124,297.

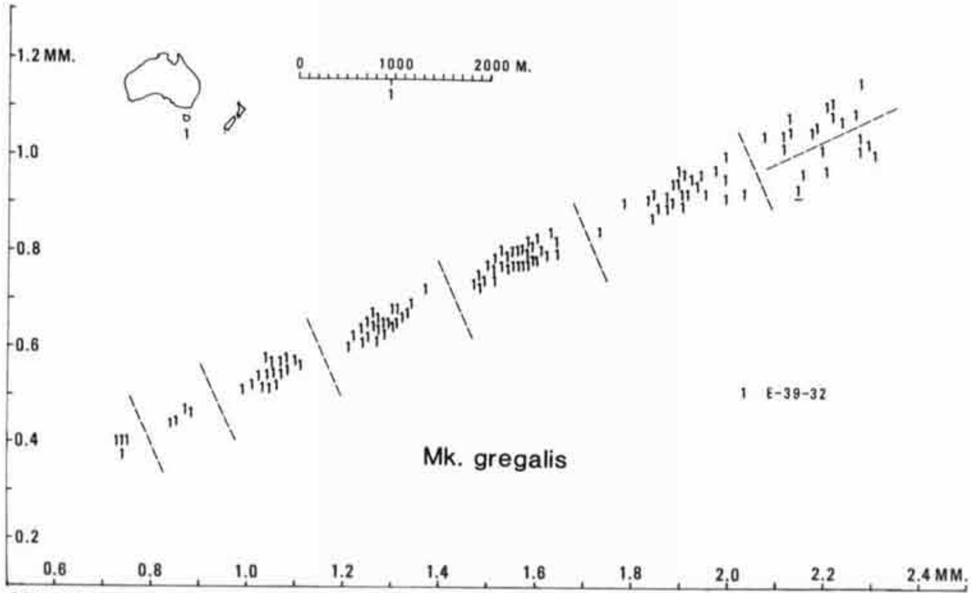
Type locality.—*Eltanin* cruise 39 station 32, 47°26.4'S, 148°17.2'E, depth 960 m.

Occurrence.—At E-39-32, 355 specimens.

Distribution.—Holocene; known only from one station south of Tasmania on the Tasman Plateau, depth 960 m.

Dimensions.—Holotype specimen 1912, RVL 2.14 mm, RVH 0.93 mm, LVL 2.09 mm, LVH 0.88 mm. Presumed females much higher than presumed males. See also Graph 9.

Diagnosis.—Carapace large, thick-shelled, opaque white. Greatest height located slightly posterior to midlength. Right valve rounded-subtriangular to hemicircular in



GRAPH 9

lateral outline; dorsal margin very highly arched sloping steeply anteriorly to narrowly rounded anterior margin, broadly inflated posteriorly with indistinct posterodorsal angle and nearly vertical posterior margin; posteroventral angle sharp, about 70° to 85°, located ventrally; ventral margin nearly straight with weak anteroventral indentation.

Comparisons.—*Mk. gregalis* is the largest species known in the genus. Presumed males are very similar in shape to the females of *Mk. glacierae* but larger and slightly more elongate.

Remarks.—There appear to be six juvenile instars represented in this material, the largest number represented for any species studied (see Graph 9).

MACROMCKENZIEA LIGUSTICA
(Bonaduce, Masoli, and Pugliese, 1977)

Graph 10; Figures 4.8, 5.7, 18.10, 24.21, 29.5, 32.1, 36–37.7, 46.26–28, 66.3; Plates 6.11,12, 7.11,12, 78.19,20

Macrocypris ligustica BONADUCE et al., 1977, p. 245, fig. 3, pl. 1, fig. 1–3; COLALONGO and PASINI, 1980, p. 62, pl. 23, fig. 6-9; BONADUCE and SPROVIERI, 1985, p. 134, pl. 2, fig. 7; BONADUCE et al., 1988, p. 463.

?*Macrocypris ligusta* [*sic*] Bonaduce, Masoli, and Pugliese PEYPOUQUET and NACHITE, 1984, table 2, 4.

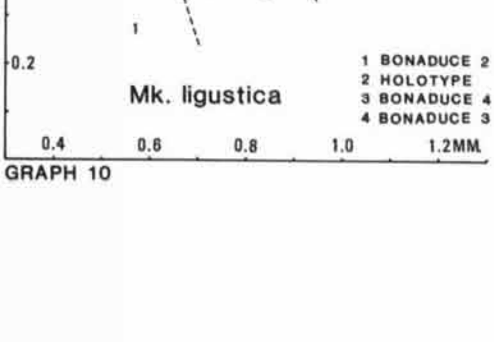
Material.—Two females in alcohol and 27 empty valves and carapaces; for a total of 29 specimens. The illustrated specimens are deposited as USNM 240382–240384, and the rest are in the collection of Giacocchino Bonaduce.

Types.—Holotype right valve, Collezioni Ostracodi B.C.M. n. 322; paratype left valve, B.C.M. n. 333, deposited in the Zoological Station in Naples, *fide* Bonaduce et al., 1977 (not seen).

Type locality.—Station 89 of Bonaduce et al. (1977) in the Ligurian Sea, south of Cape Martola, depth 102 m.

Occurrence.—At Bonaduce 2, 5 specimens; at Bonaduce 3, 2 live plus 1 specimens (2F); at Bonaduce 4, 19 specimens; at Bonaduce 9, 1 specimen; at Bonaduce 10, 1 specimen.

Distribution.—Holocene; in the Bay of Naples, known live at a depth of 145 m and dead from 95 to 340 m; in the Ligurian Sea, dead in depths of 77 to 86 m, where a range of 20 to 107 m was reported by Bonaduce et al. (1977). Bonaduce et al. (1988) considered it to be a good marker for the circalittoral zone (36 to 123 m) on the Tunisian shelf. Peypouquet and Nachite (1984) reported "autochthonous" subfossil specimens from 950 to 2640 m depth south of the Rhone Delta in the northeastern Mediterranean. The species is also reported in the Plio-Pleistocene of Calabria and Sicily.



GRAPH 10

Dimensions.—Female 2274F, RVL 1.05 mm, RVH 0.43 mm. See also Graph 10.

Diagnosis.—Right valve oblong in lateral outline; anterior margin broadly and evenly rounded; venter gently sinuate; posteroventral margin upswing; posteroventral angle distinctly obtuse, located well above venter. Dorsal margin very gently arching, without dorsal or posterodorsal angles, highest medially, sloping gradually and continuously to bluntly rounded posterior.

Female fifth limb slender, with distal setae of graduated sizes. Distal claws of sixth limb equally long. Reflexed seta of seventh limb short but conspicuously feathered, mediodistal seta exceptionally long. Furcae much reduced, with distal regions and terminal setae missing; proximal regions fused into a single, tiny, elongate process bearing just two small, rodlike proximal setae.

Comparisons.—*Mk. ligustica* is similar to *Mk. siliquosa* but smaller, a little more elongate, and a little less inflated, with a more sinuate venter and a more distinct, obtuse posteroventral angle. Soft-part differences include the equally long terminal claws of the sixth limb, conspicuously feathered reflexed seta of the seventh limb, and the reduction of each half of the furca to a single seta. Juveniles of *Mk. siliquosa* are notably higher and thicker in proportion to length, more rotund in shape.

Remarks.—This species is probably closely related to *Mk. siliquosa*, which is not known in the Mediterranean. Good SEM photos were published by Bonaduce et al. (1977). The report by Peypouquet and Nachite (1984) is queried because they did not illustrate the species and spelled the name differently.

Ruggieri (1984) designated a right valve (apparently a juvenile) from the Lower Pleistocene of Sicily as a neotype for "*Macrocypris*" *compressa* Seguenza, 1883, and he placed *Mk. ligustica* into the synonomy of that species. He did not redescribe the species, did not compare it with *Mk. ligustica, Mk. siliquosa,* or any other species, and did not discuss the evidence for this synonymy. He provided line drawings of a juvenile right valve interior, a dorsal view of a whole carapace of the same size, and a left muscle-scar pattern, but no exterior lateral views and no photographs or SEM illustrations. While Ruggieri's species probably does belong to *Macromckenziea*, his rather generalized drawings show some small differences of shape from *Mk. ligustica*. The dimensions of the proposed neotype specimen (RVL 1.31 mm, RVH 0.51 mm) are considerably larger than those reported by Seguenza (L 1.15 mm, H 0.45 mm), showing that Seguenza, likewise, may have based his species on juvenile material. The dimensions of this instar would fit well into the A–1 cluster of *Mk. siliquosa* but would correspond to the adult of *Mk. ligustica* (see Graphs 7, 10). Of course, size discrepancies are to be expected in populations from different depths, temperatures, hydrographic regimens, and geologic ages. The excellent muscle-scar pattern drawn by Ruggieri (fig. 3) is one often seen in individuals of *Mk. siliquosa* and related species as well as *Mk. ligustica*. Doubtless, this Pleistocene population is very closely related and perhaps ancestral to one or both of the living species, as well as to the Pleistocene assemblages of *Mk. ligustica* reported at other localities and horizons (Bonaduce et al., 1977; Colalongo and Pasini, 1980). Nevertheless, in the interest of nomenclatural precision and stability, it is recommended that Seguenza's name not be revived. The species connoted by the name *Mk. ligustica* has been well described and illustrated, is readily identifiable, and its ecologic, geographic, and chronostratigraphic distribution can be established with precision, while the status of "*Macrocypris compresssa*" remains equivocal. See further discussion of the latter species in Appendix I.

Argilloecia anceps Rome, 1942, was dredged living in 80–100 m depth off Monaco, well within the range of *Mk. ligustica*. Rome's illustrations show clearly that this species, which he regarded as anomalous for *Argilloecia*, belongs, in fact, to *Macromckenziea*. In particular, the reduced, club-shaped furca (Rome, 1942, pl. 1, fig. 13) is very like that of *Mk. ligustica*. However, the outline drawing of a left valve (pl. 1, fig. 3) differs greatly in shape, being much more highly arched dorsally, shorter in the posterior region, and much more acutely pointed posteriorly than *Mk. ligustica*. The length given (0.86 mm) would fit the A–1 instar of *Mk. ligustica* but is too small for the adult. The two drawings of the mandible (pl. 1, fig. 7; pl. 2, fig. 8) were made from a molting specimen, in which the masticatory teeth are being withdrawn from the old exoskeleton. Although Rome reported only adults (one male, three females) and illustrated a hemipenis with a spiral copulatory tube (pl. 1, fig. 14), it is possible that the dimensions and several of the illustrations apply to a juvenile. The types of *A. anceps* should be restudied and compared with males of *Mk. ligustica* to determine whether the latter is a junior synonym (see also Appendix I).

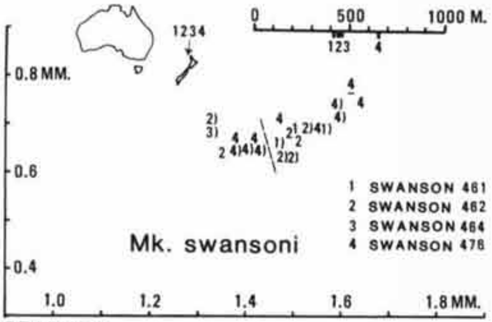
MACROMCKENZIEA PORCELANICA
(Whatley and Downing, 1983)

Graph 42

Macrocypris porcelanica Whatley and Downing, 1983, p. 353, pl. 1, fig. 11–13.

Material.—Not seen. This evaluation is based on the illustrations by Whatley and Downing (1983).

Remarks.—Whatley and Downing (1983) described this species from the Middle Miocene Balcombian Clay, Victoria, southeast Australia, and provided good SEM photos. The size, shape, and internal characters of this species as described and illustrated show that it belongs to the *Mk. glacierae* species-group. The illustrated right valve (their pl. 1, fig. 12) is very similar in shape to females of *Mk. glacierae* and to presumed males of *Mk. gregalis*, differing by its somewhat more angulate outline and sinuous ventral margin. It apparently is a little higher and more angulate in



GRAPH 11

outline than *Mk. swansoni*. Definitive diagnoses of these closely related species must await information about soft-part anatomy and sexual dimorphism as well as additional geographic and stratigraphic populations from which to assess variability.

Their statement (p. 353) that *Mk. porcelanica* "is similar in all salient characteristics, with the exception of size, to *Macrocypris similis* Brady 1880 from 160 fathoms off Ascension Island, the holotype of the species being 2.1 mm. in length and so nearly double that of the present species" merely illustrates the longstanding confusion that has surrounded the identity of Brady's species. *Mx. similis* belongs to *Macropyxis* and is not at all similar to this or other species of *Macromckenziea*. For further discussion of that species, see below.

MACROMCKENZIEA SWANSONI new species

Graph 11; Figures 4.9, 5.8; Plates 8.8,9, 9.7–9

Macrocypris (Macrocypris) sp. SWANSON, 1979a, p. 11, fig. 9.

Derivation of name.—For Kerry Swanson, who loaned the specimens.

Material.—Twenty-five empty carapaces and valves.

Types.—Holotype specimen 2332RV USNM 240385, paratypes USNM 240386–240391, other paratypes in the collections of Dr. Swanson.

Type locality.—Swanson Northland station P464, 34°24.1'S, 171°42.0'E, 655 m.

Occurrence.—At Swanson Northland P461, 7 specimens; at Swanson Northland P462, 3 specimens; at Swanson Northland P464, 11 specimens; at Swanson Northland P476, 1 specimen; at Swanson Tasman Sea P662, 3 specimens.

Distribution.—Holocene; west of North Island and east of South Island, New Zealand, known dead depth range 196 to 655 m. Swanson (1979a) reported a live depth range of 82 to 500 m for this species.

Dimensions.—Holotype 2332RV, RVL 1.33 mm, RVH 0.59 mm. See also Graph 11.

Diagnosis.—Carapace medium-sized, moderately inflated throughout; right valve elongate-subtriangular in lateral outline, with broadly arched dorsal margin separated by indistinct dorsal and posterodorsal angles into three sloping segments; greatest height located slightly behind midlength; anterodorsal margin sloping steeply to narrowly rounded anterior margin; ventral margin nearly straight; posterior margin curved and indistinctly truncate; posteroventral angle rounded, about 70°, located ventrally; radial pore canals indistinct, possibly irregularly branching.

Comparisons.—In shape *Mk. swansoni* somewhat resembles *Mk. glacierae* but is much smaller and less elongate, with a more highly arched dorsal margin and more rounded posteroventral angle. It differs from *Mk. gregalis* in being much smaller, with somewhat more angulate, elongate lateral outlines.

McKenzie (1974, fig. 3c, "*Macrocyprissa* sp.") illustrated a right valve from Bass Strait that is also very similar in shape to *Mk. swansoni*. Its length (1.43 mm) is a little less than adults of the populations here described, and it has elaborately branching radial pore canals.

Remarks.—The specimen illustrated by Swanson (1979a) from the Otago Shelf east of South Island, New Zealand, appears to be an A–1 instar (not seen).

The classification of *Mk. swansoni* in *Macromckenziea* is tentative and based on the similarity of carapace shape to *Mk. glacierae*. Information about radial pore canals and soft parts is needed.

MACROMCKENZIEA sp. 2

Graph 12; Figures 4.1, 5.1; Plates 6.8, 7.8

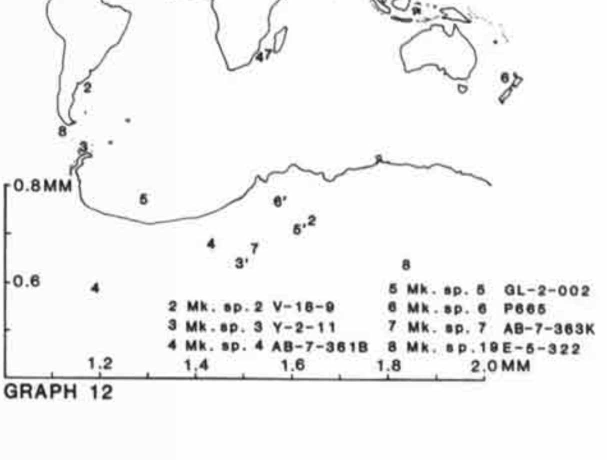
Material.—One empty carapace, USNM 240392.

Occurrence.—At V-18-9, 1 specimen.

Distribution.—Holocene; known only from one station in the southwestern Atlantic Ocean, on the continental slope of South America off Rio de la Plata, depth 676–547 m.

Dimensions.—Specimen 1960W, RVL 1.64 mm, RVH 0.73 mm, LVL 1.60 mm, LVH 0.69 mm. See also Graph 12.

Comparisons.—This oblong, light tan carapace has



GRAPH 12

approximately the right shape and dimensions for *Mk. siliquosa* but has a somewhat more narrowly rounded anterior margin and slightly greater posterodorsal inflation. Side-by-side comparison of specimens shows sufficient though subtle differences in carapace shape to treat it as a separate species, at least until geographic and morphological intermediates or soft parts are known. It has a gently arched dorsal margin, highest at midlength, a somewhat narrowly but evenly rounded anterior margin, a gently indented and curving ventral margin, a slightly upturned posteroventral margin, a truncate posterior margin with distinct posteroventral angle of about 85° to 90°, and a narrow zone of concrescence with short, straight radial pore canals.

Remarks.—This is the only known occurrence of the *Mk. siliquosa* species-group in the western side of the Atlantic Ocean.

MACROMCKENZIEA sp. 3

Graph 12; Figures 6.10, 7.8, 29.2, 32.4, 36–37.6, 46.13, 66.6, 80.19; Plates 6.10, 7.10, 78.21

Material.—One adult female in alcohol, USNM 240393.

Occurrence.—At Y-2-11, 1 live specimen (1F).

Distribution.—Holocene; Drake Passage, near South Shetland Islands, Antarctica, depth 240 m.

Dimensions.—Adult female 1995F, RVL 1.49 mm, RVH 0.64 mm; LVL 1.47 mm, LVH 0.64 mm. See also Graph 12.

Comparisons.—This elongate carapace with its distinctly obtuse posteroventral angle obviously fits the *Mk. siliquosa* species-group, but ambiguous furcal characters signal caution in its classification. On the single specimen available for study, the furca is small but apparently not reduced, with at least three proximal setae and one terminal seta. This furca is damaged, with the distal portion of the rod and the terminal seta missing from one side. Other distinctive features of *Mk.* sp. 3 include the female fifth limb, which has an exceptionally long mediodistal seta, and the reflexed seta of the seventh limb, which is very short but conspicuously feathered. These soft-part characters suggest a close relationship to *Mk.* sp. 5 and *Mk.* sp. 6.

MACROMCKENZIEA sp. 4

Graph 12; Figure 4.7; Plate 8.7

Material.—Four empty valves, USNM 240394–240395.

Occurrence.—At AB-7-361B, 4 specimens.

Distribution.—Holocene; known only at one station in the southern Mozambique Channel, depth 3829 m.

Dimensions.—Specimen 2406RV, RVL 1.43 mm, RVH 0.68 mm. See also Graph 12.

Comparisons.—The subtriangular to subtrapezoidal lateral outline with a high, distinct posterodorsal angle, sharp posterior angle of 65°, and narrowly rounded, bluntly truncate anterior margin easily distinguish *Mk.* sp. 4 from others of the genus.

MACROMCKENZIEA sp. 5

Graph 12; Figures 6.1, 7.1, 29.3, 32.5, 40.7, 46.53, 66.1, 80.17; Plates 8.1, 9.1, 78.22

Material.—One female specimen in alcohol, USNM 240396.

Occurrence.—At GL-2-002, 1 live specimen (1F).

Distribution.—Holocene; known only from one station in the Weddell Sea, Antarctica, depth 412 m.

Dimensions.—Adult female 1460F, RVL 1.61 mm, RVH 0.71 mm, LVL 1.57 mm, LVH 0.69 mm. See also Graph 12.

Comparisons.—The elongate-ovoid carapace of *Mk.* sp. 5 has a more rounded posterior angle, located slightly above venter, but otherwise fits the *Mk. siliquosa* species-group very well. The furcae are small but not vestigial, symmetrical, have three proximal setae and one terminal seta, and seem to be morphologically intermediate between *Macrocypris* and *Macromckenziea.* The mediodistal seta of the female fifth limb is also much longer than usual. Both of the latter characters suggest a close relationship with *Mk.* sp. 3 and *Mk.* sp. 6.

MACROMCKENZIEA sp. 6

Graph 12; Figures 6.2, 7.2, 29.4, 32.6, 41.4, 46.51, 66.5, 80.20; Plates 8.2, 9.2

Material.—One female specimen in alcohol, USNM 240397.

Occurrence.—At Swanson Tasman Sea P665, 1 live specimen (1F).

Distribution.—Holocene; known only in the Tasman Sea, west of New Zealand, depth 768–531 m.

Dimensions.—Adult female 2319F, RVL 1.57 mm, RVH 0.77 mm, LVL 1.55 mm, LVH 0.69 mm. See also Graph 12.

Comparisons.—The very broadly arched, oblong carapace outline, indistinct posteroventral angle of about 75°, and characters of the posterior limbs support assignment of *Mk.* sp. 6 to *Macromckenziea,* but the furca is not reduced. The female fifth limb ends in an extremely long mediodistal seta, and the terminal claws of the sixth limb are of equal length. The reflexed seta of the seventh limb is short but conspicuously feathered, and the mediodistal seta is very short. The furca is rather large, with long rods, two extremely tiny proximal setae, and fairly short terminal seta. Several of these characters suggest a relationship to *Mk.* sp. 3 and *Mk.* sp. 5.

MACROMCKENZIEA sp. 7

Graph 12; Figures 6.11, 7.9; Plates 6.9, 7.9

Macrocypris siliquosa Brady MADDOCKS, 1977, p. 153, fig. 1, 4 [*part.*].

Material.—One empty carapace, USNM 240398.

Occurrence.—At AB-7-363K, 1 specimen.

Distribution.—Holocene; known only at one station in the southern Mozambique Channel, depth 1190 m.

Dimensions.—Specimen 836W, RVL 1.52 mm, RVH 0.67 mm, LVL 1.48 mm, LVH 0.61 mm. See also Graph 12.

Comparisons.—The general shape and dimensions of this elongate-oblong carapace with indistinct, rounded posterior angle of about 80° fit *Mk. siliquosa,* but side-by-side comparison shows subtle differences of shape. In the absence of geographically and morphologically intermediate populations and of soft parts, *Mk.* sp. 7 is treated here as a separate species.

MACROMCKENZIEA sp. 19

Graph 12; Figures 6.4, 7.3, 26.20,21, 34.4, 40.4, 46.14,15, 65.2, 80.18; Plates 18.1, 19.1, 78.23, 86.12,13, 100.20,21

Material.—One male in alcohol, USNM 240399.

Occurrence.—At E-5-322, one live specimen (1M).

Distribution.—Holocene; Drake Passage, south of Tierra del Fuego, depth 1806–2013 m.

Dimensions.—Male specimen 1495M, RVL 1.84 mm, RVH 0.61 mm, LVL 1.81 mm, LVH 0.64 mm. See also Graph 12.

Comparisons.—This very elongate siliquose carapace has a bluntly rounded, truncate anterior margin, a sharp posterior angle of about 45°, and a straight ventral margin. There are also numerous, closely spaced, short, branching radial pore canals, although these are not sufficiently distinct to draw. In spite of this shape, placement of *Mk.* sp. 19 in *Macromckenziea* is supported by the blunt, oblong hemipenis with long, hemicircular copulatory rod, which closely resembles that of *Mk. glacierae,* by the short Zenker's organ, which has a very large terminal bulb, by the short, thick vas deferens, and by the reduced, fused, lamellar furcae lacking terminal setae.

Genus MACROPYXIS new genus

Derivation of name.—Greek *macro-*, large; Greek and Latin *pyxis,* a small box or casket (feminine gender).

Type species.—*Macrocypris sapeloensis* Darby, 1965.

Species included.—Listed by original binomen:

Macrocypris sapeloensis Darby, 1965; Holocene, northwestern Atlantic Ocean.

Macropyxis adrecta n. sp.; Holocene, equatorial Atlantic Ocean.

Macrocypris adriatica Breman, 1975; Pleistocene and Holocene, Adriatic Sea and Italy.

Macropyxis adunca n. sp.; Holocene, South Atlantic Ocean.

Macropyxis amanda n. sp.; Holocene, equatorial Atlantic Ocean.

Macropyxis amoena n. sp.; Holocene, Strait of Magellan and southeastern Pacific.

Macropyxis antonbruunae n. sp.; Holocene, southeastern Pacific Ocean.

Macropyxis arta n. sp.; Holocene, equatorial Atlantic Ocean.

Macropyxis audens n. sp.; Holocene, equatorial Atlantic Ocean.

Macrocypris bathyalensis Hulings, 1967a; Holocene, North Atlantic Ocean.

Macropyxis eltaninae n. sp.; Holocene, southeastern Pacific Ocean.

Macropyxis improcera n. sp.; Holocene, Gulf of Mexico.

Macropyxis kaesleri n. sp.; Holocene, equatorial eastern Pacific.

Macropyxis kalbi n. sp.; Holocene, equatorial eastern Pacific.

Macropyxis kornickeri n. sp.; Holocene, equatorial West Atlantic.

Macropyxis labutisi n. sp.; Holocene, northwestern Atlantic.

Macrocypris longana van den Bold, 1960; Eocene, Trinidad.

Macrocypris rhodana van den Bold, 1960; Eocene–Miocene, Trinidad and Cuba.

Macrocypris similis Brady, 1880; Holocene, equatorial western Atlantic Ocean.

Macropyxis simulans n. sp.; Holocene, Gulf of Mexico.

Macropyxis steinecki n. sp.; Miocene, Jamaica.

Macrocypris tenuicauda Brady, 1880; Holocene, northwestern Atlantic.

Macropyxis sp. 8; Holocene, southwestern Indian Ocean.

Macropyxis sp. 9; Holocene, Gulf of Gascony.

Macropyxis sp. 10; Miocene, Aquitaine Basin, France.

Macropyxis sp. 11; Holocene, equatorial western Atlantic Ocean.

Macropyxis sp. 12; Holocene, Gulf of Mexico.

Macropyxis sp. 13; Holocene, Mozambique Channel.

Macropyxis sp. 14; Holocene, Tasman Sea.

Macropyxis sp. 15; Holocene, Tasman Sea.

Macropyxis sp. 16; Holocene, southwestern Pacific Ocean.

Macropyxis sp. 17; Holocene, equatorial East Pacific Ocean.

Macropyxis sp. 18; Holocene, equatorial Atlantic Ocean.

Macropyxis sp. 20; Holocene, southeastern Atlantic Ocean.

Macropyxis sp. 21; Holocene, southwestern Atlantic Ocean.

Macropyxis sp. 46; Holocene, southeastern Pacific Ocean.

Geologic range.—Eocene to Holocene.

Geographic range.—Cosmopolitan, known composite live depth range 49 to 6134 m, dead specimens as shallow as 9.3 m.

Diagnosis.—Carapace large, thick-shelled, smooth, translucent to opaque white without patch pattern. Elongate-ovate in lateral view; anterior margin broadly and evenly rounded; dorsal margin very broadly and gently arched, without dorsal or posterodorsal angles; ventral margin straight to slightly convex, which is usually more or less sinuous, especially posteriorly, with prolonged and gently tapering posterior region ending in more or less acutely pointed to truncate posterior angle. Moderately inflated in dorsal view; margins not compressed; anterior and posterior ends bluntly rounded; lateral margins gently curving to nearly parallel; valves distinctly asymmetrical. Hinge thick and sturdily developed; zone of concrescence moderately wide to very wide, even; radial pore canals more or less regularly and complexly branching; vestibule not constricted; few, small sensillum pores with short, smooth, simple, unbranched setae; adductor muscle-scar group fairly small in proportion to carapace size, asymmetrical in the two valves, usually diagonally oriented.

Antennules of moderately robust proportions, tapering, with most podomeres longer than wide, with short, thick setae; podomeres II and III more or less flexibly articulated. Antenna robust with numerous, fairly long, thick terminal claws; very long sensory aesthetascs on podomere II; four or more long swimming setae on podomere III; anterodorsal setae of podomere IV very long. Podomeres I and II of maxillule palp completely fused without suture; the anterodistal setae of these two podomeres remain distinct.

Palp of male right fifth limb forms a fairly large, thick, right-angled to recurved hook; left limb more tightly recurved; two small to large, fairly slender, tapering ventral pegs and one small ventral seta; proximal sensory seta and very conspicuous terminal sensory disk present, but no dorsal seta. Palp of female fifth limb slender to robust, with three terminal setae of graduated lengths, the dorsal one the shortest and the ventral one usually the longest. Sixth leg with two distal claws of equal or nearly equal size. Seventh limb with well-feathered, short to moderately long, reflexed seta and two distal setae, the longer of which varies from half the length of the reflexed seta to distinctly longer than the reflexed seta and may be weakly pinnate. Furca small to fairly large, consisting of two long, cylindrical proximal rods, each bearing a cluster of up to four very tiny to medium-sized proximal setae located near the base, in the middle, or near the end of the rod and each terminating with a long, flexible, tapering seta; often dimorphic, usually somewhat larger in males but otherwise of similar construction to females, but occasionally absent in males, in which case it is represented only by a vestigial nub bearing four tiny proximal setae. Male hemipenis roughly subtriangular to rhomboidal to ovate in outline, with straight dorsal margin and acute to obtuse anterior angle; copulatory rod short, nearly straight to weakly curved. Zenker's organ with medium-sized to long muscularized portion and a small to large, spherical terminal bulb; vas deferens somewhat thickened, coiled in an irregular disk, a tight, regular spiral, or a tangled knot of 4 to 10 or more coils. The strands of sperm may also be coiled in a long tight spiral of 10 or more coils like a telephone cord before entering the terminal bulb.

Affinities.—*Macropyxis* includes many species formerly assigned to *Macrocypris*, and most general statements about that genus by most previous authors actually apply to *Macropyxis*. Certain undescribed Australian species referred to *Macrocyprissa* (McKenzie, 1967a, 1974, 1976; McKenzie and Peypouquet, 1984) probably belong to *Macropyxis* (or possibly to *Macromckenziea*), and the generalizations of those authors about "*Macrocypris*" should be regarded as referring to *Macropyxis*.

Macropyxis is represented by numerous species in bathyal and abyssal environments of all oceans and is far more diverse than *Macrocypris* or *Macromckenziea*. It is, in fact, the typical representative of the Macrocyprididae in psychrospheric faunas.

Remarks.—Although the branching radial pore canals are the most visible, characteristic attribute of this genus, they show considerable interspecific and intraspecific variability as well. A few specimens in any species population have narrower fused marginal zones with correspondingly shorter, less elaborately branching radial pore canals than usual for the species. Perhaps some of these specimens had molted only recently and had not completed calcification of the carapace at the time of collection. Of course this phenomenon is not, by any means, restricted to *Macropyxis;* a few thin-edged, juvenile-appearing adults may be found in large populations of any other genus and species of Macrocyprididae. It deserves special mention for *Macropyxis* only because failure to recognize this variability in marginal development may hinder identification of the genus as well as the species. Generally, the most completely developed specimens, with the most complexly branching radial pore canals, should be selected for comparison and identification.

Many species of *Macropyxis* also show moderate variability in the degree of prolongation of the posterior carapace angle, with accompanying variability of the exact shape of the posterior and posteroventral margin. In large populations at one station this intraspecific variation is readily assessed and recognized. For small populations or for single specimens from isolated stations, though, the evaluation of shape may be equivocal, especially as the shape of the posterior angle also varies with sex and sometimes with depth or geographic distance. Thus, isolated specimens of some species may be difficult to identify reliably from carapace shape alone. Several such specimens are here treated conservatively as separate species in open nomenclature.

MACROPYXIS SAPELOENSIS (Darby, 1965)

Graph 13; Figures 10.10,11, 11.9,10, 19.8, 22.15, 26.1–3, 30.1, 34.9, 38.1, 46.35,36, 50.25–27, 51.16–18, 56.4,23, 57.16, 58.8, 59.21, 61.6, 63.4, 64.11,12,42, 67.1, 71.3,4, 75.7, 78.5; Plates 10.7–12, 11.7–12, 62.4,5, 63.5,6, 66.8–11, 78.24–26, 82.7, 87.1–6, 101.1–4, 111.11

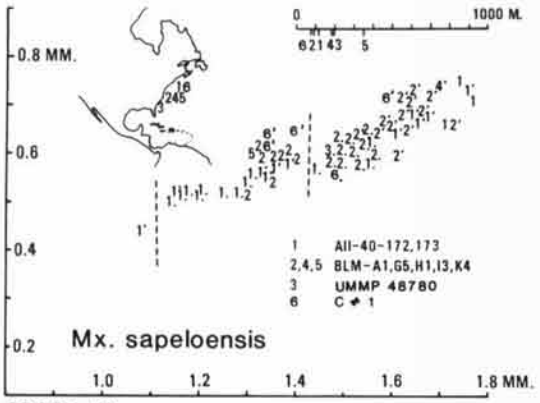
Macrocypris sapeloensis DARBY, 1965, p. 24, pl. 8, fig. 1–9, pl. 9, fig. 1–9; MADDOCKS, 1977, fig. 5; MADDOCKS, 1979, pl. 2, fig. 6, 8, 13, 18–20, 23.

Material.—The holotype; plus 366 specimens in alcohol, including 112 males, 151 females, 99 juveniles, and 4 empty capaces and valves; for a total of 367 specimens.

Types.—The holotype (University of Michigan Paleontological Museum catalog number 48780) is the adult male illustrated by Darby (1965, pl. 8, 9). The two valves are on a paper slide, and the appendages and genitalia are mounted separately on 16 glass slides.

New material for this species is deposited as USNM 240400–240420.

Type locality.—The holotype is labeled only "Recent near



GRAPH 13

Sapelo Island, Georgia." Darby (1965, p. 25) reported the habitat as follows: "Taken from 625 feet (191 m) of water, salinity approximately 35‰, water temperature 23°C., 75 miles offshore near edge of Gulf Stream." To this he added, "One living specimen from Sapelo Sound," but it is unlikely that this or any macrocypridid species lives in the polyhaline environment of Sapelo Sound.

Occurrence.—In UMMP 48780, 1 live specimen (1M); at AII-40-172, 8 live plus 4 specimens (4F, 2FJ–1, 2MJ–1); at AII-40-173, 25 live specimens (3M, 5F, 1MF?, 8MJ–1, 5FJ–1, 2FJ–2, 1FJ–3); at "Chain" C # 1, 5 live specimens (1M, 1F, 3FJ–1); at stations of the Bureau of Land Management, Middle Atlantic Outer Continental Shelf Environmental Study, a total of 324 live specimens, as follows: at BLM-A1, 183 live specimens (55M, 82F, 46J); at BLM-A2, 17 live specimens (7M, 3F, 7J); at BLM-A3, 3 live specimens (3J); at BLM-A4, 1 live specimen (1M); at BLM-E2, 1 live specimen (1M); at BLM-E4, 1 live specimen (1M); at BLM-F2, 32 live specimens (17M, 13F, 2J); at BLM-F4, 16 live specimens (5M, 6F, 5J); at BLM-G5, 11 live specimens (2M, 8F, 1J); at BLM-G6, 2 live specimens (2M); at BLM-H1, 1 live specimen (1J); at BLM-I2, 1 live specimen (1F); at BLM-I3, 7 live specimens (1M, 3F, 3J); at BLM-K4, 42 live specimens (12M, 22F, 8J); at BLM-K6, 4 live specimens (2M, 2F); at BLM-L5, 1 live specimen (1F); at BLM-L6, 1 live specimen (1M).

Distribution.—Holocene; Atlantic continental shelf of the United States, known live depth range 74 to 400 m, most abundant near shelf edge.

Dimensions.—Holotype male UMPM 48780, RVL 1.47 mm, RVH 0.61 mm, LVL 1.47 mm, LVH 0.58 mm. Females are longer and higher than males and higher in proportion to length. No effect of depth on size is evident. See also Graph 13.

Diagnosis.—Carapace elongate-ovate in lateral outline, with smoothly curving, uninterrupted contours, greatest height located near midlength; ventral margin gently indented in mouth region, gently upswung posteriorly to rounded posterior angle of about 85° to 95°; moderately inflated in dorsal view; zone of concrescence moderately wide with weakly, irregularly branching radial pore canals.

Male fifth limb with quadrate hook recurved at about 55° for right limb and 48° for left. Female fifth limb quite short, with sturdy, curved terminal claws of graduated lengths. Sixth limb with three sturdy distal claws of graduated lengths, each about 1.5 times the length of the next-shorter one. Seventh leg has exceptionally long setae on podomeres I, II, and III; reflexed seta is quite short, reaching only to joint between podomeres II and III, with extremely fine pectination (too fine to draw); longer distal seta is half again as long as the reflexed seta. Furcal rami rather thick in proportion to length, with thick, curved, flexible terminal setae, thicker in male; proximal setae located at midlength. Male hemipenis rounded-subtriangular in outline, broadening anteriorly to curved, blunt anterior margin; copulatory rod short, straight. Terminal bulb of Zenker's organ spherical, about twice the diameter of the muscularized portion; vas deferens coiled in a tight, regular spiral of about eight coils; strands of sperm also spirally coiled.

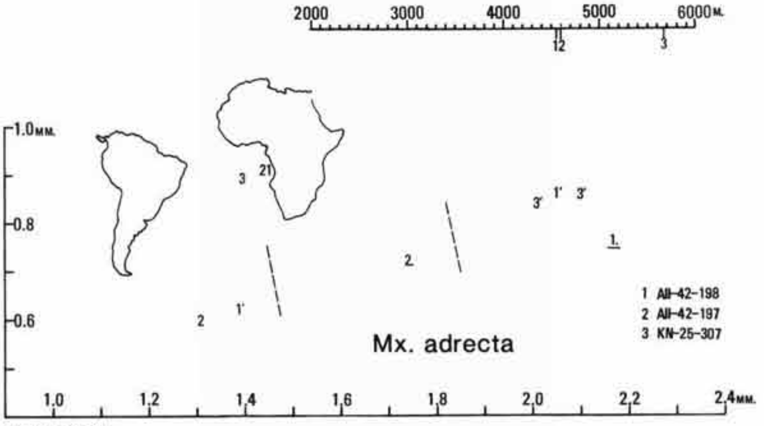
Comparisons.—*Mx. sapeloensis* may be distinguished from *Mx. labutisi,* which occurs at the same localities, by its larger size, more evenly arched dorsal margin, gently convex ventral margin, more distinct posterior angle, narrower zone of concrescence, deeper anterior and posterior vestibules, less elaborately branching radial pore canals, and nondimorphic furca. Externally adults of the two species are fairly similar, however, and juveniles are even more difficult to distinguish. Here size and appendage development are useful, as the average size of any instar of *Mx. labutisi* tends to fall below the equivalent instar of *Mx. sapeloensis* and above the preceding one, in the gap between size-clusters of the other species. Superposing the length-height scatter plots for these two species (Graphs 13 and 28) produces a continuous smear of points.

Mx. bathyalensis is much larger, with a straight or sinuous ventral margin, more acutely truncate to pointed posterior angle, broader zone of concrescence, and elaborately branching radial pore canals grouped in large bundles. *Mx. simulans* is much larger, with more sinuous contours and a straight-line, sloping posterodorsal margin. *Mx. amoena* is slightly larger, with a sinuously upswung, slightly concave posteroventral margin. *Mx. improcera* is much smaller with a sloping, acutely terminated posterior.

Remarks.—Darby (1965) illustrated this species thoroughly and accurately. It is one of the smallest, simplest, and shallowest-living species of the genus but completely typical for the genus and the best known.

MACROPYXIS ADRECTA new species

Graph 14; Figures 8.13–14, 9.13–14, 19.5, 22.8, 24.7, 26.24,25, 30.6, 34.6, 39.3, 46.62,63, 50.20,21, 51.31,32, 56.3,21, 58.13, 59.20, 61.8, 63.2, 64.8, 67.9, 80.12; Plates 14.3–6, 15.4–6, 63.1,2, 66.1,2, 78.27,28, 88.1, 102.10,13



GRAPH 14

Derivation of name.—Latin *adrectus,* upright, erect; for the rectilinear shape of the posterodorsal margin.

Material.—Eight specimens in alcohol, including 1 male, 3 females, 3 juveniles, and 1 empty valve.

Types.—Holotype male 1448M USNM 240421, paratypes USNM 240422–240428.

Type locality.—*Atlantis II* cruise 42 station 198, 10°24'S, 9°09'E, depth 4559–4566 m.

Occurrence.—At AII-42-197, 2 live specimens (1MJ–1, 1J–2); at AII-42-198, 3 live plus 1 specimens (1M, 1F, 1FJ–2); at KN-25-307, 2 live specimens (2F).

Distribution.—Holocene; in the Angola Basin, eastern South Atlantic Ocean, known live depth range 4559–5631 m.

Dimensions.—Holotype male 1448M, RVL 2.17 mm, RVH 0.76 mm, LVL 2.08 mm, LVH 0.71 mm. See also Graph 14. The male is longer than the females but not as high. There are not enough specimens to detect any influence of depth on size.

Diagnosis.—Female carapace elongate-oblong in lateral outline with high-arched dorsal margin and greatest height located near midlength; ventral margin gently sinuate, upswung near posterior; posterodorsal margin steeply sloping, straight; sharp posterior angle of about 65° in female and 45° in male; zone of concrescence broad to very broad, with elaborately branching radial pore canals.

Palp of male fifth limb has elongate basal segment; recurved terminal segment is somewhat constricted near base and more or less swollen near tip, recurved at 72° in right limb and 44° in left. Female fifth limb has normal proportions and three terminal setae of graduated lengths. Sixth limb has three slender terminal claws of unequal lengths. Seventh limb has a moderately long, finely pectinate reflexed seta; the longer of the distal setae is about half the length of the reflexed seta. Furcae long and slender in female, thicker and somewhat shorter in male, with small proximal setae located about midway on rami. Male hemipenis oblong with blunt, wrinkled anterior end; copulatory rod short, straight. Terminal bulb of Zenker's organ about twice the diameter of the relatively short muscularized portion; vas deferens thick, coiled in a tight, irregular spiral knot of about seven coils.

Comparisons.—The hemipenis of *Mx. adrecta* is very similar to that of *Mx. arta* but is not bent in the middle and is more heavily sclerotized overall. *Mx. arta* is smaller and more siliquose than *Mx. adrecta,* but the female of *Mx. arta* is roughly the same shape and size as the male of *Mx. adrecta. Mx. adunca,* which also occurs in the same region, has much more sinuous contours, a more upswung posterior angle, and distinctive soft parts.

MACROPYXIS ADRIATICA (Breman, 1975)

Graph 15; Figures 8.9,10, 9.9,10, 19.10, 22.20, 24.6;
Plates 16.9–12, 17.9–12, 78.30

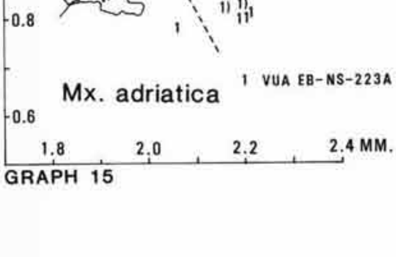
Macrocypris adriatica Breman, 1975, p. 210, pl. 2, fig. 6a–c, pl. 4, fig. 17a–d; ?Colalongo and Pasini, 1980, p. 62; Tsapralis, 1981, p. 116; Bonaduce et al., 1983, table 2; ?Van Harten, 1986a, table 1; ?Van Harten, 1987, table 1–3; Montcharmont-Zei et al., 1984, pl. 1, fig. 2.

Macrocypris sp. 1 Ascoli, 1964, p. 218, pl. 4 [*part.*]; Ascoli, 1965, p. 88, pl. 4, 5 [*part.*].

Macrocypris sp. Colalongo, 1965, p. 89, pl. 10, fig. 7; Sissingh, 1971, p. 408 (*fide* Breman, 1975).

Material.—Fifteen paratype fossil valves.

Types.—In the Instituut voor Aardwetenschappen, Vrije Universiteit, Amsterdam. The holotype adult right valve (EB-NS-223C-2) was not seen; the interior of that specimen



GRAPH 15

was illustrated by SEM by Breman (1975, pl. 4, fig. 17a,c,d). The 15 paratype valves of slide EB-NS-223A have been given my specimen numbers 2077–2091; paratypes EB-NS-223B,C,D were not seen.

Type locality.—Core 353, interval 250–585 cm of Breman (1975), in upper Pleistocene sediments of the Adriatic Sea.

Occurrence.—In VUA EB-NS-223A, 15 specimens.

Distribution.—Pleistocene and Holocene of Italy, Greece, and the Adriatic and Ionian seas; interpreted by Breman (1975) as bathyal and low-temperature. Colalongo and Pasini (1980) stated that the first appearance of this species helps to characterize the Pliocene–Pleistocene boundary. Van Harten (1986a, 1987) and van Harten and Droste (1988) reported it from 335 m to 1669 m in several basins of the western Mediterranean, stating that it became extinct in the eastern Mediterranean after an early Holocene anoxic event (about 9000 years ago).

Dimensions.—Paratype 2085, RVL 2.16 mm, RVH 0.82 mm; paratype 2086, RVL 2.37 mm, RVH 0.96 mm; paratype 2082, LVL 2.20 mm, LVH 0.81 mm; paratype 2083, LVL 2.25 mm, LVH 0.87 mm. See also Graph 15.

Diagnosis.—Carapace oblong-subtrapezoidal in lateral outline with straight or very weakly indented ventral margin; dorsal margin straight, sloping, with more or less distinct anterodorsal and posterodorsal angles; anterior margin broadly and regularly rounded; posterodorsal margin sloping steeply, straight, forming sharp posterior angle of about 45° in male to 55° in female; zone of concrescence moderately wide, radial pore canals complexly and more or less regularly branching.

Comparisons.—*Mx. adriatica* is fairly similar to *Mx. bathyalensis* but is higher in proportion to length, with a more broadly rounded anterior end, a nearly straight rather than weakly arched dorsal margin, more distinct anterodorsal and posterodorsal angles, somewhat narrower zone of concrescence, less complexly branching radial pore canals, and a thinner, less robustly developed hinge. However, both species show considerable variability in details of shape. *Mx. adrecta* is very similar but smaller, shorter, proportionately higher, with a slightly arched dorsal margin, a shorter distance between the less distinct anterodorsal and posterodorsal angles, a broader fused zone, more complexly branching radial pore canals, a curving ventral margin, and greatest height located posterior to midlength. *Mx.* sp. 20 is also remarkably similar but has a more arching dorsal margin.

Remarks.—Breman (1975) published good SEM pictures of this species.

MACROPYXIS ADUNCA new species

Graph 16; Figures 8.2,3, 9.2,3, 19.6, 22.11, 24.18, 26.30,31, 30.3, 33.2, 41.6, 46.58,59, 50.22, 51.33, 57.8, 58.12, 61.5, 64.7, 66.7, 80.10; Plates 14.1,2,7,8, 15.1–3,7,8, 58.5, 78.29, 88.13–17, 100.10,13,15–19, 111.3

Macrocypris sp. 3 Maddocks, 1977, fig. 10.

Derivation of name.—Latin *aduncus,* bent inwards, hooked; for the hooked ventral process of the hemipenis.

Material.—Fifteen specimens in alcohol, including 2 males, 4 females, and 9 juveniles.

Types.—Holotype male 1520M USNM 240429, paratypes USNM 240430–240438.

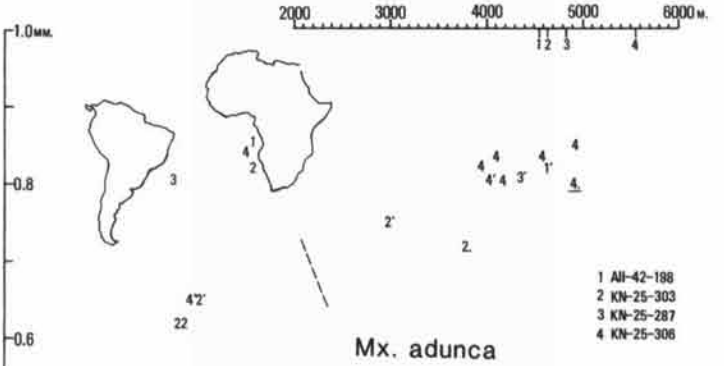
Type locality.—*Knorr* cruise 25 station 306, 15°59.5'S, 1°38.5'E, depth 5550 m.

Occurrence.—At AII-42-198, 1 live specimen (1F); at KN-25-287, 1 live specimen (1F); at KN-25-303, 5 live specimens (1M, 1F, 1FJ–1, 2J–1); at KN-25-306, 8 live specimens (1M, 6F, 1FJ–1).

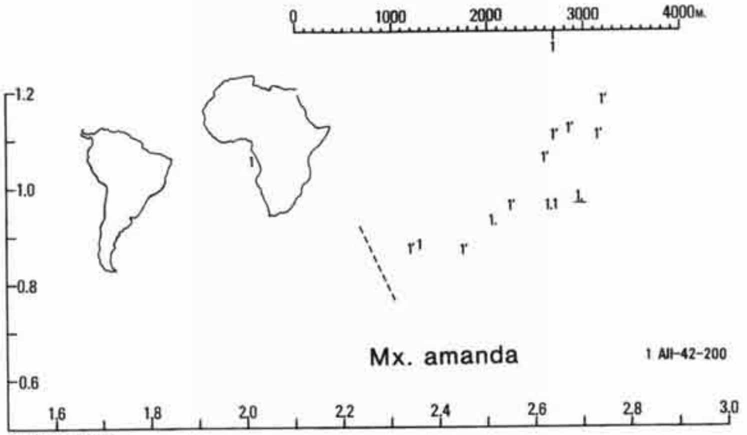
Distribution.—South Atlantic Ocean, known live depth range 4559–5550 m.

Dimensions.—Holotype male 1520, RVL 2.14 mm, RVH 0.80 mm, LVL 2.09 mm, LVH 0.75 mm. See also Graph 16. The males are somewhat longer but distinctly less high than females, with more elongate shape. Size appears to increase with depth.

Diagnosis.—Carapace elongate-ovate in lateral outline with sinuous contours; dorsal margin smoothly but gently arched; anterior margin somewhat narrowly rounded; ventral margin sinuous, distinctly indented in mouth region



GRAPH16



GRAPH 17

and upswung posteriorly; somewhat flared, truncate, sinuate posterior angle of about 45° to 55°; zone of concrescence broad, line of concrescence deeply scalloped, radial pore canals complexly branching, arranged in large bundles.

Right male fifth limb has small oblong pegs and short, thick hook recurved at 76°; left limb has longer, tapering pegs and thinner hook recurved at 55°. Female fifth limb robustly proportioned, with three terminal claws of graduated sizes. Sixth limb has two slender terminal claws of equal size. Seventh leg has distinctly pectinate but very short reflexed seta, reaching only to about the middle of podomere III; the longer of the distal setae is half again as long as the reflexed seta. Furca fairly large, dimorphic; clusters of four proximal setae are located near the base of the cylindrical rami; female rami and terminal setae slender, flexible; male rami and terminal setae not much longer but distinctly thicker, with longer proximal setae. Male hemipenis approximately subtriangular in outline, tapering anteriorly to obliquely truncate, curved anterior angle; a narrow, long, curved, thumblike, lamellar process extends anteriorly from the lowest part of the ventral margin; an oblong lamellar flap covers an indentation in the dorsal margin; copulatory rod short and straight. Spherical bulb of Zenker's organ about 1.5 times as thick as muscularized portion; vas deferens tightly coiled in a tangled knot of at least six coils.

Comparisons.—*Mx. audens* is similar to *Mx. adunca* but exaggerated in shape, with grotesquely sinuous contours and a more broadly rounded anterior margin. *Mx. adrecta* has less sinuous contours, a more nearly straight ventral margin, and sharply angled posterior end. *Mx. simulans* is much larger and more inflated, especially posteroventrally. *Mx. similis* is larger and much more elongate, with more complexly branching radial pore canals. The male hemipenis of *Mx. adunca* is unique and diagnostic.

MACROPYXIS AMANDA new species

Graph 17; Figures 8.6,7, 9.6,7, 19.1, 22.7, 24.9, 26.26,27, 30.10, 33.8, 41.5, 46.54,55, 67.10, 80.4; Plates 12.1–6, 13.1–6, 79.1,2, 83.1, 88.5–7, 102.1–4

Macrocypris sp. 5 MADDOCKS, 1979, fig. 10.

Derivation of name.—Latin *amandus,* pleasing; for the graceful, sinuous outline.

Material.—Fifteen specimens in alcohol, including 3 males, 10 females, and 2 empty carapaces and valves.

Types.—Holotype male 1406M USNM 240439, paratypes USNM 240440–240447.

Type locality.—*Atlantis II* cruise 42 station 200, 9°41'–9°43.5'S, 10°55'–10°57'E, depth 2644–2754 m.

Occurrence.—At AII-42-200, 13 live plus 2 empty specimens (3M, 10F).

Distribution.—Holocene; known only at one station in the Angola Basin, eastern South Atlantic Ocean, depth 2644–2754 m.

Dimensions.—Holotype male 1406M, RVL 2.69 mm, RVH 0.98 mm, LVL 2.68 mm, LVH 0.97 mm. See also Graph 17. The males are slightly shorter and distinctly less high than the females, with more elongate shape.

Diagnosis.—Carapace large, elongate-oblong in lateral outline with pointed posterior angle; anterior margin broadly and slightly obliquely rounded; ventral margin slightly sinuous to nearly straight, slightly upswung posteriorly; dorsal margin broadly arched in a high, sweeping curve, greatest height located anterior to midlength; posterior angle sharp, about 45° to 55°; zone of concrescence wide; radial pore canals complexly and somewhat irregularly branching.

Right male fifth limb short and thick, with stout hook recurved at 51°; left limb less robust, with widely separated pegs, and slender hook recurved at 20°. Female fifth limb long, with graduated terminal setae. Sixth limb robustly proportioned with terminal claws of unequal length. Seventh limb small, with long, very finely pectinated reflexed seta (too fine to draw); the longer distal seta is not quite as long as the reflexed seta. Furca quite large, dimorphic; female furca has thick cylindrical rami, with clusters of four fairly large proximal setae located near base of rami and fairly short, thin, flexible terminal setae. Male furca smaller, with short cylindrical rami consisting only of the proximal portion, distal portion missing, proximal setae located at end of ramus; terminal setae not reduced, fairly long and flexible. Male hemipenis oblong, with cushion-like contours, five-sided; ventral margin obtusely angled; anterior margin truncate, sloping ventrally; dorsal margin indented; a curved, sclerotized chitinous lamella stiffens the anterodorsal region of the margin; copulatory rod quite large, tapering, directed posterodorsally, curved into a right angle near its tip. Zenker's organ has a very large spherical bulb, about three times the diameter of the rather short muscularized portion; vas deferens thick, coiled into an irregular, discoidal spiral of about six loops of increasing diameter.

Comparisons.—*Mx. kalbi* is similar to *Mx. amanda* in size and shape but has a convex ventral margin and less elaborately branching radial pore canals; its posterior angle is located distinctly above the venter. *Mx.* sp. 8 and *Mx.* sp. 21 are higher, with distinct dorsal angle located at midlength. *Mx. simulans* is smaller, more oblong, and more sinuous in shape. *Mx. bathyalensis* has different dimorphism and much more elaborately organized branching radial pore canals.

Remarks.—Specimen 1792F and perhaps 1526F are newly molted with incompletely calcified marginal zones.

MACROPYXIS AMOENA new species

Graph 18; Figures 6.15,16, 7.13,14, 18.12, 22.16, 24.22, 25.9,10, 30.20, 36–37.10, 46.16–19, 54.26–30, 55.37, 57.27, 58.7, 60.9, 64.27; Plates 20.7,8, 21.7,8, 79.3, 86.14,15

Macrocypris sp. 7 MADDOCKS, 1977, fig. 10.

Derivation of name.—Latin *amoenus*, pleasant, charming; for the graceful, sinuous outline.

Material.—Five specimens in alcohol, including 2 males, 1 female, and 2 juveniles; plus 187 empty dry carapaces and valves; for a total of 192 specimens.

Types.—Holotype male 1463M USNM 240448, paratypes USNM 240449–240455 and KUMIP 1,123,685–1,123,888.

Type locality.—*Hero* cruise 69-5 station 213, 51°27.5'S, 74°03'W, depth 696.3–916.3 m.

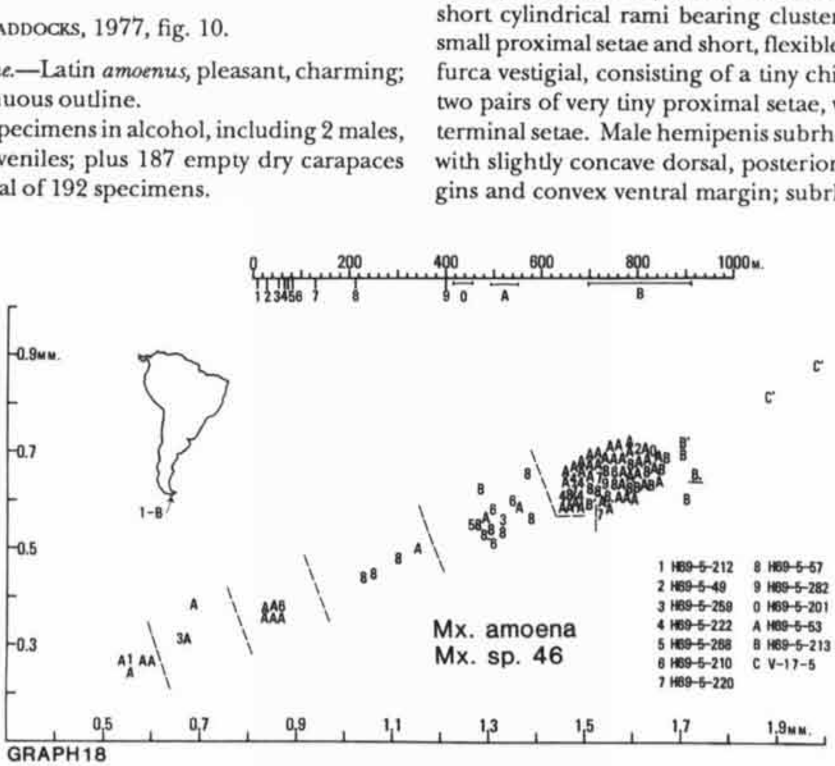
Occurrence.—At H-69-5-49, 1 specimen; at H-69-5-53, 130 specimens; at H-69-5-57, 2 live plus 24 specimens (1M, 1MJ–1); at H-69-5-201, 1 specimen; at H-69-5-210, 6 specimens; at H-69-5-212, 1 specimen; at H-69-5-213, 3 live plus 13 specimens (1M, 1F, 1FJ–1); at H-69-5-220, 3 specimens; at H-69-5-222, 5 specimens; at H-69-5-259, 1 specimen; at H-69-5-268, 1 specimen; at H-69-5-282, 1 specimen.

Distribution.—Holocene; Strait of Magellan and southeastern Pacific Ocean, known live depth range 214 to 916 m, dead specimens as shallow as 9.3 m.

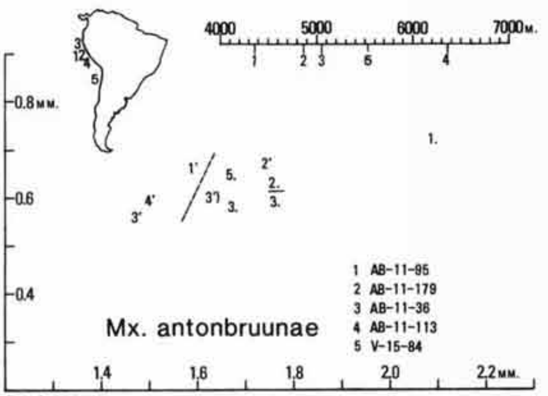
Dimensions.—Holotype male 1463M, RVL 1.73 mm, RVH 0.66 mm, LVL 1.56 mm, LVH 0.64 mm. See also Graph 18. Males are not as high as females. Size increases with depth.

Diagnosis.—Carapace elongate-ovate in lateral outline with sinuous contours; dorsal margin very broadly arched, greatest height located slightly anterior to midlength; anterior margin broadly and somewhat narrowly rounded; ventral margin sinuous, slightly indented in mouth region, upswung posteriorly to acute posterior angle of about 65° to 70°; anterior zone of concrescence broad, radial pore canals more or less elaborately branching.

Male fifth limbs with thick, nearly right-angled hook. Female fifth limb robustly proportioned. Seventh limb with long, thick, conspicuously pectinate recurved seta; both distal setae fairly short. Female furca small, with very short cylindrical rami bearing clusters of three or more small proximal setae and short, flexible terminal seta; male furca vestigial, consisting of a tiny chitinous nub bearing two pairs of very tiny proximal setae, without any rami or terminal setae. Male hemipenis subrhomboidal in outline with slightly concave dorsal, posterior, and anterior margins and convex ventral margin; subrhomboidal lamellar



GRAPH18



GRAPH 19

process projects anterodorsally; copulatory rod short, thick, straight.

Comparisons.—The carapace of *Mx. amoena* is smaller and more compact than most others in the genus; the sinuous posterior angle is especially distinctive. *Mx. labutisi* is somewhat similar in shape and furcal dimorphism but much smaller, with more elaborately branching radial pore canals. *Mx. eltaninae* has similar size and proportions but has less sinuous outlines and a nearly straight ventral margin, and the male furca is not reduced. *Mx.* sp. 46 is nearly identical in shape and female soft parts but very much larger.

Remarks.—The soft parts of the holotype male 1463M are fragmentary and incomplete.

MACROPYXIS ANTONBRUUNAE new species

Graph 19; Figures 6.17,18, 7.15,16, 20.10, 22.6, 24.11, 26.6–9, 30.13, 33.1, 40.3, 46.66–68, 50.4, 51.14, 57.7, 58.10, 61.1, 64.6, 65.6, 80.15; Plates 18.7–12, 19.7–12, 62.8, 66.3,4, 79.4,5, 83.7, 89.1–6, 99.10–15

Macrocypris sp. P Maddocks, 1977, fig. 8, 10.
Macrocypris n. sp. 3 Maddocks, 1979, pl. 1, fig. 17, 18, 20, 21.

Derivation of name.—For the Research Vessel *Anton Bruun.*

Material.—Eleven specimens in alcohol, including 6 males, 2 females, and 3 juveniles.

Types.—Holotype male specimen 332M USNM 240456, paratypes USNM 240457–240466.

Type locality.—*Anton Bruun* cruise 11 station 179, 8°54'S, 80°41'W, depth 4823–4925 m.

Occurrence.—At AB-11-36, 4 live specimens (2M, 1F, 1FJ–1); at AB-11-95, 2 live specimens (1M, 1FJ–1); at AB-11-113, 1 live specimen (1FJ–1); at AB-11-179, 3 live specimens (2M, 1F); at V-15-84, 1 live specimen (1M).

Distribution.—Holocene; in the Peru–Chile Trench, known live depth range 4332 m to 6134 m.

Dimensions.—Holotype male 332M, LVL 1.77 mm, LVH 0.62 mm. See also Graph 19. Males are lower and longer than females. Size decreases with depth.

Diagnosis.—Carapace elongate-siliquose in lateral outline with smoothly curving contours; dorsal margin very gently arched, greatest height near midlength; anterior margin broadly and somewhat obliquely rounded; ventral margin straight or slightly convex to weakly sinuous, upswung posteriorly to sharp posterior angle of 50° to 60°; zone of concrescence broad; anterior radial pore canals complexly branching.

Male fifth limbs nearly symmetrical, with short, moderately thick hooks recurved at 72° to 98°. Female fifth limb has an exceptionally long ventrodistal seta. Terminal claws of the sixth leg are nearly equal in length. Reflexed seta of seventh limb fairly short, reaching only to middle of podomere II, finely pectinate; distal seta about three-quarters as long as reflexed seta. Furca large, with long cylindrical rami and flexible terminal setae in both sexes; clusters of at least three small to medium-sized proximal setae are located at about one-third length on cylindrical rami. Male hemipenis oblong with large, rostrate anterodorsal projection, strengthened by chitinous struts; copulatory rod short, straight. Muscularized portion of Zenker's organ thin, long; spherical terminal bulb only slightly thicker; vas deferens slightly thickened, coiled in a tight, irregular spiral of at least eight loops.

Comparisons.—*Mx. antonbruunae* is much smaller and more elongate than *Mx. kalbi* and *Mx. kaesleri,* with which it occurs; the latter species is also much more sinuous in shape and has more elaborately organized radial pore canals. *Mx. arta* has a straight ventral margin and greatly extended posterior end with deep posterior vestibules. *Mx. eltaninae* is shorter and higher, with a nearly straight ventral margin and domed dorsal margin; its hemipenis is less elongate than but shows structural homologies with that of *Mx. antonbruunae. Mx. bathyalensis* also has a higher, more strongly sclerotized hemipenis of similar structure.

Remarks.—The occurrence of this species (with *Mx. kalbi* and *Mx. kaesleri*) at AB-11-113, depth 5986–6134 m, marks the deepest known occurrence of live Macrocyprididae. Specimen 341M is recently molted and incompletely calcified.

MACROPYXIS ARTA new species

Graph 20; Figures 8.11,12, 9.11,12, 19.3, 22.3,4, 24.16,17, 26.4,5, 30.9, 34.2, 40.1, 46.60,61, 56.18, 57.4, 58.4, 59.15, 61.9, 63.5, 64.10,44, 67.2, 80.13; Plates 16.2–4, 17.3–5, 79.6,7, 83.4,8, 88.2–4

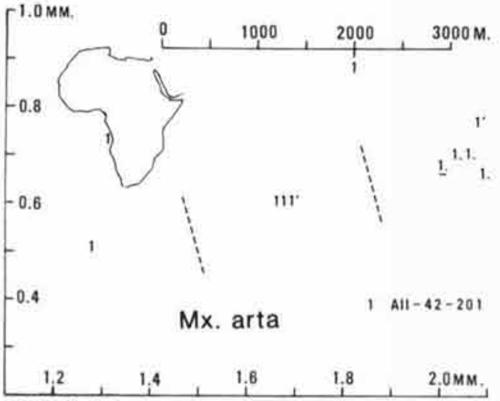
Macrocypris similis Brady Maddocks, 1977, fig. 1, 6.

Derivation of name.—Latin *artus,* close, strait, narrow; for the extremely elongate shape.

Material.—Nine specimens in alcohol, including 4 males, 1 female, and 4 juveniles belonging to 2 instars.

Types.—Holotype male specimen 1456M USNM 240467, paratypes USNM 240468–240471.

Type locality.—*Atlantis II* cruise 42 station 201, 9°29'–9°25'S, 11°34'–11°25'E, depth 1964–2031 m.



GRAPH 20

Occurrence.—At AII-42-201, 9 live specimens (4M, 1F, 1FJ–1, 3J–1).

Distribution.—Holocene; known only from one station in the Angola Basin, eastern South Atlantic Ocean, depth 1964–2031 m.

Dimensions.—Holotype male 1456M, RVL 2.01 mm, RVH 0.68 mm, LVL 1.96 mm, LVH 0.65 mm. See also Graph 20. The female is distinctly higher than the males.

Diagnosis.—Carapace medium-sized, elongate-siliquose in lateral outline; dorsal margin gently arching; anterior margin broadly and somewhat obliquely rounded; ventral margin straight to slightly sinuate, only very slightly upswung posteriorly; posterior region greatly extended, ending in slightly truncate angle of about 45° to 50°; anterior zone of concrescence very broad, with elaborately branching radial pore canals arranged in bundles.

Male fifth limbs large, thick, with short, thick pegs and thick, tapering hooks recurved at 65° for right limb and 33° for left. Female fifth limb robustly proportioned, ending in rather short, thick claws of graduated lengths. Sixth limb ends in two claws of nearly equal length. Seventh limb has a short, distinctly pectinate reflexed seta, reaching only to the joint between podomeres II and III; the longer of the distal setae is much longer than the reflexed seta and finely pectinate. Furca large, weakly dimorphic, larger in males than in female, consisting of long, stout cylindrical rami with flexible terminal setae, plus clusters of four large proximal setae located at about one-third length of rami. Male hemipenis oblong, flexed at midlength, with concave dorsal margin, angulate-convex ventral margin, bluntly truncated anteriorly, weakly sclerotized, without lamellar projections; copulatory rod short, straight.

Comparisons.—*Mx. adrecta* is higher and somewhat larger than *Mx. arta*, with a more domed dorsum and more truncate, tapering posterior angle; its hemipenis is more quadrate in outline but shows structural homologies with that of *Mx. arta*. *Mx. adunca*, *Mx. audens*, *Mx. similis*, and *Mx. kornickeri* are larger, less elongate, and have more sinuous contours. *Mx. antonbruunae* is smaller with a less tapered posterior angle, shallower posterior vestibules, and more evenly rounded anterior margin.

MACROPYXIS AUDENS new species

Graph 21; Figures 8.4,5, 9.4,5, 19.2, 22.12, 24.8, 26.22,23, 30.4, 33.7, 39.1, 46.56,57, 50.23, 51.34, 57.5, 58.15, 61.7, 64.9, 67.8, 80.11; Plates 14.9–12, 15.9–12, 60.5–7, 63.3,4, 79.8–10, 81.26,27, 82.3,4, 88.8–12, 102.5–9

Macrocypris sp. 4 MADDOCKS, 1977, fig. 10.

Derivation of name.—Latin *audens*, daring, bold, courageous; for its relatively large size and deep habitat.

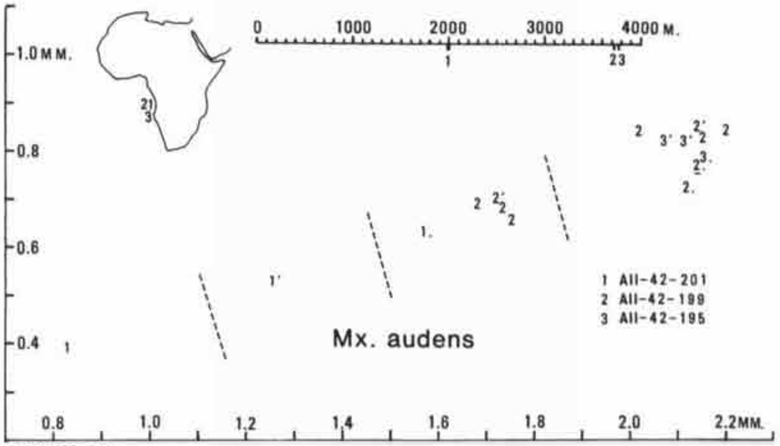
Material.—Eighteen specimens in alcohol, including 3 males, 6 females, and 7 juveniles belonging to 3 instars.

Types.—Holotype male 1446M USNM 240472, paratypes USNM 240473–240281.

Type locality.—*Atlantis II* cruise 42 station 199, 9°47'–9°49'S, 10°29'–10°33'E, depth 3764–3779 m.

Occurrence.—At AII-42-195, 3 live specimens (1M, 2F); at AII-42-199, 10 live specimens (2M, 4F, 1FJ–1, 3J); at AII-42-201, 5 live specimens (1MJ–1, 1FJ–2, 1J–4, 2 undetermined).

Distribution.—Holocene; in the Angola Basin, southeastern Atlantic Ocean, known live depth range 1964 m to 3797 m.



GRAPH 21

Dimensions.—Male 1446M, RVL 2.14 mm, RVH 0.77 mm, LVL 1.05 mm, LVH 0.71 mm. See also Graph 21. Females distinctly higher than males. Size may increase with depth.

Diagnosis.—Carapace elongate-ovate in lateral outline with very sinuous contours; dorsal margin gently arched to nearly straight, greatest height located anterior to midlength, anterior margin broadly and evenly rounded; ventral margin sinuate, indented in mouth region, upswung posteriorly to prolonged, acutely tapering, slightly flared posterior angle of 35° to 40°; anterior zone of concrescence broad, with elaborately branching radial pore canals.

Male fifth limbs with small, elongate palps and small hooks recurved at 39° to 50°. Female fifth limb of moderate proportions; the lower two of the three distal claws are nearly equal in length. The two distal claws of the sixth limb are nearly equal in length. Seventh leg rather small, with fairly short but very coarsely pectinate reflexed seta, reaching back to midddle of podomere III; the longer of the distal setae is also finely pectinate, about three-fourths as long as pectinate seta. Furca dimorphic, larger in males than females; female with long, thick, cylindrical rami and slender, flexible terminal setae, and with clusters of moderately large proximal setae located at about one-third length on rami; male rami about twice as long and proportionally thicker than in female, with shorter, much thicker, tapering, flexible terminal setae. Male hemipenis fusiform with curved, triangular anterodistal projection; copulatory rod rather large, tapering, bent in obtuse angle. Spherical terminal bulb of Zenker's organ hardly any wider than muscularized portion; vas deferens thickened, curled into broad, irregular coil of about five loops; strands of sperm also spirally coiled.

Comparisons.—The carapace of *Mx. audens* is similar in shape to those of *Mx. adrecta, Mx. arta,* and especially *Mx. adunca* but is more exaggerated in its features, with more extended posterior angle and more conspicuously sinuate ventral and posterior contours. The hemipenis of *Mx. audens* is similar in outline to those of *Mx. antonbruunae* and *Mx. eltaninae* but lacks the chitinous stiffening struts; it is more elongate and curving in shape than that of *Mx. labutisi* but structurally quite similar.

MACROPYXIS BATHYALENSIS (Hulings, 1967)

Graph 22; Figures 10.2–4, 11.2–4, 18.8, 19.4, 22.2,10, 24.5, 26.16,17, 30.7,12, 33.5, 34.5, 39.5, 46.41–43, 50.24, 51.19,20, 67.3, 80.7; Plates 12.7–12, 13.7–12, 22.7, 62.1, 63.7–10,12, 66.5, 79.11–13, 90.5–8,11,13, 102.11,12, 103.4–9

Macrocypris bathyalensis HULINGS, 1967a, p. 638, fig. 4r–u, 3f [*part.*]; HULINGS, 1967b, p. 314, fig. 8a–d, pl. 4, fig. 1 [*part.*].

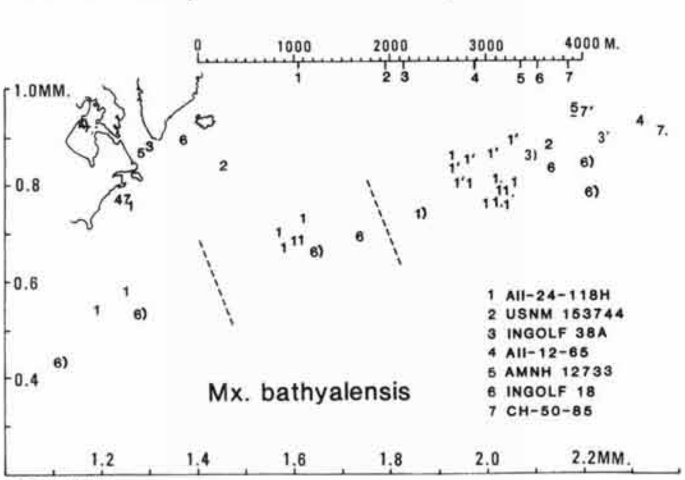
Not *Macrocypris bathyalensis* Hulings MADDOCKS, 1977, fig. 1, 5, 10; CRONIN, 1983, p. 107, pl. 4, fig. A, C, D.

Macrocypris minna (Baird) TRESSLER, 1941, p. 98, pl. 19, fig. 26.

?*Macrocypris* sp. cf. *M. minna* (Baird) WHATLEY and COLES, 1987, pl. 1, fig. 7.

Material.—The holotype plus 34 specimens in alcohol, including 4 males, 8 females, 4 juveniles belonging to 2 instars, and 19 empty carapaces and valves; and 1 fossil valve; for a total of 36 specimens.

Types.—Holotype female AMNH 12733, labelled "VEMA station V-17-118, 57°50'N. Lat., 56°06'W. Long., Depth 3369 m." The specimen consists of two valves in a vial of alcohol, without any corresponding dissection-mount. This is probably one of the two live female specimens mentioned by Hulings (1967a, p. 639, line 3 of "Occurrence"; also 1967b, p. 314). The soft parts of this specimen, the second live specimen reported by Hulings, and the dead specimens identified as this species that were collected from between Cape Hatteras and Jupiter Inlet by Hulings cannot be located in the American Museum of Natural History (Julia Golden, personal communication, 6 October 1977).



GRAPH 22

The new material for this species is deposited as USNM 240282–240289.

Type locality.—Vema cruise 17 station 118, 55°50'N, 56°06'W, depth 3369 m.

Occurrence.—In AMNH 12733, 1 live specimen (1F); at AII-12-65, 1 specimen; at AII-24-118H, 12 live plus 10 specimens (3M, 5F, 2J–1, 2J–2); at C-50-85, 2 live specimens (1M, 1F); at Ingolf 18, 7 specimens; at Ingolf 38a, 1 live plus 1 specimens (1F); in USNM 153744, 1 specimen.

Distribution.—Living and Quaternary in the North Atlantic Ocean, known live depth range 1135 m to 3834 m.

Hulings (1967a) reported this species at four stations between Cape Hatteras and Jupiter Inlet, on the middle Atlantic continental shelf of the United States at depths of 201 to 667 m, but those records probably belong to *Mx. sapeloensis.* The report from the Florida slope by Cronin (1983) probably applies to *Mx. tenuicauda.*

The juvenile valve reported by Whatley and Coles (1987) as "*Macrocypris* sp. cf. *M. minna*" from the Quaternary (zone NN 19) at Deep Sea Drilling Program leg 94 site 606 (hole 606A, core catcher 4 and 5, 37°20.32'N, 35°29.99'W, present water depth 3022 m) may belong to *Mx. bathyalensis.*

Dimensions.—Holotype female AMNH 12733, RVL 2.18 mm, RVH 0.96 mm, LVL 2.13 mm, LVH 0.86 mm. See also Graph 22. Males are longer but not as high as females and have a more elongate shape. Size increases with depth. The much smaller dimensions given by Hulings (1967a) probably belong instead to *Mx. sapeloensis.*

Diagnosis.—Carapace large, elongate-oblong in lateral outline with tapered posterior; dorsal margin arching smoothly to greatest height near midlength in females or slightly anterior to midlength in males; anterior margin broadly and fairly evenly rounded; ventral margin nearly straight to slightly sinuate, with weak indentation in mouth region, weakly upswung posteriorly in females, nearly straight in males; posterodorsal margin sloping steeply and continuously to sharp posterior angle of 45° to 50°; anterior zone of concrescence very wide, with complexly branching radial pore canals arranged in elaborate bundles, anterior vestibule correspondingly shallow; posterior zone of concrescence of moderate width, vestibule deep, especially in males.

Male fifth limbs slender, with elongate pegs and small hooks recurved at 91° for right limb and 25° for left. Female fifth limb of moderate proportions with setae of graduated lengths. Terminal claws of sixth limb of nearly equal lengths. Reflexed seta of sixth leg finely pectinate, of moderate length, reaching only to joint between podomeres II and III; the longer of the two distal setae is nearly as long as the reflexed seta. Furca of moderate size, larger in male, with long cylindrical rami and slender, flexible terminal setae in both sexes; clusters of medium-sized to large proximal setae located near end of ramus. Hemipenis oblong, strongly muscularized, with overhanging, beaklike anterodistal portion, sinuous ventral margin, and strongly sclerotized anteroventral, arcuate-triangular plate; copulatory rod short, thick, nearly straight. Zenker's organ with long, narrow muscularized portion and large, circular terminal bulb; vas deferens coiled in a tight spiral of about six whorls.

Comparisons.—Mx. bathyalensis is distinguished from most other Atlantic species of the genus by its nearly straight ventral margin and tapering posterior end. *Mx. adriatica* is similar in size but of more rectilinear shape, having distinct anterodorsal and posterodorsal angles and less complexly branching radial pore canals. *Mx. audens, Mx. adunca, Mx. simulans,* and *Mx. adrecta* have more sinuous shapes and less domed dorsal margins. *Mx.* sp. 11 is similar but much smaller and proportionally not as high. *Mx. amanda* is larger and proportionally more elongate with a more gently arched dorsum. *Mx. sapeloensis* and *Mx. labutisi* are much smaller, with more rounded posterior ends and less angular outlines. The hemipenis of *Mx. bathyalensis* is like those of *Mx. antonbruunae* and *Mx. eltaninae* in structure but proportionally higher, with a larger, less pointed anterodistal region, more irregular outline, and conspicuously sclerotized anteroventral plate.

Remarks.—Mx. bathyalensis has been confused with at least five other other species of Macrocyprididae. Hulings (1967a) reported dead specimens under this new name at four stations between Cape Hatteras, North Carolina, and Jupiter Inlet, Florida, on the middle Atlantic continental shelf of the United States, at depths of 201, 576, 585, and 667 m. However, he selected the holotype specimen from a *Vema* station off Labrador. The dimensions he reported (L 1.67 to 1.80 mm, H 0.6 to 0.8 mm) for the southern specimens are more appropriate for *Mx. sapeloensis,* which is known to live in that area. Yet, the comparative statements (1967a, p. 638, in "Remarks") appear to apply to the *Vema* specimens of *Mx. bathyalensis.* The same set of four drawings was published in both papers, identified as female in both captions and identified as the holotype in figures 4r–s (Hulings, 1967a, fig. 4r–u; 1967b, fig. 8a–d); they probably illustrate the *Vema* holotype of *Mx. bathyalensis.* The original photograph (1967a, fig. 13f) shows a right valve published at 36 mm long; plate IV, fig. 1 (1967b) appears to be the same photograph published at 38 mm long. If so, the actual magnifications would be ×16.5 and ×17.4, respectively, rather than ×40 as reported by Hulings in both captions. These photographs show little except the outline of a right valve, but that outline is appropriate for *Mx. bathyalensis.*

The species misidentified by Maddocks (1977) as *Mx. bathyalensis* is *Mx. labutisi.* Because *Mx. sapeloensis* and *Mx. labutisi* nearly always occur together, Hulings (1967a) may have included both species within his concept of *Mx. bathyalensis.*

The species illustrated under this name by Cronin (1983) from bathyal stations east of Florida is smaller, with a more highly arched, angulate dorsal margin and truncate posterior angle. It is probably *Mx. tenuicauda* (as revised below).

The specimen (USNM 153744) figured by Tressler

(1941) as "*Macrocypris minna*" from a deep-sea core in the North Atlantic, depth 1955 m, belongs to *Mx. bathyalensis* (see Plate 22.7). It is likely that the juvenile left valve illustrated by Whatley and Coles (1987, pl. 1, fig. 7) from the Quaternary of DSDP leg 94 also belongs to *Mx. bathyalensis.*

MACROPYXIS ELTANINAE new species

Graph 23; Figures 6.8, 7.7, 26.10,11, 30.18, 33.9, 40.2, 46.69,70, 50.5, 51.15, 57.6, 58.11, 61.3, 64.5, 65.4, 80.14; Plates 20.10–12, 21.10–12, 62.6,7, 66.6,7, 79.14,15, 89.7–9

Derivation of name.—For the U.S.N.S. *Eltanin.*

Material.—Eight specimens in alcohol, including 1 male, 3 females, 1 specimen of indeterminate sex, and 3 juveniles belonging to 1 instar.

Types.—Holotype male 831M USNM 240490, paratypes USNM 240491–240497.

Type locality.—*Eltanin* cruise 4 station 65, 25°43'–25°42'S, 71°07'W, depth 3149–3257 m.

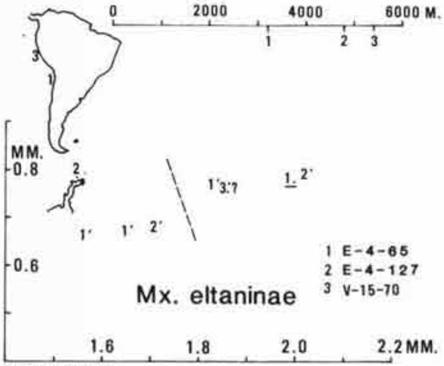
Occurrence.—At E-4-65, 5 live specimens (1M, 2F, 2FJ–1); at E-4-127, 2 live specimens tentatively identified (1F, 1FJ–1); at V-15-70, 1 live specimen (1MF?).

Distribution.—Holocene; Drake Sea and Peru–Chile Trench, known live depth range 3149 to 5666 m.

Dimensions.—Holotype male 831M, RVL 1.99 mm, RVH 0.78 mm, LVL 1.95 mm, LVH 0.73 mm. See also Graph 23. The single male is longer than the female from the same station but the same height. It is not clear whether size increases with depth.

Diagnosis.—Carapace fairly small, ovoid-oblong; dorsal margin high, smoothly arched, greatest height located at midlength; anterior margin broadly and somewhat obliquely rounded; ventral margin nearly straight with slight median sinuosity, and sharp posterior angle of about 60°; anterior zone of concrescence moderately wide, anterior radial pore canals irregularly branching.

Male fifth limb with fairly elongate palps, straight-sided hooks recurved at 68° in right limb and 56° in left. Female fifth limb fairly robustly proportioned; the mediodistal claw is the longest. Both distal claws of the sixth limb are the same length. Seventh limb very large, with long, finely pectinate reflexed seta reaching at least to middle of podomere II; the longer of the distal setae is about half as long as the reflexed seta. Furca large, apparently dimorphic, larger in male; female has slender cylindrical rami bearing clusters of very tiny proximal setae at about midlength and slender, flexible terminal setae; male has longer, thicker rami, slightly larger proximal setae, and very much thickened terminal setae. Male hemipenis fusiform in outline, with sinuate dorsal margin, very convex, smoothly rounded ventral margin, and curved, triangular anterodistal projection supported by weak chitinous struts; copulatory rod very small, straight.



GRAPH 23

Comparisons.—*Mx. eltaninae* differs from most western Pacific species of the genus by its compact carapace with nonsinuate outline. *Mx. antonbruunae* has a hemipenis of homologous structure, differing in shape and strength of chitinous supports; its carapace is not as high in proportion to length and has a straight to smoothly convex ventral margin. *Mx. amoena* is similar in size and shape but has more sinuous ventral and posterior margins and very different furcal dimorphism. *Mx. amanda* is much larger and more elongate, especially posteriorly.

Remarks.—Because most specimens are nearly opaque, the radial pore canals could not be seen clearly.

MACROPYXIS IMPROCERA new species

Graph 24; Figures 6.13,14, 7.11,12; Plates 24.1,7, 25.1,7, 59.6

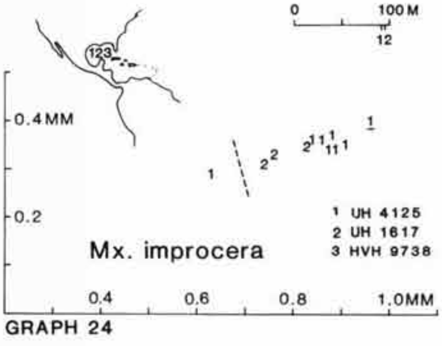
Macrocyprissa sp. HOWE and VAN DEN BOLD, 1975, p. 308, pl. 3, fig. 2.

Derivation of name.—Latin *improcerus,* of small stature, undersized; because it is the smallest species in the genus.

Material.—Twenty-four empty valves and carapaces, including juveniles of one instar; plus 2 fossil specimens; for a total of 26 specimens.

Types.—Holotype 2413RV USNM 240498, paratypes USNM 240499–240503 and HVH 9738.

Type locality.—UH 4125, *Gyre* cruise 77-G-14 station 7, 27°53.8'N, 93°37.7'W, depth 91.5 m.



GRAPH 24

Occurrence.—At UH 1617, 7 specimens; at UH 4125, 17 specimens; in HVH 9738, 2 specimens.

Distribution.—Pleistocene and Holocene, Gulf of Mexico. Howe and van den Bold reported it from mudlumps on the Mississippi River delta with radiocarbon date of 15,000 years B.P.

Dimensions.—Holotype 2413RV, RVL 0.96 mm, RVH 0.40 mm; 2412LV, LVL 0.99 mm, LVH 0.38 mm; 2415RV, RVL 0.83 mm, LVH 0.33 mm; 2414LV, LVL 0.83 mm, LVH 0.33 mm; HVH 9738 (the illustrated, gold-coated left valve), LVL 0.96 mm, LVH 0.33 mm. See also Graph 24. Adult specimens show considerable range in size, perhaps attributable to sexual dimorphism. The measurements for the smallest and largest adult specimens are listed above, and those specimens are illustrated in Figures 6.13,14 and 7.11,12.

Diagnosis.—Carapace small, laterally compressed, elongate-ovate; dorsal margin broadly and smoothly arched; anterior margin somewhat narrowly but regularly rounded; ventral margin straight to slightly sinuate, only slightly upswung near posterior; rounded posterior angle of about 45° to 50°; anterior zone of concrescence of moderate width, anterior radial pore canals irregularly branching.

Comparisons.—*Mx.* sp. 13 and *Mx.* sp. 14, which are also very small and tentatively assigned to this genus, are much more elongate than *Mx. improcera*. The smallest species whose soft parts are known, *Mx. labutisi*, is similar in lateral outline but less compressed, with more elaborately branching radial pore canals.

Remarks.—This is by far the smallest species referred to this genus. Within the family Macrocyprididae, only *Macrocyprina bermudae* has adults of such small size. The shape, radial pore canals and absence of patch pattern support tentative assignment to *Macropyxis*, pending discovery of soft parts.

The adult left valve illustrated by Howe and van den Bold (HVH 9638) is slightly lower, with a longer, lower, more tapered posterior end and slightly narrower anterior end than any of the adult specimens in UH 1617 and 4125, but these differences most probably fall within the range of individual variability in the species. The gold coating has been almost entirely removed, and it shows well developed branching radial pore canals.

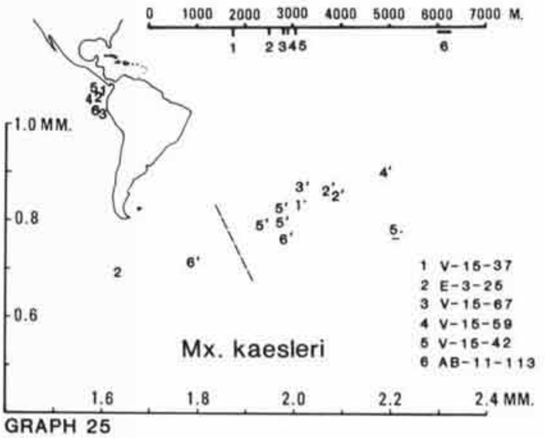
MACROPYXIS KAESLERI new species

Graph 25; Figures 6.6,7, 7.5,6, 20.11,12, 24.12,13, 26.18,19, 30.17, 33.11, 40.5, 46.64,65, 67.4, 71.5, 75.6, 78.6; Plates 20.2–6, 21.1–6, 79.16,17, 87.7, 111.2

Derivation of name.—For Roger L. Kaesler, who loaned numerous samples for this study.

Material.—Twelve specimens in alcohol, including 1 male, 9 females, and 2 juveniles belonging to 1 instar.

Types.—Holotype male 1967M USNM 240504, paratypes USNM 240505–240514.



GRAPH 25

Type locality.—*Vema* cruise 15 station 42, 7°55'N, 86°00'W, depth 3078–3085 m.

Occurrence.—At E-3-25, 3 live specimens (2F, 1J–1); at AB-11-113, 2 live specimens (1F, 1FJ–1); at V-15-37, 1 live specimen (1F); at V-15-42, 4 live specimens (1M, 3F); at V-15-59, 1 live specimen (1F); at V-15-67, 1 live specimen (1F).

Distribution.—Holocene; in the eastern Pacific Ocean off northern Peru, on the continental slope and northern part of the Peru–Chile Trench, known live depth range 1749 m to 6134 m.

Dimensions.—Holotype male 1976M, RVL 2.21 mm, RVH 0.78 mm, LVL 2.16 mm, LVH 0.74 mm. See also Graph 25. The single female is longer than but almost as high as the females from the same station. The relationship of size to depth is unclear.

Diagnosis.—Female carapace of moderate size, elongate-ovate in lateral outline; dorsal margin very high-arched, rising to greatest height anterior to midlength; anterior margin narrowly and somewhat obliquely rounded; ventral margin convex and slightly sinuate, smoothly upswung posteriorly to slightly flared, truncate posterior angle of about 50°; lateral outline of male carapace much more elongate both anteriorly and posteriorly, with sinuous posterodorsal margin and greatly extended posterior angle; anterior zone of concrescence quite wide, anterior radial pore canals elaborately branching, grouped in bundles.

Male fifth limb with somewhat elongate palp, long, thin pegs, and small, straight-sided hook recurved at 92° in right limb and 57° in left. The two lower distal claws of the female fifth leg are equal in length. The two distal claws of the sixth leg are nearly equal in length. The conspicuously pectinate reflexed seta of the seventh limb is short, reaching only to the joint between podomeres II and III; the longer of the two distal setae is about half again as long as the reflexed seta. Furca slightly larger in male than female, having clusters of fairly large proximal setae located at half or two-thirds length on the cylindrical rami, and slender, flexible terminal setae. Male hemipenis fusiform-subtriangular, with nearly straight dorsal margin, convex, angulate ventral margins, ending in large, triangular anterodistal projection without any chitinous stiffening struts; copulatory rod short, curved. Zenker's organ with long muscularized portion and large, teardrop-shaped to spherical terminal bulb; vas deferens fairly thick and tightly coiled in a spiral.

Comparisons.—The hemipenis of *Mx. labutisi* is structurally very similar to that of *Mx. kaesleri*, with the most important differences being details of the internal, heavily chitinized copulatory rod and tube and supporting chitinous elements; the carapace of *Mx. labutisi* is much smaller, more elongate, and has different dimorphism. In size, shape, dimorphism and marginal features, *Mx. kaesleri* resembles *Mx. adunca* and *Mx. audens*, differing in details of shape and soft parts. *Mx.* sp. 17 is smaller and less produced posteriorly, with a nearly straight ventral margin.

Remarks.—The occurrence of this species (with *Mx. antonbruunae* and *Mx. kalbi*) at AB-11-113, depth 5986–6134, marks the deepest known occurrence of live Macrocyprididae.

MACROPYXIS KALBI new species

Graph 26; Figures 6.20,21, 7.18,19, 20.9, 22.5, 24.10, 26.32,33, 30.14, 33.4, 40.6, 46.71, 50.28–31, 51.21–24, 56.15,16, 57.3,28, 58.14, 59.14,28, 61.2, 63.7,21, 64.4,41, 67.5, 80.5; Plates 1, 18.3–6, 19.2–6, 60.9, 61.9, 67.1–4, 79.18–20, 89.10–15, 101.12–15, 110.6, 112.5

Macrocypris sp. O Maddocks, 1977, fig. 10.

Derivation of name.—For Jon Kalb, who collected many of the samples in which this species occurs.

Material.—Thirty-one specimens in alcohol, including 5 males, 4 females, and 22 juveniles belonging to 3 instars.

Types.—Holotype male 351M USNM 240515, paratypes USNM 240516–240538.

Type locality.—*Anton Bruun* cruise 11 station 36, 5°43'S, 82°00.5'W, depth 5047 m.

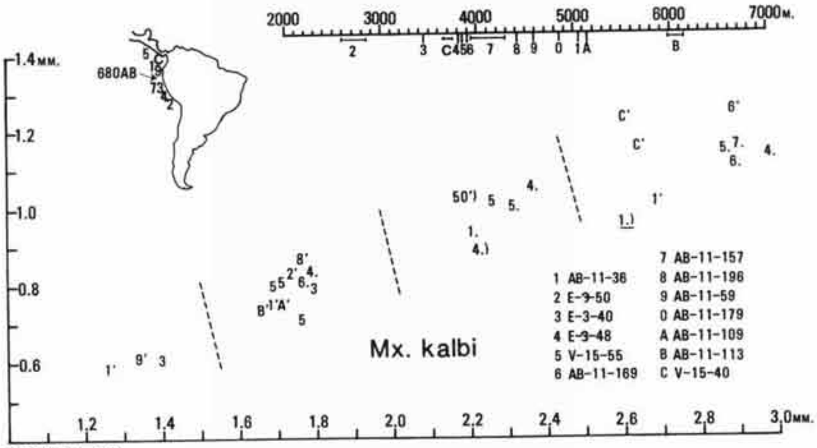
Occurrence.—At AB-11-36, 5 live specimens (1M, 1F, 1MJ–1, 1FJ–2, 1FJ–3); at AB-11-59, 1 live specimen (1FJ–3); at AB-11-109, 1 live specimen (1FJ–2); at AB-11-113, 1 live specimen (1FJ–2); at AB-11-157, 1 live specimen (1M); at AB-11-169, 3 live specimens (1M, 1F, 1MJ–2); at AB-11-179, 1 live specimen (1FJ–1); at AB-11-196, 1 live specimen (1FJ–2); at E-3-40, 2 live specimens (1J–2, 1J–3); at E-3-48, 5 live specimens (1M, 2MJ–1, 1MJ–2, 1J); at E-3-50, 1 live specimen (1FJ–2); at V-15-40, 2 live specimens (2F); at V-15-55, 7 live specimens (1M, 1MJ–1, 2J–1, 3J–2).

Distribution.—Holocene; in the eastern Pacific Ocean off northern South America and Central America, on the continental slope and northern part of the Peru–Chile Trench, known live depth range 2599 m to 6134 m.

Dimensions.—Holotype male 351M, LVL 2.60 mm, LVH 0.96 mm, RV not measurable. See also Graph 26. Males are not as high as females. Size appears to increase with depth down to about 4000 m and then to decrease thereafter.

Diagnosis.—Carapace very large, ovate-siliquose; dorsal margin very broadly arched, rising to highest point anterior to midlength; anterior margin narrowly and evenly rounded; ventral margin slightly convex and sinuate; posterior angle smoothly upswung to slightly truncate, about 50° to 60°; anterior zone of concrescence of moderate width, anterior radial pore canals irregularly branching.

Male fifth limb with large palps and thick tapering hooks recurved at 51° in right limb and 33° in left. Female fifth limb robustly proportioned, with distal claws of graduated lengths. Sixth limb has two distal claws of equal length. Seventh limb has long, finely pectinate reflexed seta that reaches to middle of podomere II; the longer of the two distal setae is only one-third as long as the reflexed seta. Furcae with rather thick cylindrical rami and stout, barbed terminal setae; proximal setae located near base of rami. Male hemipenis oblong-subtriangular in outline, with sinuous, angulate margins; an oblong, lamellar projection of curved outline projects anterodistally, accounting for about one-third of the area of the whole organ; the

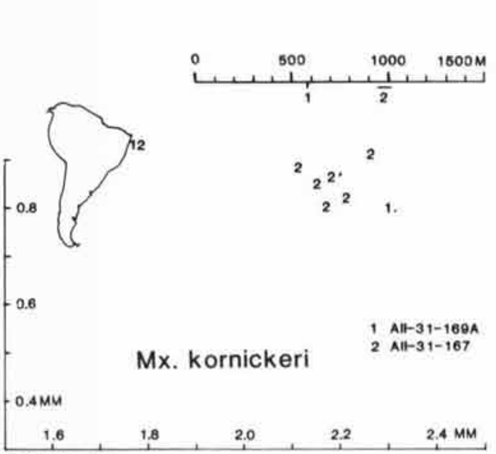


GRAPH 26

copulatory rod is very thick, curved, tapering, with a minutely papillose surface. The Zenker's organ has a spherical terminal bulb no wider than the muscularized portion; the vas deferens is enlarged and coiled in an irregular knot; strands of sperm are coiled in a tight, irregular spiral of at least 12 loops.

Comparisons.—*Mx.* sp. 21 is very similar to *Mx. kalbi* in shape and size, with slightly less convex ventral margin and less elongate posterior, but differs in appendage details. *Mx. amanda* is more elongate with a nearly straight ventral margin and more elaborate radial pore canals.

Remarks.—This is one of the largest species in the genus, exceeded only by *Mx.* sp. 12 and some species of *Macrocypris*. The structure of the hemipenis is unique. The occurrence of this species (with *Mx. antonbruunae* and *Mx. kaesleri*) at AB-11-113, depth 5986–6134 m, marks the deepest known occurrence of live Macrocyprididae.



GRAPH 27

MACROPYXIS KORNICKERI new species

Graph 27; Figures 10.15,16, 11.13,14, 18.7, 22.1, 26.14,15, 30.8, 34.7, 41.2, 46.47,48, 67.7, 80.8; Plates 24.4,5, 25.4,5, 79.21, 90.4,12, 103.1–3

Derivation of name.—For Louis S. Kornicker, who loaned these and many other specimens.

Material.—Thirteen specimens in alcohol, including one male, one female, and 11 empty valves and carapaces.

Types.—Holotype male 2384M USNM 240539, paratypes 240540–240541.

Type locality.—*Atlantis II* cruise 31 station 169A, 8°2–3'S, 34°23–25'W, 587 m.

Occurrence.—At AII-31-167, 1 live plus 11 specimens (1F); at AII-31-169A, 1 live specimen (1M).

Distribution.—In the western Atlantic Ocean on the continental slope off Brazil, known live depth range 587 m to 1007 m.

Dimensions.—Holotype male 2384M, RVL 2.30 mm, RVH 0.80 mm, LVL 2.23 mm, LVH 0.73 mm. See also Graph 27. The male is longer than but not as high as the female. The relationship between size and depth cannot be determined.

Diagnosis.—Carapace oblong-siliquose with extended posterior; dorsal margin broadly arched, with indistinct dorsal and posterodorsal angles separating nearly straight segments; greatest height located anterior to midlength; anterior margin broadly and evenly rounded; ventral margin straight, without indentation in mouth region, but with very slight sinuosity in the posteroventral region, slightly upswung posteriorly to sharp, only slightly flared posterior angle of about 35° to 50°; anterior zone of concrescence extremely wide, with elaborately branching radial pore canals grouped into bundles, anterior vestibule correspondingly shallow; posterior zone of concrescence moderately wide, posterior vestibule deep.

Male fifth limbs somewhat elongate with narrow pegs and short, distally expanded hooks recurved at 92° in right limb and 70° in left. Female fifth limb of normal proportions with graduated distal claws. The sixth limb has two stout distal claws, one half again as long as the other. Seventh limb large with fairly short reflexed seta, reaching only a little past the joint between podomeres II and III, finely pectinate; the longer of the distal setae is almost as long as the reflexed seta. Furca in both sexes consists of slender cylindrical rami, on which the clusters of tiny proximal setae are located beyond midlength to two-thirds length of rami, and slender, flexible terminal setae, which are shorter and thicker in the male. Hemipenis oblong, compressed, with smoothly curving outlines, blunt anterior margin, triangular anteroventral expansion connected to venter only by a nearly transparent film, without anterodistal or other accessory lamellae or appendages; copulatory rod short, straight, located posteriorly. Zenker's organ with long, narrow muscularized portion and large, spherical terminal bulb; vas deferens tightly coiled in a spiral of about 10 whorls, like a telephone cord.

Comparisons.—*Mx. similis*, which occurs at the same stations, is larger and more elongate, with more curving, sinuous contours, a concave ventral margin, and a more extended, flared posterior end. *Mx. bathyalensis* is similar in shape but higher in proportion to length, with greatest height located near midlength, more sinuous ventral margin, and less prolonged posterior angle. *Mx.* sp. 18 is very similar but slightly smaller, with a convex ventral margin, more smoothly arched dorsal margin, and less extended posterior angle. *Mx.* sp. 20 is larger and higher in proportion to length, with distinct ventral indentation and smoothly domed dorsal margin. *Mx. kaesleri* is smaller and more elongate, with more curving, sinuous outlines. *Mx.* sp. 11 is smaller and less elongate, with a less extended posterior angle. *Mx. adunca* and *Mx. audens* are somewhat smaller, with much more curving, sinuous contours. *Mx. adrecta* is more siliquose with a less arched dorsal margin, higher in the posterodorsal region, and a less extended posterior angle.

The hemipenis of *Mx. kornickeri* is unusually simple and not closely similar to that of any other known species of the genus. Its general structure is not unlike that of some species of *Macrocypris* but lacks the long copulatory rod, sclerotized marginal struts, and lengthwise-contracting musculature of that genus.

Remarks.—This species has the most elaborately branched anterior radial pore canals in the family.

MACROPYXIS LABUTISI new species

Graph 28; Figures 10.8,9, 11.7,8, 19.9, 22.14, 24.15, 26.12,13, 30.16, 33.10, 38.5, 46.38–40, 50.6–11, 51.25–30, 56.6,26,29,33,34, 57.17,18,30, 58.9, 59.22,31,37,38, 61.4, 63.1,20, 64.31–34,45–47,54–57, 66.8, 80.16; Plates 10.1–6, 11.1–6, 62.2,3, 67.5–7, 79.22,23, 87.8–13, 101.5–11, 111.4

Macrocypris bathyalensis HULINGS, 1967a, p. 638 [*part.*]; MADDOCKS, 1977, p. 151, fig. 5, 10 [*part.*].

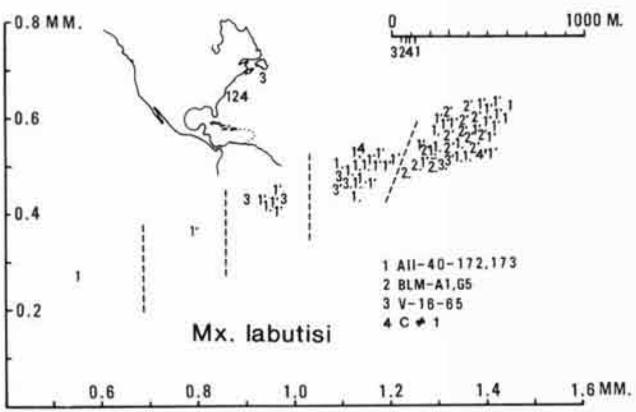
Derivation of name.—For Vidmantas R. Labutis, who helped as graduate research assistant on this project.

Material.—728 specimens in alcohol, including 139 males, 512 females, and 77 juveniles belonging to 4 instars.

Types.—Holotype male 1351M USNM 240542, paratypes USNM 240543–240569.

Type locality.—*Atlantis II* cruise 40 station 173, 40°10.8'–40°10.6'N, 70°43.6'–70°44.0'W, depth 122.6 m.

Occurrence.—At AII-40-172, 118 live specimens (30M, 70F, 9MJ–1, 6FJ–1, 1MJ–2, 2FJ–2); at AII-40-173, 53 live specimens (17M, 19F, 7MJ–1, 5FJ–1, 3FJ–2, 1J–3, 1J–4); at *Chain* C # 1, 2 live specimens (1F, 1J); at V-16-65, 8 live specimens (1M, 2F, 1MJ–1, 1FJ–1, 1J–1, 2J–2); at stations of the Bureau of Land Management, Middle Atlantic Outer Continental Shelf Environmental Study, a total of 547 live specimens, as follows: at BLM-A1, 173 live specimens (26M, 138F, 9J); at BLM-A2, 153 live specimens (22M, 115F, 16J); at BLM-A3, 23 live specimens (3M, 18F, 2J); at BLM-A4, 7 live specimens (7F); at BLM-D4, 1 live specimen (1J); at BLM-F2, 21 live specimens (3M, 18F); at BLM-F3, 7 live specimens (6F, 1J); at BLM-F4, 11 live specimens (1M, 10F); at BLM-G5, 58 live specimens (8M, 49F, 1J); at BLM-G6, 31 live specimens (3M, 26F, 2J); at BLM-G7, 13 live specimens (6M, 6F, 1J); at BLM-I2, 1 live specimen (1F); at BLM-I3, 4 live specimens (1M, 3F); at BLM-J1, 5 live specimens (3M, 2F); at BLM-K4, 25 live specimens (7M, 15F, 3J); at BLM-K5, 1 live specimen (1F); BLM-K6, 6 live specimens (3M, 2F, 1J); at BLM-L5, 4 live specimens (3M, 1F); at BLM-L6, 3 live specimens (1M, 2F).



GRAPH 28

Distribution.—Holocene; Atlantic outer continental shelf, northeastern United States to Newfoundland, known live depth range 49 to 410 m, most abundant near shelf edge.

Dimensions.—Holotype male 1351M, RVL 1.29 mm, RVH 0.53 mm, LVL 1.25 mm, LVH 0.50 mm. See also Graph 28. Females are slightly longer and higher than males and a little higher in proportion to length. No effect of depth on size is apparent.

Diagnosis.—Carapace small, elongate-ovate in lateral outline; ventral margin nearly straight to very gently sinuous, only slightly upswung posteriorly; anterior margin broadly rounded; dorsal margin smoothly arched with greatest height located just anterior to midlength, sloping in a gentle, continuous curve to rounded posterior angle of about 55° to 60°; anterior zone of concrescence broad, anterior radial pore canals complexly branching.

Male fifth limbs short, with thick hooks recurved at 54° in right limb and 15° in left. Female fifth limb robust; mediodistal seta is longer and thicker than the others. The sixth limb ends in two rather short claws of nearly equal length. Reflexed seta of seventh limb very short, reaching almost to joint between podomeres II and III; the larger of the distal setae is fairly short, half as long as reflexed seta. Furcae conspicuously dimorphic; females have short, almostly completely fused cylindrical rami, small but conspicuous proximal setae located near end of rami, and long, flexible, tapering terminal setae; males have only a tiny, vestigial nub bearing two clusters of three or four proximal setae, from which the cylindrical rami and terminal setae are entirely missing. Male hemipenis weakly sclerotized, subrhomboidal in outline with sinuous margins and an acute anterodistal angle; copulatory rod short, nearly straight. Terminal bulb of Zenker's organ about 1.5 times as wide as muscularized portion; vas deferens slightly thickened for a short distance, not coiled.

Comparisons.—*Mx. labutisi* may be distinguished from *Mx. sapeloensis,* which occurs at many of the same stations, by its smaller size, more tapered posterior region, broader zone of concrescence, more elaborately branched radial pore canals, and dimorphic furca. Juveniles of the two species may be difficult to separate, however, unless size and development of appendages are carefully compared. *Mx. bathyalensis,* with which this species has formerly been confused, is much larger, with a straight ventral margin and more truncate, angulate posterior region. *Mx. improcera* is much smaller with a more highly arched dorsum. *Mx. amoena* is much larger, with a sinuate venter, especially posteriorly.

Remarks.—The adults of *Mx. labutisi* are approximately the same size as or slightly larger than the A–1 instar of *Mx. sapeloensis,* and the late instars roughly correspond in size to the next-earlier instars of *Mx. sapeloensis* or to the gaps between size-clusters in that species. Presence or absence of a furca is the best criterion for distinguishing these sympatric species.

MACROPYXIS LONGANA (van den Bold, 1960)

Graph 42; Plates 22.10–12, 23.8–12, 79.24

Macrocypris longana van den Bold, 1960, p. 156, pl. 1, fig. 7a,b.

Material.—Four fossil type specimens.

Types.—Holotype USNM 563493, paratypes USNM 563494, 563495.

Type locality.—Eocene, San Fernando Formation, Harmony Well 2, depth 686–698 feet, San Fernando area, Trinidad.

Occurrence.—In USNM 563493 to 563495, 4 specimens.

Distribution.—Eocene and Oligocene of Trinidad.

Dimensions.—Holotype USNM 563493, H 1.95 mm, L 0.70 mm. See also Graph 42.

Diagnosis.—Carapace fairly large, not very thick in dorsal view, only moderately asymmetrical; siliquose in lateral outline; dorsal margin very gently and smoothly arched; anterior margin evenly and somewhat narrowly rounded; ventral margin straight, not upswung posteriorly; posterior angle slightly rounded, about 40°.

Comparisons.—*Mx. longana* is much larger and more elongate than *Mx. rhodana,* which occurs in the same interval, and also has a more tapered, less sinuate shape and less asymmetrical valves. It has no dentiform corner and lacks the sinuous contours of contemporary species of *Macrocyprissa,* such as *Mc. vandenboldi* or *Mc. cylindracea,* and also lacks the delicately tapering, sinuous shape of *Macrosarisa. Mx. steinecki* is much higher and has a much more angulate, sinuous shape. Among living species, *Mx. antonbruunae* is fairly similar in shape, though with a slightly upturned posterior angle.

Remarks.—The anterior radial pore canals are not visible on these specimens, and the assignment to *Macropyxis* is tentative, based on shape alone. The three paratypes are probably juveniles. USNM 563494 may be a juvenile of a different species, perhaps *Mx. rhodana.*

MACROPYXIS RHODANA (van den Bold, 1960)

Graph 42; Plates 22.4–6, 23.3–6, 79.25

Macrocypris rhodana van den Bold, 1960, p. 156, pl. 1, fig. 6a,b.

Macrocyprina rhodana (van den Bold) van den Bold, 1971b, p. 123, 126, table 1; 1973, p. 161, pl. 1, fig. 7.

Material.—Four fossil type specimens.

Types.—Holotype USNM 563496, paratypes USNM 563497–563499.

Type locality.—Eocene, San Fernando Formation, Harmony Well 2, depth 609–618 feet, San Fernando area, Trinidad.

Occurrence.—In USNM 563496–563499, 4 specimens.

Distribution.—Van den Bold (1960, 1971, 1973) reported this species in the Eocene and Oligocene of Trinidad and the Oligocene to lower Miocene of Cuba.

Dimensions.—Holotype USNM 563496, L 1.48 mm, H 0.59 mm. See also Graph 42.

Diagnosis.—Carapace medium-sized, rather asymmetrical, elongate-ovoid in lateral outline; dorsal margin smoothly arching and rising to more or less distinct dorsal angle located at or slightly anterior to midlength; anterior margin narrowly and obliquely rounded; ventral margin sinuous with indentation in mouth region, upswung posteriorly to rounded, slightly flared posterior angle of about 45°; broad zone of concrescence, and branching radial pore canals.

Comparisons.—*Mx. rhodana* is smaller, much less elongate and much less sinuous in shape than *Mx. longana,* with which it occurs. It is much smaller, less expanded dorsally, and has less angular, less exaggerated outlines than *Mx. steinecki.*

Remarks.—The complexly branching radial pore canals cannot be traced in detail from these whole carapaces.

MACROPYXIS SIMILIS (Brady, 1880)

Graph 29; Figures 10.6,7, 11.5,6, 18.6, 22.13, 26.28,29, 30.5, 34.16, 38.4, 46.49,50, 67.6, 80.6; Plates 24.2,3,11,12, 25.2,3, 79.26,27, 90.9,10,14, 103.10–12

Macrocypris similis Brady, 1880, p. 42, pl. 2, fig. 2a–d; Müller, 1912, p. 122; Puri and Hulings, 1976, p. 260, pl. 1, fig. 13, 14.

Not *Macrocypris similis* Brady A. Scott, 1905, p. 370; Chapman, 1919, p. 20, pl. 2, fig. 2a–d; Tressler, 1954, p. 433; Maddocks, 1977, fig. 3, 6, 7; Hanai et al., 1980, p. 121.

Not *Macrocypris* sp. aff. *similis* Brady Herrig, 1977, p. 1156.

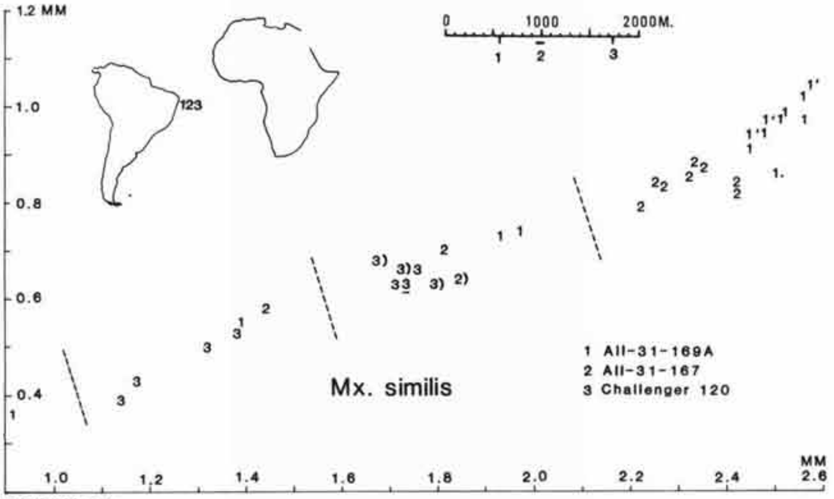
Not *Macrocypris* cf. *M. similis* Brady Neale, 1967, p. 7, pl. 1, fig. s, s', t.

Not *Macrocyprina similis* (Brady) Bhatia et al., 1972, p. 37.

Material.—Ten type specimens (empty carapaces and valves); and 27 specimens in alcohol, including 3 females, 1 male, 4 juveniles; and 19 carapaces and valves; for a total of 37 specimens.

Types.—The lectotype specimen selected by Puri and Hulings (1976) is a right valve in the British Museum (Natural History), G. S. Brady *Challenger* collection, labeled "Challenger no. 120, Depth 675, 80.38.14." There are also four paralectotype specimens, all right valves, in a slide labeled "153, Challenger no. 120, Depth 675, 80.38.14." Puri and Hulings (1976) mentioned additional topotypic specimens BMNH 1974.143 and 1974.244 from additional sediment at this locality (not examined).

Five more specimens from the same *Challenger* station are in the G. S. Brady cabinet in the Hancock Museum, Newcastle-upon-Tyne, in a slide labeled "*Cytherella lata,* n.



GRAPH 29

s., *Macrocypris similis,* n. s., *Bythocypris reniformis,* n. s., Challenger no. 120, depth 675 fath., washing of dredge, G. S. Brady, 9/9/73." The two juvenile left valves that Brady reported at *Challenger* station 305 are in the Hancock Museum in a slide labeled "*Bairdia amygdaloides* B., *Macrocypris similis* sp. nov., Challenger No. 305, depth 160 fath., sounding, G. S. Brady, 13/1/76." However, they belong to a different species of *Macropyxis* than those from *Challenger* 120, which cannot be identified with any of the species discussed in this monograph.

Brady also reported this species from *Challenger* station 344, off Ascension Island at a depth of 420 fathoms (768 m), but this material has not been located, and this record cannot be verified.

The whole carapace illustrated and described by Brady (1880) and said by him to have a length of 2.1 mm is apparently not present in either museum. All of the type specimens appear to be juveniles.

The new material for this species is catalogued as USNM 240570–240573.

Type locality.—Challenger station 120, 8°37'S, 34°28'W, depth 675 fathoms (1234 m), off Pernambuco, Brazil, September 9, 1873.

Occurrence.—In BMNH 80.38.14, 1 specimen; in BMNH 80.38.14, slide 153, 4 specimens; in HM *Challenger* 120, 5 specimens; at AII-31-167, 14 specimens; at AII-31-169A, 8 live plus 5 specimens (1M, 3F, 2J–1, 1J–2, 1J–3).

Distribution.—Holocene; in the western Atlantic Ocean off Brazil, known live depth range 587 to 1007 m, dead specimens as deep as 1234 m.

Dimensions.—Lectotype BMNH 80.38.14, my specimen number 2148, a juvenile right valve, RVL 1.72 mm, RVH 0.63 mm; adult male 2382M, RVL 2.50 mm, RVH 0.86 mm, LVL 2.46 mm, LVH 0.79 mm; adult female 2383F, RVL 2.45 mm, RVH 0.94 mm, LVL 2.41 mm, LVH 0.86 mm. See also Graph 29. The male is as long as the females but not as high. Size appears to decrease with depth.

Diagnosis.—Carapace elongate-siliquose in lateral outline with sinuous contours; dorsal margin low-arched, somewhat irregular, with greatest height located at midlength; anterior margin broadly and evenly rounded; ventral indentation shallow but distinct; posteroventral margin nearly straight in female, slightly upturned in male; prolonged, truncate angle of about 30° to 40°, located a little above venter, flared in male; zone of concrescence very broad, vestibules correspondingly small, anterior radial pore canals elaborately branching.

Male fifth limbs very elongate, with slender hooks recurved at 77° in right limb and 38° in left, with very slender pegs of moderate length. Terminal claws of female fifth limb of average thickness and graduated lengths. Sixth limb rather large, robustly proportioned; posterodistal claw about four-fifths as long as mediodistal claw. Recurved seta of seventh limb very short, flexible, with hairs too fine to draw (accidentally bent forward in Fig. 38.4); one of the distal setae is very long. Furcae long but very thin, with tiny proximal setae, apparently dimorphic, male twice as large as female. Hemipenis oblong, irregularly subrectangular in outline, with sinuously curved anterior margin, a thick, curved copulatory rod of moderate length, and a larger, curved, tapering, hooklike appendage. Zenker's organ with long, narrow muscularized portion and moderately large, spherical terminal bulb; vas deferens coiled into a clump of about 5 circular whorls.

Comparisons.—*Mx. similis* is larger and more elongate, with a less angular, more equilateral outline, than *Mx. kornickeri,* which occurs at the same stations. The female of *Mx. similis* is quite similar in size and shape to the male of *Mx. bathyalensis* but has a more extended anterior region, a deeper ventral indentation, and a more truncate posterior angle. *Mx. arta* is similar in general proportions but much smaller and less sinuate. *Mx. kaesleri* is also somewhat similar in shape but has more extreme dimorphism. The hemipenis is unique, not to be confused with any other.

Remarks.—Brady's illustration of a relatively nondescript, high-arched carapace with truncate posterior has been the basis for considerable misidentification of *Mx. similis.* Neither Brady's illustrated specimen nor any syntypes from *Challenger* station 344 can be located, from which to obtain more information about the characters of that species. The remaining syntypes from *Challenger* stations 120 and 305 represent a different species or perhaps two different species from the one Brady intended to describe. Moreover, all remaining type specimens are juveniles, probably A–1 and A–2. Thus, by selecting this juvenile lectotype specimen, Puri and Hulings (1976) transferred Brady's name to a different species, one for which the adult characters were neither known nor easily predictable.

Isolated juveniles of Macrocyprididae are not easily identifiable to species. Large populations with long growth series are needed, preferably from multiple localities and depths, if such identifications are to have any validity. This is especially true of *Macropyxis,* which seems to have more species, more sympatric species, more influence of depth on general size, and more geographic shape variability within species than do many of the other genera.

In the case of *Mx. similis,* juveniles from AII-31-167 and AII-31-169A are very similar in shape to the juvenile *Challenger* syntypes, in side-by-side comparisons. The size difference corresponds in direction and magnitude to that established for the adults and confirms the predicted depth-size cline. Juveniles of other species of *Macropyxis* from nearby stations cannot be reconciled to *Mx. similis* in this same fashion. For example, fig. 7 of Maddocks (1977), drawn before the collections at AII-31-167 and AII-31-169A had become available, erroneously attempted to identify populations of *Mx. arta* as *Mx. similis,* but the discrepancies are obvious.

A. Scott (1905) and Tressler (1954) did not illustrate the species they reported under this name, and there is no evidence that *Mx. similis* occurs in either the Gulf of Mexico or the Indian Ocean. The unusually attenuate valve reported under this name by Chapman (1919) from a depth of 2633 m east of Tasmania might belong to an unknown species of *Macropyxis,* or else to a homeomorphic genus, such as *Argilloecia,* but is certainly not *Mx. similis.* The juvenile valves reported by Neale (1967) from Halley Bay, Antarctica, belong, as he thought, to a different species. They are redescribed below as *Macroscapha* sp. 26.

MACROPYXIS SIMULANS new species

Graph 30; Figures 8.8, 9.8; Plates 24.6, 25.6

Derivation of name.—Latin *simulans,* imitative; because it is one of a large group of species with very similar shapes.

Material.—Fifteen empty carapaces and valves.

Types.—Holotype 2416RV, USNM 240574, paratypes USNM 240575–240577.

Type locality.—UH 4132, Texas A&M R.V. *Gyre* 77-G-14 station 13, 27°20.9'N, 95°9.0'W, depth 1079 m.

Occurrence.—At UH 4130, 3 specimens; at UH 4132, 12 specimens.

Distribution.—Holocene; northwestern Gulf of Mexico, known dead depth range 1079–1116 m.

Dimensions.—Holotype 2416, RVL 2.29 mm, RVH 0.90 mm. Paratype 2417, LVL 2.22 mm, LVH 0.79 mm. See also Graph 30.

Diagnosis.—Carapace elongate-oblong in lateral outline without distinct anterodorsal or posterodorsal angles; dorsal margin high-arched; greatest height at or slightly posterior to midlength; posterodorsal margin sloping steeply and nearly straight; anterior margin broadly rounded; ventral margin gently sinuate and broadly convex posterior to mouth region, rising slightly posteriorly to slightly truncate, distinct posterior angle of about 30°; anterior zone of concrescence only moderately broad, with several bundles of curved, branching radial pore canals and false pore canals.

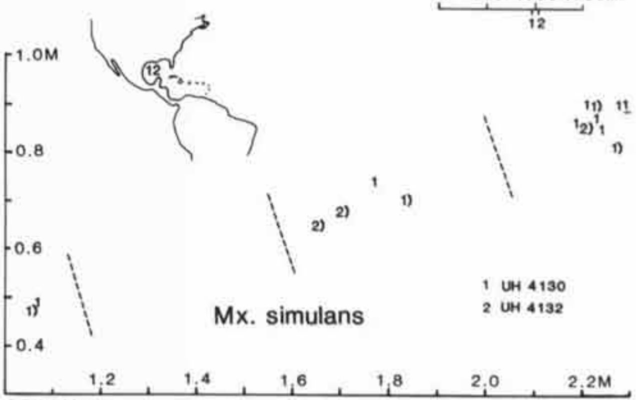
Comparisons.—*Mx. sapeloensis* is much smaller than *Mx. simulans,* with less sinuous contours and more curving dorsal margin. *Mx. bathyalensis* is proportionally higher, with a nearly straight venter. *Mx. amanda* is larger, tapering posteriorly to a more siliquose shape, and has a more sinuous outline. *Mx. adunca, Mx. adrecta,* and *Mx. audens* are smaller, proportionally not as high, and have broader zones of concrescence with more elaborately branching radial pore canals.

Remarks.—Even though none of the individual characters of this species are especially distinctive, taken together they readily distinguish it from others. Although the available specimens do not give unambiguous evidence of sexual dimorphism, it is likely that the holotype is a female.

MACROPYXIS STEINECKI new species

Graph 31; Plates 22.1–3, 23.1,2,7

Macrocypris sp. 1 Steineck, 1981, p. 348–350, fig. 7.



GRAPH 30

Derivation of name.—For Paul Lewis Steineck, who loaned the specimens.

Material.—Twenty-eight fossil specimens.

Types.—Holotype 2101W USNM 438230, paratypes USNM 438231–438257 and in the collection of Paul Steineck.

Type locality.—Lower Miocene, Montpelier Group, Spring Garden Formation, Steineck sample M27A, exposed in road cuts along the Montego Bay–Adelphi road in northwestern Jamaica. The age of this sample is N7 or N8 according to the planktonic foraminifera (Steineck, personal communication).

Occurrence.—At Steineck M17, 3 specimens; at Steineck M23, 2 specimens; at Steineck M25, 3 specimens; at Steineck M27, 1 specimen; at Steineck M27A, 9 specimens; at Steineck M28, 4 specimens; at Steineck M29, 6 specimens. The planktonic foraminiferal biozones to which these samples belong are N4 to N8 (Steineck, personal communication).

Distribution.—Lower Miocene of Jamaica.

Dimensions.—Holotype 2101W, L 2.19 mm, H 0.94 mm. It is likely that the somewhat shorter, more elongate specimens are males. See also Graph 31.

Diagnosis.—Carapace large, oblong-ovoid with angulate-sinuate contours, relatively high in proportion to length; dorsal margin with distinct dorsal and posterodorsal angles, straight posterodorsal and dorsomedial segments, anterodorsal segment slightly concave; anterior margin broadly but somewhat obliquely rounded; ventral margin sinuate, with marked indentation in mouth region, convex ventromedially, smoothly upswung and slightly concave posteroventrally; sharp, slightly flared posterior angle of about 60° located distinctly above venter.

Comparisons.—*Mx. steinecki* is the largest, most sinuate, most angulate, and most abundant of the several species of Macrocyprididae that occur together in this stratigraphic interval (Steineck, 1981), most of which are not considered in this monograph. *Mx. rhodana* is similar but smaller and less sinuate in outline. Among living species, a comparably sinuous but less angular shape is seen in *Mx. audens*, while *Mx. kaesleri* has similar angularity and the arrow-shaped posterior angle but not the anterior shape.

Remarks.—Although the radial pore canals cannot be traced distinctly from these whole carapaces, they appear to branch in a complex fashion.

MACROPYXIS TENUICAUDA (Brady, 1880)

Graph 32; Plates 25.10–12

Macrocypris tenuicauda Brady, 1880, p. 41 [*part.*; not pl. 2, fig. 1a–f, pl. 3, fig. 2a,b]; Müller, 1912, p. 122 [*part.*]; Puri and Hulings, 1976, p. 261, pl. 1, fig. 11, 12.

Not *Macrocypris tenuicauda* Egger, 1902, p. 424, pl. 1, fig. 13–24; Crespin, 1943, p. 101; De Deckker and Jones, 1978, p. 133; Ruggieri, 1960, p. 124; Maddocks, 1977, fig. 11.

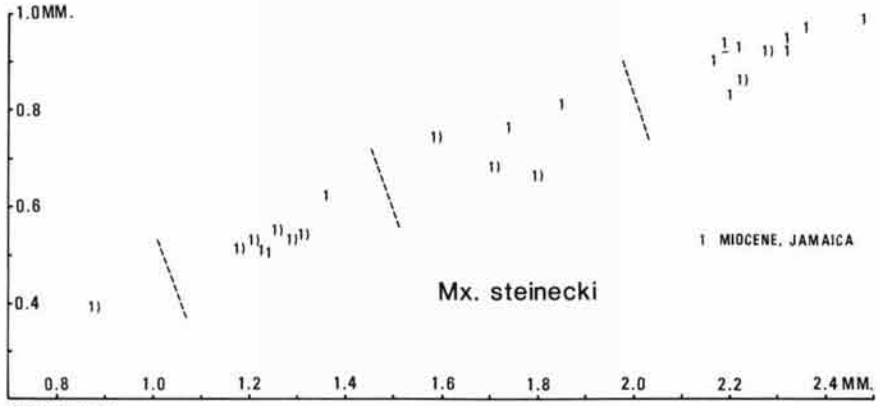
Macrocypris bathyalensis Hulings Cronin, 1983, p. 107, pl. 4, fig. A, C, D.

Material.—Two type specimens.

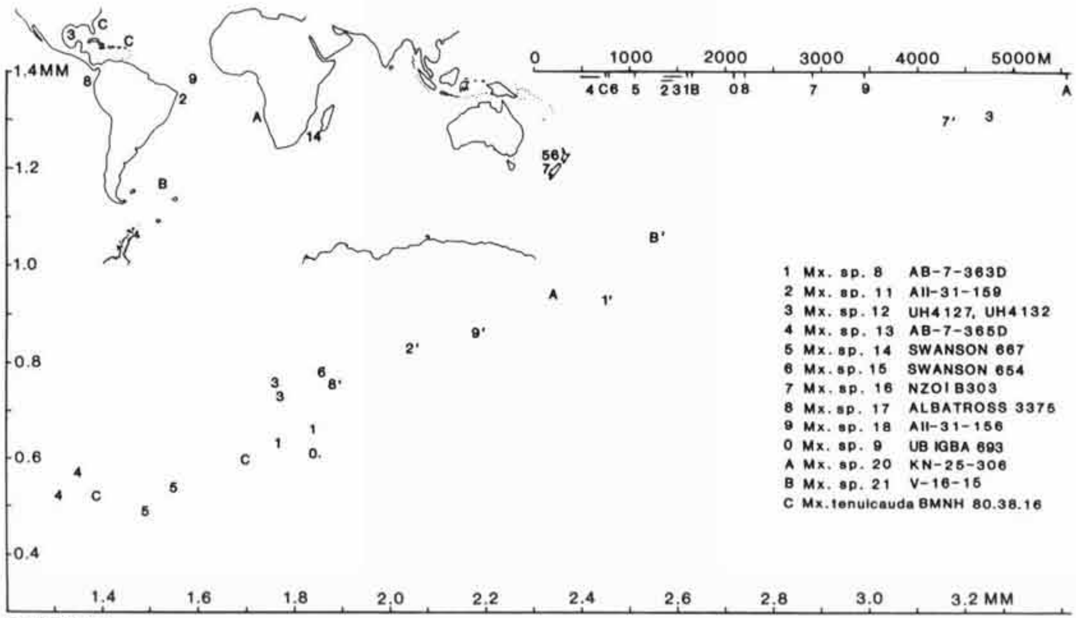
Types.—The lectotype specimen selected by Puri and Hulings (1976) is a left valve, labeled "*Macrocypris tenuicauda* Brady, lectoholotype H. S. Puri 7/67, Challenger no. 24, D 390, N. of St. Thomas, 80.38.16" in the G. S. Brady *Challenger* collection in the British Museum (Natural History). This specimen does not belong to the species illustrated as *M. tenuicauda* by Brady and as understood by later workers. By selecting this specimen as the lectotype, Puri and Hulings transferred the name *tenuicauda* from one species to another. The species formerly considered to be *M. tenuicauda* is herein renamed *Macrosarisa bensoni* (see below).

A paralectotype left valve from the same station is labeled "*Macrocypris tenuicauda* Brady, lectoparatype H. S. Puri, 7/67, Challenger No. 24, D. 390, N. of St. Thomas, 80.38.16, 154."

Several topotype specimens of this species were recovered by Puri and Hulings (1976) from additional sediment from *Challenger* station 24; they are catalogued as BM 1971.242 (not seen).



GRAPH 31



GRAPH 32

The numerous syntype specimens of "*M. tenuicauda*" collected at *Challenger* station 122 do not belong to the revised *Mx. tenuicauda* but belong to to *Macrosarisa bensoni*. Three such slides in the British Museum are catalogued as BMNH 80.38.15 and 1961.12.4.65; another slide is in the Hancock Museum.

Type locality.—*Challenger* station 24, north of St. Thomas Island, 18°38'30"N, 65°05'30"W, depth 390 fathoms (713 m).

Occurrence.—In BMNH 80.38.16, 1 specimen; in BMNH 80.38.16, slide 154, 1 specimen.

Distribution.—Holocene; West Indies to Florida–Hatteras Slope, known dead depth range 664 to 713 m. Cronin (1983) reported that "*Macrocypris* spp." (including this species) together range from 136 to 1029 m on the Florida–Hatteras Slope, being especially common in the oxygen-minimum zone above 750 m.

Dimensions.—Lectotype BMNH 80.38.16, LVL 1.70 mm, LVH 0.60 mm. Paralectotype BMNH 80.38.16, slide 154, LVL 1.39 mm, LVH 0.52 mm. See also Graph 32. According to Cronin (1983), presumed females are proportionally higher than presumed males.

Diagnosis.—Carapace elongate-siliquose in lateral outline, broadly arched dorsally, with greatest height located slightly in front of midlength, with indistinct anterodorsal and posterodorsal angles; anterior margin narrowly rounded; ventral margin nearly straight to slightly concave; posterodorsal margin nearly straight, sloping steeply to acute posterior angle of about 40°; anterior zone of concrescence extremely broad, with several elaborately organized bundles of branching radial pore canals.

Comparisons.—*Mx. tenuicauda* is less extreme in its characters and therefore less distinctive than most other very elongate species of *Macropyxis*. It is proportionally higher, more arched dorsally, and has rather more angulate contours than *Mx. similis*, *Mx. arta*, or *Mx. simulans*. It tapers more regularly than such oblong, sinuous species as *Mx. kornickeri*, *Mx. adrecta*, *Mx. adunca*, and *Mx. audens*.

MACROPYXIS sp. 8

Graph 32; Figures 10.12,13, 11.11,12, 18.11; Plates 59.4, 79.28

Material.—Three specimens in alcohol, including 1 female and 2 empty valves, USNM 240578–240579.

Occurrence.—At AB-7-363D, 1 live plus 2 specimens (1F).

Distribution.—Holocene; southwestern Indian Ocean south of Madagascar, depth 1605 m.

Dimensions.—Adult female 126F, RVL 2.45 mm, RVH 0.93 mm. See also Graph 32.

Comparisons.—*Mx.* sp. 8 has an elongate-subtriangular lateral outline with indistinct dorsal angle located a little ahead of midlength; a nearly straight ventral margin, not upturned posteriorly, a narrowly but evenly rounded anterior margin, a slightly rounded, sharp posterior angle of about 55°; a moderately broad anterior zone of concrescence, very irregular line of concrescence, and irregularly branching radial pore canals. *Mx. simulans* and *Mx. amanda* are similar in size and general proportions but have convex, sinuous ventral margins and more truncate posterior angles. *Mx. kalbi* is much larger but similarly proportioned, with slightly convex, curving, upswung ventral margin. *Mx.* sp. 13, which occurs at a nearby station, is much smaller and more elongate, with a more flared, truncate posterior angle and slightly more sinuous ventral margin. Species of *Macrocypris*, such as *M. proclivis* and

M. sp. 1, have even more angulate, straight-line contours and proportionally greater height, although there are some similarities of shape and radial pore canals.

MACROPYXIS sp. 9

Graphs 32, 42; Plates 16.1, 79.29

Macrocypris minna (Baird, 1850) McKenzie et al., 1979, p. 12.

Material.—One fossil right valve.

Occurrence.—In UB IGBA slide no. 693 of the reference collection of the Institut de Géologie du Bassin d'Aquitaine, University of Bordeaux, labeled "*Macrocypris minna* (Baird 1850), CREO 6502-37, 2100 m, Atlantique, C. O. 693," 1 specimen.

Distribution.—Holocene; Gulf of Gascony.

Dimensions.—UB IGBA slide no. 693, my specimen 2338, RVL 2.32 mm, RVH 0.92 mm. See also Graph 32.

Comparisons.—This specimen of *Mx.* sp. 9 differs from all other Atlantic species in such details of shape as dorsal curvature, ventral sinuosity, posterior angle, and overall size. It is most similar to the *Ingolf* specimens of *Mx. bathyalensis,* from which it differs by larger size, proportionately lower height, more elongate shape, and less steeply sloping posterodorsal margin. It may prove to be a geographic variant of *Mx. bathyalensis,* but this cannot be demonstrated from the evidence available. *Mx. adrecta* is much smaller, proportionally higher, more oblong, and has a more sinuate ventral margin. *Mx. adunca* is smaller, with a much more sinuate ventral margin and a more truncate posterior angle. *Mx. amanda* is much larger, with a more sinuate ventral margin, rather more truncate posterior angle, and much narrower zone of concrescence. *Mx. arta* and *Mx. audens* are smaller with more sinuate ventral margins, more truncate posterior angles, and narrower zones of concrescence.

MACROPYXIS sp. 10

Graph 42; Plates 16.7, 17.1,2,7, 84.9,10

Macrocypris wrightii Jones and Hinde Ducasse, 1977, p. 420.
Macrocyprissa cf. *wrightii* (Jones and Hinde, 1890) McKenzie et al., 1979, p. 12.

Material.—One fossil carapace.

Occurrence.—In UB IGBA slide 296 in the reference collection of the Institut de Geologie du Bassin d'Aquitaine, University of Bordeaux, labeled "*Macrocypris* gr. *wrightii* Jones & Hinde, forage Sanbrigues H.1, 331 m, Miocene, CO 296," 1 specimen.

Distribution.—Miocene; Maremne, Aquitaine Basin, France.

Dimensions.—UB IGBA slide no. 296, my specimen 2337, L 1.37 mm, H 0.52 mm. See also Graph 42.

Comparisons.—This elongate-oblong, streamlined, somewhat featureless specimen of *Mx.* sp. 10 is smaller than most other species of *Macropyxis* and does not closely resemble any other species described here. It is far less attenuated than *Ms. wrightii* and has no dentiform corner.

MACROPYXIS sp. 11

Graph 32; Figures 8.1, 9.1, 19.7, 22.9, 24.14, 30.2, 34.3, 39.2, 46.45, 65.3, 80.9; Plates 16.6, 17.6

Material.—One female in alcohol, USNM 240580.

Occurrence.—At AII-31-159, one live specimen (1F).

Distribution.—Holocene; central Atlantic Ocean off the eastern tip of South America, depth 834–939 m.

Dimensions.—Female specimen 1416F, RVL 2.04 mm, RVH 0.83 mm, LVL 1.96 mm, LVH 0.75 mm. See also Graph 32.

Comparisons.—The sinuate-oblong carapace of *Mx.* sp. 11 with its distinct dorsal and posterodorsal angles, nearly straight ventral margin, sharp and slightly flared posterior angle of about 55°, and elaborately branching radial pore canals resembles *Mx. adunca, Ms. audens, Mx. similis, Mx. bathyalensis,* and *Mx. kornickeri,* but details of shape and curvature prevent ready assignment to any of these closely related species. It is here treated as a separate species until a better understanding of the geographic variability among populations of these Atlantic species is achieved.

MACROPYXIS sp. 12

Graph 32; Figure 11.1; Plate 22.9

Material.—Three empty valves, USNM 240581–240582.

Occurrence.—At UH 4127, two specimens; at UH 4132, one specimen.

Distribution.—Holocene; northwestern Gulf of Mexico, depth 841–1079 m.

Dimensions.—Adult RV specimen 2411, RVL 3.25 mm, RVH 1.31 mm. See also Graph 32.

Comparisons.—This huge carapace of *Mx.* sp. 12, the largest species of the genus, is similar in shape to *Mx. kalbi* but much larger, somewhat more elongate, with indistinct posterodorsal angle and less triangular lateral outline.

MACROPYXIS sp. 13

Graph 32; Figures 6.12, 7.10; Plates 24.8,9, 25.8,9

Material.—Four empty valves, USNM 240583–240586.

Occurrence.—At AB-7-365D, 4 specimens.

Distribution.—Holocene; southern Mozambique Channel near southwestern Madagascar, 475–695 m.

Dimensions.—Specimen 2376, RVL 1.35 mm, RVH 0.47 mm. See also Graph 32.

Comparisons.—The tiny carapace of *Mx.* sp. 13 is very elongate, with a more streamlined, siliquose shape than even *Mx. arta* or *Mx. similis.* The low triangular shape and indistinct radial pore canals would permit assignment to *Macrocypris,* but the smooth outline, obliquely truncate anterior margin, and fairly wide zone of concrescence suggest that it is a *Macropyxis.*

MACROPYXIS sp. 14

Graph 32; Figure 6.3; Plate 24.10

Material.—Three empty valves, USNM 240587 and in the collection of Kerry Swanson.

Occurrence.—At Swanson Tasman Sea P653, 1 specimen; at Swanson Tasman Sea P667, 2 specimens.

Distribution.—Holocene; Tasman Sea west of New Zealand, 1047 m.

Dimensions.—Adult specimen 2424, RVL 1.55 mm, RVH 0.54 mm. See also Graph 32.

Comparisons.—The small, siliquose carapace of *Mx.* sp. 14 with its narrowly rounded, obliquely truncate anterior margin and sharp, slightly truncate posterior angle is not unlike *Mc. arcuata* in the North Atlantic or such Cretaceous species as *Ms. graysonensis,* but it has no dentiform corner and lacks the flattened venter, compressed anterior and posterior margins, and obscurely sinuous contours of those genera. The slightly sinuous ventral margin and sharp posterior angle suggest assignment to *Macropyxis.*

MACROPYXIS sp. 15

Graph 32; Figures 6.5, 7.4; Plates 16.8, 17.8

Material.—Two empty valves, USNM 240588–240589.

Occurrence.—At Swanson Tasman Sea P654, 2 specimens.

Distribution.—Holocene; Tasman Sea west of New Zealand, depth 769 m.

Dimensions.—Specimen 2425, RVL 1.86 mm, RVH 0.78 mm. Specimen 2426, LVL 1.82 mm, LVH 0.69 mm. See also Graph 32.

Comparisons.—This medium-sized, thick-walled, oblong carapace of *Mx.* sp. 15 lacks the sinuous ventral margin of *Mx. amoena* and is not as highly arched dorsally as *Mx. eltaninae.* Although several species of *Macromckenziea* have a similar lateral outline, the broad, irregular anterior and posterior zones of concrescence and branching radial pore canals support classification of this species in *Macropyxis.*

MACROPYXIS sp. 16

Graph 32; Figures 1.5,6, 30.19, 33.3, 36,37.1, 46.12; Plate 79.30

Material.—One female in alcohol, USNM 240590.

Occurrence.—At NZOI B-303, one live specimen (1F).

Distribution.—Holocene; southwestern Pacific Ocean near the New Zealand Plateau, depth 2888 m.

Dimensions.—Female specimen 327F, RVL 3.15 mm, RVH 1.24 mm. See also Graph 32.

Comparisons.—The large, smoothly arched, subtriangular carapace of *Mx.* sp. 16 is not unlike *Macrocypris* in general proportions but has a bluntly truncate posterior angle of about 55°, elevated distinctly above the venter, and a broad zone of concrescence with irregularly branching radial pore canals, which suggest affinity to *Macropyxis.* It is much higher and has a more broadly rounded anterior margin than *Mx. kalbi.* The truncate posterior angle and slightly anterior location of greatest height distinguish it from *Mx.* sp. 21.

MACROPYXIS sp. 17

Graph 32; Figures 10.1, 46.44; Plates 20.1, 80.1

Material.—One dry, fragmentary female, USNM 240591.

Occurrence.—At Albatross 3375, 1 live specimen (1F).

Distribution.—Holocene; eastern Pacific Ocean south of Panama, depth 2197 m.

Dimensions.—Female specimen 1150F, RVL 1.88 mm, RVH 0.76 mm, LVL 1.86 mm, LVH 0.70 mm. See also Graph 32.

Comparisons.—This medium-sized, very thick-walled, elongate-oblong carapace of *Mx.* sp. 17 has an exceptionally broad anterior zone of concrescence with very elaborately branching radial pore canals, a nearly straight ventral margin, and a sharp, slightly flared and truncate posterior angle of about 60°, slightly elevated above the venter. It is proportionally much higher than *Mx. kaesleri* and lacks the sinuate, convex ventral margin of the latter. *Mx.* sp. 11 is a little higher and has a much more angulate shape, including a sinuous, ventrally extended posterior angle. *Mx. adunca* is larger and proportionally higher with a much more sinuous outline. *Mx. bathyalensis* is much larger and proportionally higher, with a more acute posterior angle and more broadly rounded anterior margin. *Mx.* sp. 20 is much larger and proportionally higher but otherwise fairly similar, while *Mx. kornickeri* is larger and has a more angulate outline. *Mx.* sp. 17 is here treated as a separate species until the geographic variability of these and related species is better understood.

MACROPYXIS sp. 18

Graph 32; Figures 10.14, 30.11, 33.6, 41.1, 46.46; Plates 16.5, 80.2

Material.—One female in alcohol, USNM 240592.

Occurrence.—At AII-31-156, one live specimen (1F).

Distribution.—Holocene; equatorial Atlantic Ocean off the eastern tip of South America, depth 3459 m.

Dimensions.—Female specimen 1443F, RVL 2.18 mm, RVH 0.86 mm. See also Graph 32.

Comparisons.—*Mx.* sp. 18 is very similar in size and general shape to *Mx. kornickeri* but has a slightly less angulate dorsal margin, a more acute, upturned posterior angle, and a slightly convex ventral margin. It is more elongate and more acutely terminated than *Mx.* sp. 11, *Mx. adunca, Mx. bathyalensis,* and *Mx. audens* but less so than *Mx. similis* and *Mx. adrecta.* It is here treated as a separate species until the complex geographic variability in shape and size seen in populations of these and related species can be better understood.

MACROPYXIS sp. 20

Graph 32; Figure 10.5; Plate 22.8

Material.—One right valve, USNM 240593.

Occurrence.—At KN-25-306, one specimen.

Distribution.—Holocene; southeastern Atlantic Ocean on the Angola abyssal plain, depth 5550 m.

Dimensions.—Specimen 1784RV, RVL 2.34 mm, RVH 0.94 mm. See also Graph 32.

Comparisons.—*Mx.* sp. 20 is similar in size and general shape to *Mx. bathyalensis* but has less sinuous contours. The shape is also fairly similar to that of of *Mx. adriatica.* The radial pore canals are not visible on this opaque specimen. Because no geographically intermediate populations are known, and the patterns of geographic variability in *Mx. bathyalensis* and closely related species are not well understood, this specimen is treated as a separate species for the time being.

MACROPYXIS sp. 21

Graph 32; Figures 6.19, 7.17, 30.15, 34.14, 41.3, 46.52, 68.15, 80.3; Plates 18.2, 80.3, 111.1

Material.—One female in alcohol, USNM 240594.

Occurrence.—At V-16-15, one live specimen (1F).

Distribution.—Holocene; southwestern Atlantic Ocean between South Georgia and the Falkland Islands, depth 1622 m.

Dimensions.—Female specimen 1962F, RVL 2.55 mm, RVH 1.06 mm, LVL 2.55 mm, LVH 0.97 mm. See also Graph 32.

Comparisons.—*Mx.* sp. 21 is similar in size and shape to *Mx. kalbi* but has a more narrowly rounded anterior margin, a slightly truncate posterior angle, and more central location of greatest height. It is larger and proportionally higher than *Mx.* sp. 8 but similar in its subtriangular shape. The narrowly rounded, slightly truncate, slightly upswung posterior angle supports the assignment to *Macropyxis* rather than *Macrocypris.*

MACROPYXIS sp. 46

Graph 18; Plates 20.9, 21.9

Material.—Two females in alcohol, USNM 240595.

Occurrence.—At V-17-5, 2 live specimens (2F).

Distribution.—Holocene; off the west coast of Chile, depth 3824–3739 m.

Dimensions.—Female 1965F, RVL 1.88 mm, RVH 0.82 mm, LVL 1.84 mm, LVH 0.75 mm.

Comparisons.—*Mx.* sp. 46 is much larger than but very similar in shape to *Mx. amoena,* and the female soft parts are also very similar though inconclusive. Because no males and no geographically or bathymetrically intermediate populations are known, and because including these specimens in *Mx. amoena* would give that species the unlikely depth range of 9 to 3824 m, they are here treated as a separate species.

Genus MACROCYPRIA Sars, 1923

Macrocypria Sars, 1923, p. 60; Sylvester-Bradley, 1961, p. Q207; Triebel, 1960, p. 115; Howe, 1962, p. 139; Morkhoven, 1963, p. 87.

Type species.—*Macrocypris sarsi* Müller, 1912.

Species included.—Listed by original binomen:

Macrocypris sarsi Müller, 1912; Holocene, North Atlantic Ocean.

Macrocypris canariensis Brady, 1880; Holocene, northeastern Atlantic Ocean.

Macrocypria semesa n. sp.; Holocene, southeastern Pacific Ocean.

Geologic range.—So far, known only by living species.

Geographic range.—North Atlantic and southeast Pacific oceans. The known composite live depth range is 36 to 5195 m.

Diagnosis.—Carapace elongate, boat-shaped, very asymmetrical; right valve with dorsal margin broadly arched in lateral view, sloping steeply to acutely pointed or narrowly and obliquely rounded, angulate anterior margin; ventral margin sinuous, convex to nearly straight, upswung in posterior; posteroventral angle acute, prolonged or flared, located well above venter; greatest height and greatest thickness located near midlength; anterior and posterior dentiform corners well developed, conspicuous, asymmetrical; vestibules deep, open; greatly swollen medially in dorsal view, with abruptly compressed, sharply tapering anterior and posterior ends; line of dorsal overlap sinuous, exaggerated; zone of concrescence fairly broad, traversed by numerous, straight radial pore canals; hinge thin but finely crenulate.

Antennule long, slender, with setae of graduated lengths from short to very long; podomeres II and III inflexibly articulated or joined by rigid suture. Antenna very slender, elongate, with fairly short sensory aesthetascs on podomere II; podomere III with at most two vestigial swimming setae; podomere IV with short proximoventral and anterodorsal setae; three thick, clawlike terminal setae of moderate length, all others much reduced. Podomeres I and II of maxillule palp separated by suture (*Ma. semesa*) or fused without suture (*Ma. sarsi*); anterodistal setae of the two podomeres remaining distinct.

Mediodistal seta of female fifth limb much longer than the other two. Dorsodistal seta of sixth limb much reduced. Distal seta of seventh limb very short. Furcae large, asymmetrical, with left ramus much shorter than right but not fused with it; distal seta continuous with proximal rod to make a single, smoothly tapering, terminally pointed, slightly flexible, leverlike appendage; proximal setae exceedingly tiny. Zenker's organ with large spherical anterior bulb; vas deferens coiled into a broad spiral of five to seven loops. Hemipenis oblong with straight dorsal margin, truncate anterior margin, obliquely curved ventral margin; short, thick, curved copulatory tube and short, conical copulatory rod.

Affinities.—Asymmetrical furcae are characteristic but not diagnostic of *Macrocypria,* being well developed in at least three species of *Macroscapha.* Weak asymmetry may be noted in species of other genera as well.

The new genera *Macrocyprissa* and *Macrosarisa* also have a well developed dentiform corner, and other morphological similarities show them to be fairly closely related to *Macrocypria.* They have a symmetrical furca and a bluntly rounded rather than pointed anterior carapace margin.

Kozur (1971, p. 10, translated from German) stated that "The hinge of *Macrocypria* has not yet been described. In the drawing in the Treatise, Part Q, no crenulate hinge-elements are to be seen. If the hinge-elements of *Macrocypria* should be smooth, this genus must be placed in the Subfamily Acratiinae." It can now be stated that the hinge of *Macrocypria* is crenulate and of normal macrocypridid character. However, because the degree of visibility of hinge crenulation in Macrocyprididae depends on the thickness of the hinge, which is a function of the thickness of the shell, it probably ought not to have much taxonomic significance. There is no reason to classify *Macrocypria* separately from other genera of Macrocyprididae.

Remarks.—The wide geographic separation of the three species of *Macrocypria* argues for geological antiquity and the existence of additional, unknown, living and fossil species in this genus.

MACROCYPRIA SARSI (Müller, 1912)

Graph 33; Figures 12.14,15, 13.14,15, 21.25, 23.21, 24.35, 28.40,41, 29.11, 35.20, 44.7, 47.2,3, 50.2, 51.7, 57.9, 58.16, 60.8, 64.25, 68.2, 72.4–6, 76.6, 78.8; Plates 26.2–7, 27.2–6, 68.1–5, 69.2–8, 80.4, 81.23, 84.2, 91.1,2, 105.4,5, 111.12

Bairdia angusta SARS, 1866, p. 22.

Not *Cythere angusta* MÜNSTER, 1830, p. 63, pl. 6, fig. 10.

Not *Cythere (Bairdia) angusta* (Münster) JONES, 1849, p. 26, pl. 6, fig. 18a–f.

Not *Bairdia angusta* (Münster) REUSS, 1854, p. 139.

Macrocypris angusta (Sars) BRADY and NORMAN, 1889, p. 117, 243, pl. 9, fig. 17, 18; SARS, 1891, p. 18; NORMAN, 1891, p. 110; KORNICKER, 1969, table II.

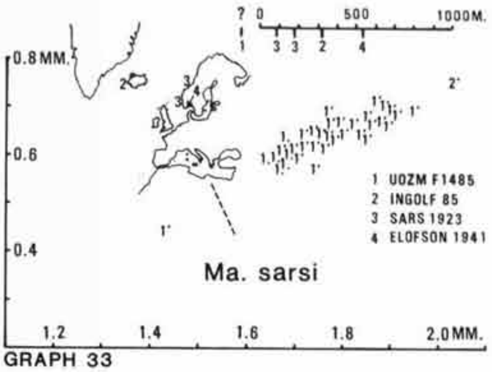
Not *Macrocypris angustata* BRADY, 1887, p. 164, 194 (*nomen nudum,* probably intended to be *Bairdia angustata*); KORNICKER, 1969, table 1.

Macrocypria angusta (Sars) SARS, 1923, p. 61, pl. 28; ELOFSON, 1941, p. 31, map 14; KLIE, 1929, p. 11; MORKHOVEN, 1963, p. 89; NEALE, 1964, p. 264, table 1; MADDOCKS, 1977, p. 154, fig. 1.

Macrocypris sarsi MÜLLER, 1912, p. 123 (replacement name).

Macrocypria sarsi (Müller) SYLVESTER-BRADLEY, 1961, p. Q207, fig. 146-2; MADDOCKS, 1979, fig. 11, 12, 14, 15, pl. 2, fig. 1–4.

Material.—Thirty-eight specimens in alcohol, including 6 males, 31 females, and 1 juvenile.



GRAPH 33

Types.—The G. O. Sars collection in the Zoological Museum of the University of Oslo has the following material for "*Macrocypria angusta* G. O. Sars": F1483 (alcohol, not seen), F1484 (alcohol, described here), F8017 and F8018 (slides, not seen). Dr. Marit Christiansen wrote (March 18, 1980) that "we don't have any material registered on *Bairdia angusta.* Unfortunately, Sars never labeled his original material as type material . . . [and] no locality is given on any of the three samples of *M. angusta,* so I cannot tell you if this is his original material or not." Since Sars did not illustrate the species in 1866, it is unlikely that those syntypes can now be distinguished reliably from the specimens he used for the more complete description and illustration in 1923. Fortunately, the species is so distinctive that no confusion is possible. As no immediate purpose would be served by the designation of a lectotype, and there is some risk of making an erroneous designation, no lectotype has been selected.

Type locality.—Not specified. Sars (1866) reported the species from the coast of Norway, off Christiania and Nidaros.

Occurrence.—In UOZM F1484, 37 live specimens (6M, 30F, 1FJ–1); at Ingolf 85, 1 live specimen (1F).

Distribution.—Holocene; in the high North Atlantic near Iceland and off the coast of Norway and Sweden, reported depth range 36 to 541 m. Elofson (1941, p. 32) described the species as living "on various types of soft bottoms" and as being "stenothermic and stenohaline."

Brady (1887, p. 164) listed "*Macrocypris angustata*" at *Talisman* station 85, but at the end of that paper he suggested that he meant *Bairdia angustata* instead. This mistaken citation was carried over to the appendix of the North Atlantic monograph by Brady and Norman (1889, p. 243), even though earlier in that paper (p. 117) they had stated that "*Macrocypris angusta*" had not been found outside of Norwegian waters. Kornicker (1969) provided corrected station data for *Talisman* station 85, but this is probably not a valid record for the species. Sars (1866, 1891, 1923), Norman (1891), and Elofson (1941) reported this species only from the southern coast of Norway and Sweden. The occurrence at *Ingolf* station 85 extends its known range to southwest of Iceland.

Dimensions.—Male 1998M, L 1.68 mm, H 0.58 mm;

female 2000F L 1.72 mm, H 0.62 mm. See also Graph 33. Females are longer than males but have similar proportions. The *Ingolf* specimen is distinctly larger than the Norwegian population.

Diagnosis.—Carapace elongate, thin-shelled, very asymmetrical, especially at the anterior margins, boat-shaped; dorsal margin of right valve broadly arched in lateral view, sloping steeply anteriorly to pointed, truncate anterior margin, sloping less steeply posteriorly to slightly flared posterior angle; greatest height located slightly anterior to midlength; ventral margin slightly convex to nearly straight, upswung in posterior. Anterior dentiform corner consisting of two broad, triangular, fan-shaped, sensory setae emerging from indented, enlarged radial pore canals; located just above a projecting, toothlike, solid spine, located near venter in right valve, located at one-quarter to one-third of height in left valve; posterior dentiform corner similar but less conspicuous, with narrow, triangular sensory setae and less prominent spine. Vestibules deep, open; zone of concrescence fairly broad, with straight, evenly spaced radial pore canals.

Palp of male fifth limb slender, with narrow hook, longer on left than right side, recurved at 45° on right limb and 49° on left; two slender pegs of equal size on the right limb, of unequal size on the left. Female fifth limb slender, with flexible setae; mediodistal seta much longer than the other two, which are of equal length. Sixth limb small, slender; podomere II has a conspicuous fringe of tiny hairs along the dorsal edge; mediodistal seta very long, dorsodistal and ventrodistal setae very much reduced. Seventh limb with long, conspicuously feathered reflexed seta and very tiny distal setae. Furca large, tapering to fine, curved point, asymmetrical; smaller left side thinner than and only about one-third as long as right side. Hemipenis elongate in lateral view, with obliquely truncate anterior margin, straight dorsal margin, and obliquely upswung ventral margin; two large, triangular, platelike, anterior lamellar projections; copulatory rod short, straight. Zenker's organ with enlarged, spherical anterior bulb, rather short muscularized segment; vas deferens coiled into about 5 broad coils.

Comparisons.—*Ma. sarsi* differs from *Ma. semesa* by its very much smaller size; less elongate shape; slightly flared posterior angle; small, normally constructed male fifth limb with recurved hooks; greater reduction of dorsodistal seta of sixth limb; more reduced, more asymmetrical furca; and by the distinctive hemipenis. It may be distinguished from *Ma. canariensis* by the broader, more truncate anterior margin and the upswung, less attenuate posterior end.

Remarks.—The female specimen (1340F) from *Ingolf* station 85 is a little larger than the Norwegian specimens but very similar in carapace and soft-part characters.

One female specimen (1999F) in the Norwegian population shows reversal of valve overlap and hingement (left over right); but the left side of its furca is reduced, which is the normal condition for this species, and other internal characters are normal.

Nomenclatural remarks.—G. W. Müller (1912) considered *Bairdia angusta* Sars, 1866, to be a junior homonym of "*Bairdia angusta* Reuss, 1854," and proposed the replacement name *Macrocypris sarsi*. In point of fact, the Cretaceous species identified by Reuss as *Bairdia angusta* had been named originally by von Münster (1830) as *Cythere angusta* and later transferred to the subgenus *Bairdia* by Jones (1849) as *Cythere (Bairdia) angusta* (Münster). None of the two or three Cretaceous species that have been identified by these combinations are today classified as *Bairdia* or as Macrocyprididae.

According to Mayr (1969, p. 364), "the 1901 Code [of Zoological Nomenclature] said that a junior homonym was to be rejected. Some zoologists interpreted this to mean only primary junior homonyms, others both primary and secondary junior homonyms." In the 1961 Code (International Commission on Zoological Nomenclature, 1961, p. 57), Article 59 provided that "a species-group name that is a junior primary homonym must be permanently rejected," that "a species-group name that is a junior secondary homonym must be rejected by any zoologist who believes that the two species-group taxa in question are congeneric," and that "a name rejected after 1960 as a secondary homonym is to be restored as the valid name whenever a zoologist believes that the two species-group taxa in question are not congeneric, unless it is invalid for other reasons." The Third Edition of the Code (International Commission on Zoological Nomenclature, 1985, p. 111) unambiguously states that "a junior secondary homonym replaced before 1961 is permanently invalid," and that "if the use of a replacement name for such a junior secondary homonym is a cause of confusion, the case is to be referred to the Commission for a ruling" (Article 59).

Bairdia angusta Sars was a junior secondary homonym at the time of its establishment, although probably no worker ever considered the two species to be congeneric. It corresponds to Type I in table 14 (Types of Homonyms) of Mayr et al. (1953, p. 226), and by the actuality principle (Mayr, 1969) such a historical homonym ought not to have been renamed. However, Müller did rename it, and the rejected name is now permanently invalid. The species is rare, and the redescription by Sars (1923) represents its only subsequent occurrence in the primary taxonomic literature, not counting catalogs, treatises, and ecological surveys. It cannot be argued that continued use of *sarsi* will cause confusion.

MACROCYPRIA CANARIENSIS (Brady, 1880)

Graph 53; Plates 26.13,14, 27.14,15

Macrocypris canariensis Brady, 1880, p. 42, pl. 2, fig. 3a–d; Müller, 1912, p. 122; Puri and Hulings, 1976, p. 260, pl. 1, fig. 15, 16.

Not *Macrocypris canariensis* Brady EGGER, 1902, p. 423, pl. 1, fig. 30–32.

Material.—One empty carapace.

Types.—The single type specimen, designated the lectotype by Puri and Hulings (1976), is BMNH 81.5.6, slide 148 of the G. S. Brady *Challenger* Collection.

Type locality.—Challenger station 8, 28°03'15"N, 17°27'0"W, depth 620 fathoms (1134 m), a dredging off Gomera, the Canary Islands, "on a bottom of sandy mud and shells."

Occurrence.—In BMNH 81.5.6, one specimen.

Distribution.—Holocene; known only from one locality near the Canary Islands, depth 1134 m.

Dimensions.—Lectotype BMNH 81.5.6, RVL 1.99 mm, RVH 0.70 mm, LVL 2.03 mm, LVH 0.61 mm. See also Graph 53.

Diagnosis.—Carapace very elongate, asymmetrical, boat-shaped, with flattened venter and somewhat triangular cross-section; dorsal margin of right valve broadly and evenly arched in lateral outline; anterior margin narrowly and obliquely truncated; ventral margin sinuous, upswung posteriorly to flared, narrowly truncate posterior margin; greatest height and thickness located near midlength. Left valve with more narrowly pointed anterior and especially posterior angles in lateral view, extending in front of right valve anteriorly. Anterior and posterior dentiform corners present. Inner lamella broad, vestibules deep, open; zone of concrescence fairly broad; radial pore canals straight, evenly spaced.

Comparisons.—Ma. canariensis differs from *Ma. sarsi* by the more prolonged, lower anterior region, more angulate dorsal margin, and the more flaring, attenuate posterior angle. *Ma. semesa* is much larger and has a more acutely pointed posterior angle.

Remarks.—In carapace characters this species differs only slightly from *Ma. sarsi*, but until the soft anatomy, sexual dimorphism, geographic range and population variability can be studied, it is best to treat it as a separate species.

Two small elevated rings on the left valve of this specimen may have been caused by a parasite or epibiont.

Egger (1902) incorrectly reported this species at *Gazelle* station 13 near the Cape Verde Islands, depth 63 m; at station 90 near Australia, 18°52'S, 116°13'E, depth 357 m; and at station 66 near Mauritius at depth 411 m. The reported dimensions (L 0.36 mm, H 0.12 mm), the wide geographic range, and the illustrations show plainly that these were nonmacrocypridid specimens.

MACROCYPRIA SEMESA new species

Graph 53; Figures 12.7, 13.7, 28.42,43, 29.10, 35.17, 44.2, 47.1, 50.1, 51.1–3, 56.12, 57.10, 58.19, 60.7, 64.26, 68.1, 72.7, 76.4,5, 78.7; Plates 26.1, 27.1,9, 69.9, 105.6

Derivation of name.—Latin *semesus*, half-eaten, half-consumed; to describe the asymmetrical furca, and also to describe the soft, fragmentary carapaces of most of the available specimens.

Material.—Five specimens in alcohol, including 1 male, 1 female, and 3 juveniles.

Types.—Holotype male 843M USNM 240596, paratypes USNM 240597–240600.

Type locality.—Eltanin cruise 3 station 48, 14°11'–14°08'S, 77°8'–77°9'W, depth 3883–4004 m.

Occurrence.—At E-3-40, 3 live specimens (3J); at E-3-43, 1 live specimen (1F); at E-3-48, 1 live specimen (1M).

Distribution.—Holocene; southeastern Pacific Ocean, known live depth range 3402 to 5195 m.

Dimensions.—Paratype female specimen 857F, L 2.99 mm, H approximately 0.88 mm. Other specimens not measurable. See also Graph 53.

Diagnosis.—Carapace very elongate, thin-shelled; dorsal margin of right valve unevenly arched in lateral view, with greatest height located slightly behind midlength, sloping steeply posteriorly to elevated, very pointed posterior angle, sloping less steeply anteriorly to narrowly truncated anterior margin; ventral margin gently convex; anterior dentiform corner located slightly above venter in right valve, at about midheight on left valve; posterior angle very acute, located at about one-third height, with dentiform corner; vestibules deep and open, zone of concrescence broad, especially ventrally, radial pore canals straight; hinge thin, with finely crenulate elements.

Palps of male fifth limb very asymmetrical; right hook recurved at 73°, with two small pegs and no dorsal seta; left hook much larger, curved at 159°, with two large, unequal pegs and a short dorsal seta. Palp of female fifth limb tapering rapidly to fairly thick, clawlike distal seta. Sixth limb very large and elongate, with dorsodistal seta about one-third as long as the slender mediodistal claw. Seventh limb has conspicuous feathering of two sizes on the reflexed seta; both distal setae are short. Furcae large, asymmetrical, right ramus tapering to bluntly curved point, reduced left ramus just as thick as right proximally but tapering more rapidly, about one-half as long as right side. Hemipenis elongate-oblong in lateral view with straight dorsal margin, perpendicularly truncate anterior margin, and convex, upswung ventral margin; anterior lobe inconspicuous, copulatory rod sigmoid, labyrinthine passages near distal end strongly chitinized. Zenker's organ with large, spherical anterior bulb, muscularized segment of normal length; vas deferens coiled into about seven broad coils.

Comparisons.—Ma. semesa may be distinguished from both *Ma. sarsi* and *Ma. canariensis* by the much greater size and more elongate shape, with more acutely pointed posterior angle. It also differs from *Ma. sarsi* by the very asymmetrical male fifth limb with straight left hook, the less reduced dorsodistal seta of the sixth limb, the less asymmetrical furcae, and the distinctive hemipenis.

Remarks.—Because of the fragmentary and partially decalcified condition of these specimens, the carapace shape, dimensions, and sexual dimorphism cannot be precisely defined.

Genus MACROCYPRISSA Triebel, 1960

Macrocypris (*Macrocyprissa*) TRIEBEL, 1960, p. 116.
Paramacrocypris COLALONGO and PASINI, 1980, p. 106.

Type species.—*Bairdia cylindracea* BORNEMANN, 1855.

Species included.—Listed by original binomen:

Bairdia cylindracea Bornemann, 1855; Oligocene of Germany and Miocene of Sardinia.
Paramacrocypris arcuata Colalongo and Pasini, 1980; Holocene, North Atlantic, and Pleistocene of Italy.
Macrocyprissa vandenboldi n. sp.; Miocene, Jamaica.
Macrocyprissa sp. 22; Eocene, Aquitaine Basin.

Geologic range.—Oligocene to Holocene.

Geographic range.—Europe, North Atlantic, West Indies. The only live record is at a depth of 1491–1500 m.

Diagnosis.—Carapace elongate-oblong to siliquose in lateral outline, tapered, smooth, fairly thick-shelled; dorsal margin of right valve arched to nearly straight in lateral view; ventral margin nearly straight to highly sinuous; posterior margin tapered to truncate, with distinct posteroventral angle. Carapace lozenge-shaped in dorsal view, with subparallel flanks and bluntly rounded or gradually tapering anterior and posterior ends, with conspicuous stragulum and sinuous valve-contact line; inner lamella broad, fused zones especially broad anterodorsally and posterodorsally, narrow anteriorly; anterior radial pore canals short and straight, anterodorsal and posterodorsal radial pore canals few, curving, irregular; anterior vestibule crescent-shaped, dorsally constricted by lobate zone of concrescence; posterior vestibule reduced, triangular, constricted by expanded posterodorsal zone of concrescence; well developed anterior dentiform corner; hinge robust, normal for family; adductor muscle-scar pattern fairly small, elongate, normal for family.

Antennule moderately slender, with short setae; podomeres II and III fused completely, without any trace of a vestigial suture. Antenna of moderate proportions with numerous, long, thick terminal claws; very long sensory aesthetascs on podomere III; two moderately long anterodorsal setae on podomere IV; four short so-called swimming setae of graduated sizes on podomere III. Podomeres I and II of maxillule palp completely fused without suture; the anterodistal seta of podomere I has migrated distally to join the three setae of podomere II.

Palps of male fifth limbs slender, tapering, asymmetrical, with long ventral peg on left limb. Seventh limb with short reflexed seta and short distal setae. Furcae long, slender, tapering, curved, distally pointed. Zenker's organ with very small anterior bulb; vas deferens makes two short, oblong loops.

Affinities.—*Macrocyprissa* does not have close affinities to the genus *Macrocypris* as revised here, and *Macrocyprissa* is here elevated to generic rank.

The well-developed dentiform corner is a mark of affinity with *Macrocypria* and *Macrosarisa*, and this hypothesis is also supported by the structure of the furca and other soft-part characters.

The most characteristic attribute of *Macrocyprissa* is the constricted vestibule with dorsally and ventrally scalloped line of concrescence and lobate zone of concrescence. Around the anterior margin proper, the zone of concrescence is narrow, and the radial pore canals are mostly short and straight. Contrary to the interpretations of some authors, the anterior radial pore canals of *Macrocyprissa* rarely branch.

Most species referred to "*Macrocyprissa*" on the basis of branching radial pore canals, including the Indo-Pacific and Australasian species referred to "*Macrocyprissa*" by McKenzie (1967a, 1974) and McKenzie and Peypouquet (1984), probably belong to the new genus *Macropyxis* or perhaps to *Macromckenziea* (see discussion above). Accompanying ecological generalizations about "*Macrocyprissa*" (for example, by McKenzie and Peypouquet, 1984) apply to *Macromckenziea* or *Macropyxis*, likewise.

Some species of *Macromckenziea* approach *Macrocyprissa* in elongate lateral outline, though they do not show as much ventral sinuosity and never have the restricted vestibules. An even more interesting convergence is seen with some species of *Krithe*, *Argilloecia*, and *Phlyctenophora*, which also have this thick-shelled, oblong shape and constricted vestibules. Species of *Macrocyprissa* may be easily distinguished from these homeomorphs by the right-valve overlap, sinuous dorsal valve contact, macrocypridid hinge, and distinctive muscle-scar pattern that characterize all Macrocyprididae.

Colalongo and Pasini (1980) proposed the genus *Paramacrocypris* for one Pleistocene species, *P. arcuata*, diagnosing the genus as follows (p. 106, translated from Italian): ". . . carapace elongated, of large dimensions and with maximum height about at mid-length. *Paramacrocypris* is distinguished from *Macrocyprissa* by having a more elongate, narrower carapace, pointed posteriorly; different form of vestibule; different grouping of marginal pore canals." Obviously here, as has so often been the case, "*Macrocyprissa*" refers to the large, inflated, sinuously curved, deep-sea forms with branching radial pore canals, which comprise the new genus *Macropyxis*, rather than to the concept typified by *Mc. cylindracea*. Only with this interpretation can meaning be found in this vague diagnosis. With this substitution, the characters illustrated for *Paramacrocypris arcuata* Colalongo and Pasini agree exactly with those that Triebel (1960) gave for *Macrocyprissa cylindracea* and that he considered to be diagnostic of the genus *Macrocyprissa*. To confirm this identity, the excellent illustrations of Colalongo and Pasini show conspicuous anterior and posterior dentiform corners, not mentioned in their description.

Mc. arcuata is redescribed below on the basis of a living North Atlantic population. It certainly should be classified in the genus *Macrocyprissa*.

Remarks.—Because three of the four known species are fossils, the soft parts are known only for *Mc. arcuata*.

MACROCYPRISSA CYLINDRACEA
(Bornemann, 1855)

Graph 42; Plates 30.11,12, 31.12,13, 63.11,14, 72.5,12, 80.5,6

Bairdia cylindracea Bornemann, 1855, p. 359, pl. 20, fig. 5.

Argilloecia cylindracea (Bornemann) Lienenklaus, 1900, p. 507; Sohn, 1970, p. 49.

Macrocypris (Macrocyprissa) cylindracea (Bornemann) Triebel, 1960, p. 116, pl. 13, fig. 1–3, pl. 14, fig. 4–6; Sohn, 1970, p. 49; ?Bonaduce and Russo, 1984, p. 424, 425; ?Monostori, 1985, p. 215.

?*Macrocypris cylindracea* (Bornemann) Ciampo, 1980, p. 7; Ciampo, 1981, p. 55.

Not *Macrocypris cylindracea* (Bornemann) van den Bold, 1946, p. 65, pl. 4, fig. 2; Ruggieri, 1960, p. 124, pl. 1, fig. 1, pl. 2, fig. 11, 12; Russo, 1964, p. 239, pl. 43, fig. 5a,b; Dieci and Russo, 1964, p. 57, pl. 14, fig. 8a,b.

Not *Nesidea cylindracea* (Bornemann) Kuiper, 1918, p. 16, pl. 1, fig. 3 (*fide* Triebel, 1960).

Not *Bairdia cylindracea* (Bornemann) Staesche and Hiltermann, 1940, pl. 24, fig. 11 (*fide* Triebel, 1960).

Material.—In the Natur-Museum und Forschungs-Institut Senckenberg, slide Xe 3359, four fossil valves. This slide, labeled "*Macrocypris cylindracea* (Bornemann), Trb. 1960, Xe 3359, Septarienton b. Berlin," contains the topotype specimens described and illustrated by Triebel (1960). The additional specimens (Xe 3354–3360) reported by Triebel from the Septarienton of the Walsrode well, Lower Saxony, were not studied.

Types.—The location of Bornemann's types is unknown. The following description is based on material studied by Triebel (1960).

Type locality.—Oligocene, Septarian Clay, Hermsdorf, near Berlin.

Occurrence.—In NMFIS Xe 3359, 4 specimens.

Distribution.—Reported from the Oligocene of Germany, Eocene to Oligocene of Hungary, and Miocene of Sardinia.

Dimensions.—Specimen 2305, LVL 1.05 mm, LVH 0.37 mm. Specimen 2306, LVL 1.03 mm, LVH 0.35 mm. Specimen 2307, RVL 1.00 mm, RVH 0.41 mm. Specimen 2308, RVL 1.07 mm, RVH 0.40 mm. See also Graph 42.

Diagnosis.—Carapace elongate-oblong, thick-shelled, very asymmetrical, flattened ventrally and compressed laterally in the posterior region; dorsal margin of right valve gently convex to nearly straight in dorsal view; anterior margin broadly and obliquely rounded; ventral margin sinuous, upswung anteriorly, convex anteromedially, straight to slightly concave medially, slightly convex posteromedially, and strongly concave to stepped posteriorly; posterior margin truncate, straight, steeply sloping from rounded posterodorsal region, meeting ventral margin at acute angle, which is located distinctly above venter; anterior and posterior dentiform corners present but not conspicuous.

Comparisons.—*Mc. cylindracea* differs from *Mc. vandenboldi* by being less elongate, less sinuous, with a more truncate posterior, and with posteroventral angle distinctly elevated above venter. It is easily distinguished from *Mc. arcuata* and *Mc.* sp. 22 by its less elongate, oblong, sinuous shape.

Remarks.—This species was well illustrated by Triebel (1960). However, the fourth, anterior scar of the upper muscle-scar group in his pl. 13, fig. 3b, which has been retouched, does not exist.

The illustrations given by Ruggieri (1960), Russo (1964), and Dieci and Russo (1964) belong to species of *Macromckenziea* and *Macropyxis*. The specimen illustrated by van den Bold (1946) could be a species of *Macropyxis, Macroscapha*, or *Macrocyprina*.

MACROCYPRISSA ARCUATA
(Colalongo and Pasini, 1980)

Graph 34; Figures 12.17,18, 13.17,18, 21.24, 23.24, 24.34, 28.29,30, 29.9, 35.19, 44.5, 47.6,7, 50.15–19, 51.9–13, 56.10,24,27, 57.11,32, 58.18, 59.26,33, 60.4, 63.3,17, 64.23,40,51, 68.5, 72.1–3, 76.3, 78.9,10; Plates 30.7–10, 31.7–11, 67.8,9, 68.6–14, 69.1, 70.1–4, 80.7, 91.10–14, 104.1–5, 111.6

Paramacrocypris arcuata Colalongo and Pasini, 1980, p. 106, pl. 25, fig. 1–8; ?Bonaduce and Sprovieri, 1985, p. 134.

Macrocypris sp. Colalongo, 1965, p. 89, pl. 1, fig. 7.

Macrocypria (?) n. sp. 2 Maddocks, 1979, pl. 1, fig. 6–10.

Material.—Approximately 900 specimens in alcohol, including males, females, and juveniles belonging to three instars.

Types.—Holotype I.O.179/a, paratypes I.O.179/b, in the Instituto di Geologia e Paleontologia dell' Universitá di Bologna (not seen).

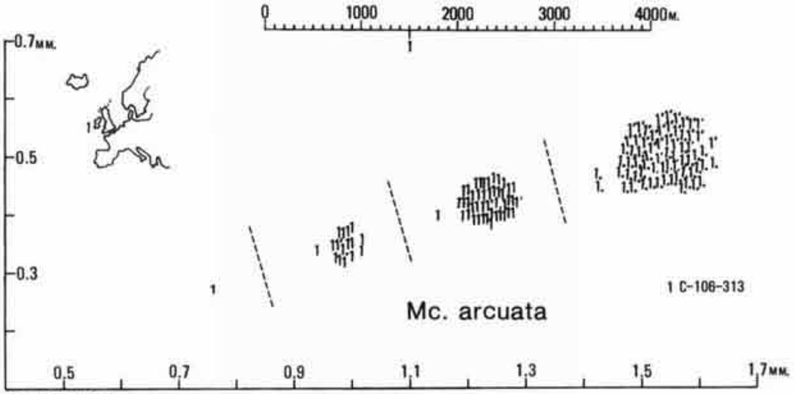
The new material for this species is USNM 240601–240613.

Type locality.—Plio-Pleistocene, the Vrica Section at Crotone, Calabria, Italy.

Occurrence.—At C-106-313, approximately 900 live specimens (59M, 44F, 2FJ–1, 2MJ–1, 42J–1, 1MJ–2, 1FJ–2, 16J–2, 2J–3, and at least 730 additional adults whose sex was not determined).

Distribution.—Live at a depth of 1500–1491 m in the northeastern Atlantic Ocean, and Plio-Pleistocene of Italy.

Dimensions.—Male 1533M, RVL 1.52 mm, RVH 0.47

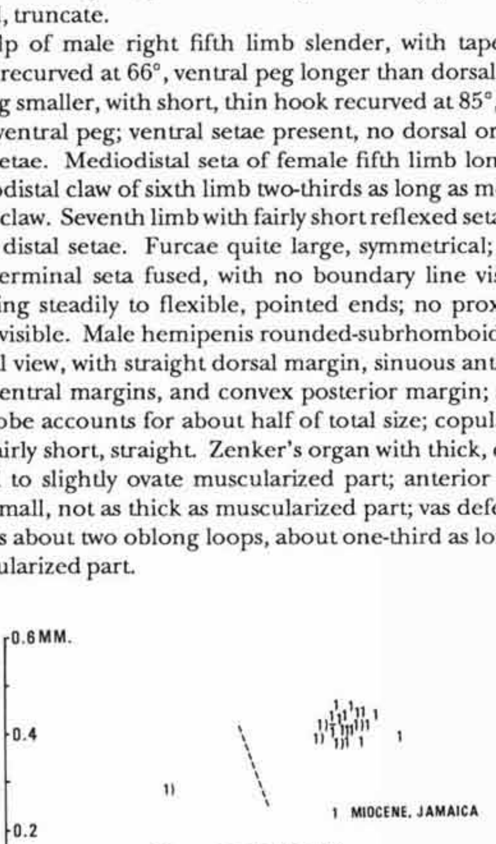


GRAPH 34

mm, LVL 1.48 mm, LVH 0.46 mm. See also Graph 34. Females are the same length as males but distinctly higher.

Diagnosis.—Carapace very elongate, siliquose; dorsal margin of right valve broadly and smoothly arched, greatest height located medially; anterior margin narrowly and evenly rounded, with distinct anteroventral dentiform corner; ventral margin straight overall, gently sinuous in posteromedial region; posterior margin narrowly produced, flared, truncate.

Palp of male right fifth limb slender, with tapering hook recurved at 66°, ventral peg longer than dorsal peg; left leg smaller, with short, thin hook recurved at 85°, very long ventral peg; ventral setae present, no dorsal or sensory setae. Mediodistal seta of female fifth limb longest. Dorsodistal claw of sixth limb two-thirds as long as mediodistal claw. Seventh limb with fairly short reflexed seta and short distal setae. Furcae quite large, symmetrical; base and terminal seta fused, with no boundary line visible; tapering steadily to flexible, pointed ends; no proximal setae visible. Male hemipenis rounded-subrhomboidal in lateral view, with straight dorsal margin, sinuous anterior and ventral margins, and convex posterior margin; anterior lobe accounts for about half of total size; copulatory rod fairly short, straight. Zenker's organ with thick, cylindrical to slightly ovate muscularized part; anterior bulb very small, not as thick as muscularized part; vas deferens makes about two oblong loops, about one-third as long as muscularized part.



GRAPH 35

Comparisons.—*Mc. arcuata* differs from *Mc. cylindracea* and *Mc. vandenboldi* by the concave to nearly straight venter and tapering posterior. It is similar in shape to *Mc.* sp. 22 but much larger and more elongate.

Remarks.—The specimens of the Atlantic population described here are a little smaller than the dimensions given for the Italian Pleistocene population (L 1.93 mm, H 0.58 mm) and have a slightly less concave, less sinuous ventral margin, but all other characters agree.

MACROCYPRISSA VANDENBOLDI new species

Graph 35; Plates 30.1–5, 31.1–6, 80.8

Macrocypris sp. VAN DEN BOLD, 1971, p. 339, pl. 1, fig. 7a,b.
Macrocypris sp. 2 STEINECK, 1981, p. 348, 349, 351, fig. 8.

Derivation of name.—For W. A. van den Bold, who first described the species.

Material.—Twenty-seven fossil specimens.

Types.—Holotype 2118RV USNM 438258, paratypes USNM 438259–438281.

Type locality.—Lower Miocene; Montpelier Group, Spring Garden Formation, Steineck sample M27A, exposed in road cuts along the Montego Bay-Adelphi road in northwestern Jamaica.

Occurrence.—At Steineck M15, 5 specimens; at Steineck M25, 2 specimens; at Steineck M27, 1 specimen; at Steineck M27A, 5 specimens; at Steineck M28, 3 specimens; at Steineck M29, 5 specimens; at Steineck M32, 6 specimens.

Distribution.—Miocene of Jamaica. The ages of these samples range from zones N4 to N9, lower Miocene to lower middle Miocene (Steineck, 1981, and personal communication).

Dimensions.—Holotype 2118, RVL 1.18 mm, RVH 0.43 mm. See also Graph 35. These specimens show much variability in length-height proportions. It is likely that the more elongate, more sinuous ones are males.

Diagnosis.—Carapace very elongate, siliquose; dorsal margin of right valve gently arched to sloping, greatest height located anterior to midlength; anterior margin broadly and evenly rounded; ventral margin very sinuous, with broad, deep ventral indentation in mouth region and upswung, concave to nearly straight posterior segment; posterior margin short, truncate, steeply sloping down to rounded, acute posterior angle.

Comparisons.—*Mc. vandenboldi* differs from *Mc. cylindracea* by being more elongate and more sinuous in shape, with a more tapered posterior. The oblong, sinuous outline distinguishes it from *Mc. arcuata* and *Mc.* sp. 22.

Remarks.—Because no dentiform corner is visible on these specimens, the generic assignment is tentative.

MACROCYPRISSA sp. 22

Graph 42; Plates 30.6, 80.9

Macrocypris wrightii Jones and Hinde Ducasse, 1973, unnumbered table; Ducasse, 1974, p. 130; Ducasse, 1975, fig. 1.

Macrocyprissa wrightii (Jones and Hinde) McKenzie et al., 1979, p. 12.

Material.—One fossil valve, in the reference collections of the Institut de Géologie du Bassin d'Aquitaine, University of Bordeaux, Slide BD.1086, labeled "*Macrocypris wrightii* Jones et Hinde 1890, X868, BD. 1086."

Occurrence.—In UB IGBA slide 1086, 1 specimen.

Distribution.—Eocene, Aquitaine Basin and Gulf of Gascony.

Dimensions.—Specimen UB IGBA slide 1086, my specimen no. 2336, RVL 1.11 mm, RVH 0.40 mm. See also Graph 42.

Comparisons.—The elongate-siliquose carapace of *Mc.* sp. 22 with constricted vestibules is very similar to *Mc. arcuata* but less elongate and much smaller. The straight ventral margin and tapered posterior distinguish it from *Mc. cylindracea* and *Mc. vandenboldi.*

Genus MACROSARISA new genus

Derivation of name.—From Greek *macro,* large, and Latin *sarisa* (feminine), a long Macedonian lance; for the elongate proportions and lanceolate shape of many of these species.

Type species.—*Macrosarisa bensoni* new species.

Species included.—Listed by original binomen:

Macrosarisa bensoni n. sp.; Holocene, Atlantic Ocean; Miocene?–Pleistocene?, Sicily and Greece?.

Macrosarisa capacis n. sp.; Holocene, Mozambique Channel.

Macrocypria elegantula Whatley and Downing, 1983; Miocene, Australia.

Macrocypris exquisita Kaye, 1964; Lower Cretaceous, England.

Macrocypris graysonensis Alexander, 1929; Lower Cretaceous, Texas.

Macrosarisa hiulca n. sp.; Holocene, south of Madagascar.

Macrocypris muensteriana Jones and Hinde, 1890; Cretaceous, England.

Cythere (Bairdia) siliqua Jones, 1849; Upper Cretaceous, Europe.

Macrocypris simplex Chapman, 1898; Upper Cretaceous, England.

Macrosarisa texana n. sp.; Holocene, Gulf of Mexico.

Macrocypris wrightii Jones and Hinde, 1890; Upper Cretaceous, England.

Macrosarisa sp. 23; Holocene, mid-equatorial Atlantic Ocean.

Macrosarisa sp. 24; Holocene, coast of Norway.

Macrosarisa sp. 47; Holocene, Mozambique Channel.

Geologic range.—Lower Cretaceous (Albian) to Holocene.

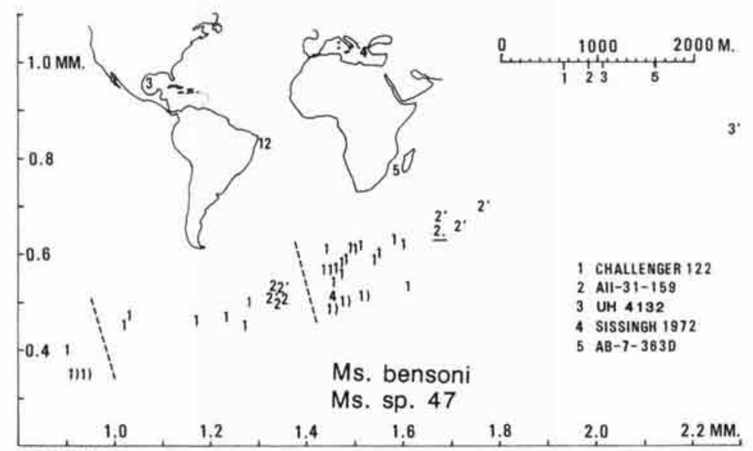
Geographic range.—Atlantic Ocean and southwestern Indian Ocean, known composite live depth range 40 to 3783 m, dead specimens 38 to 1079 m in the material studied.

Diagnosis.—Carapace elongate, with gently arched to angulate dorsal margin; ventral margin concave, straight, or sinuate; anterior margin unevenly rounded to broadly truncate; posterior end acutely tapered to narrowly truncate, often with a slight posterodorsal concavity and a flared, flange-like posterior margin; distinct anteroventral dentiform corner on both valves; medially swollen in dorsal view, with abruptly compressed, flattened or tapering anterior and posterior ends; conspicuous stragulum and very sinuous dorsal line of valve contact; vestibules deep and open; zone of concrescence may be narrow, with short, straight radial pore canals, to fairly broad, with numerous, fairly straight, nearly parallel radial pore canals and occasional false radial pore canals.

Antennule elongate, very slender, with setae of graduated lengths from short to very long; podomeres II and III inflexibly articulated or fused, with complete or partial, vestigial suture between them. Antenna elongate; podomere II with fairly long or variable sensory aesthetascs; podomere III with two or three small, variable swimming setae; podomere IV with short or fairly long proximoventral setae and short anterodorsal setae; with three thick terminal claws; other terminal setae greatly reduced. Podomeres I and II of maxillule palp separated by distinct, inflexible suture, which may be partially obsolete; the anterodistal setae of the two podomeres remain distinctly separated.

Mediodistal seta of female fifth limb longer than the other two, which may be very tiny. Furca large, symmetrical; terminal seta enlarged and fused to proximal rod. Zenker's organ with large, ovate anterior bulb; muscularized segment short; vas deferens variable.

Affinities.—Species of this genus differ from those of *Macrocypria* by the broadly rounded, truncate anterior margin and the symmetrical furca, as well as the laterally compressed anterior and posterior regions. From *Macrocyprissa* they differ chiefly in the open nature of the vestibule and the straight, nearly parallel radial pore canals, as well as in the laterally compressed and tapering anterior



GRAPH 36

and posterior regions. The three genera are probably closely related.

Remarks.—The available specimens for *Ms. muensteriana*, *Ms. wrightii*, and *Ms. simplex* do not show a dentiform corner. Because this feature may be damaged in poorly preserved fossils, those species are tentatively assigned here on the basis of overall shape.

MACROSARISA BENSONI new species

Graph 36; Figures 12.8,9, 13.8,9, 21.20, 23.23, 24.31, 28.31,32, 29.7, 35.23, 44.4, 47.4,5, 50.3, 51.8, 57.12, 58.17, 62.4, 64.24, 68.4, 73.6,7,9, 76.1,2, 79.8; Plates 28.9–14, 29.9–14, 60.8, 61.8, 68.15,16, 69.10, 70.5, 71.1,2,4, 72.1,2, 73.1–3,16, 74.1, 84.3, 91.3,4, 104.6,7, 111.5

Macrocypris tenuicauda BRADY, 1880, p. 41, pl. 2, fig. 1a–f, pl. 3, fig. 2a,b [*part.*]; MÜLLER, 1912, p. 122 [*part.*]; ?RUGGIERI, 1960, p. 124 [*part.*]; MADDOCKS, 1977, fig. 11 [*part.*].

Not *Macrocypris tenuicauda* Brady EGGER, 1902, p. 424, pl. 1, fig. 23, 24; PURI and HULINGS, 1976, p. 261, pl. 1, fig. 11, 12.

Probably not *Macrocypris tenuicauda* Brady CRESPIN, 1943, p. 101.

?*Macrocypris* sp. 1 SISSINGH, 1972, p. 79, pl. 3, fig. 14.

Macrocypria (?) n. sp. 1 MADDOCKS, 1979, pl. 1, fig. 1–5.

?*Macrocypris* sp. COLALONGO and PASINI, 1980, p. 62.

?*Macrocypris* sp. 3 CIAMPO, 1981, p. 55.

Derivation of name.—For Richard H. Benson, who loaned numerous samples for this study, and whose photographs of the *Challenger* lectotypes were published by Puri and Hulings (1976).

Material.—Ninety-one specimens in alcohol, including 1 male, 3 females, 5 juveniles, 2 carapaces and valves, and 80 undetermined; plus 81 subfossil specimens; for a total of 172 specimens.

Types.—Holotype male 1869M USNM 240614, paratypes 240615–240622.

Type locality.—*Atlantis II* cruise 31 station 159, 7°58.0'S, 34°22.0'W, depth 834–939 m.

Occurrence.—At AII-31-159, 9 live specimens (1M, 3F, 2FJ–1, 3J–1); at AII-31-167, 15 live specimens (undetermined); at AII-31-169A, 65 live plus 2 specimens (undetermined); at UH 4132, 2 specimens; in BMNH 80.38.15, 5 specimens; in BMNH 80.38.15 slide 157, 4 specimens; in BMNH 1961.12.4.65, 7 specimens; in HM *Challenger* st. 122, 29 specimens.

Also, at *Challenger* station 122, off north Brazil, 9°5'S, 34°49'W, depth 350 fathoms (640 m), 15 syntype specimens of *Macrocypris tenuicauda* Brady that belong now to *Ms. bensoni*. These specimens are in the G. S. Brady *Challenger* collection of the British Museum (Natural History), as slides BMNH 80.38.15 (two slides) and 1961.12.4.1965.

Also, from the same *Challenger* station, 19 specimens of *Macrocypris tenuicauda* Brady that do not belong to that species as revised. This slide, in the G. S. Brady cabinet at the Hancock Museum, Newcastle-upon-Tyne, is labeled "*Macrocypris tenuicauda* Brady, Challenger no. 122, depth 350 fath., washings of dredge, G. S. Brady, 10/9/73."

Distribution.—Holocene; tropical eastern Atlantic Ocean and Gulf of Mexico, known live depth range 834 to 939 m, dead from 640 to 1079 m. Ruggieri (1960) reported this species from the Miocene of Sicily. Sissingh (1972) and Colalongo and Pasini (1980) reported and illustrated it from the Lower Pleistocene of Greece and Italy.

The report from the Arabian Sea by Müller (1912) has not been confirmed. Egger (1902) reported this species from *Gazelle* station 90 near Australia (18°52'S, 116°13'E, depth 357 m) and from station 18 off the coast of Monrovia (Liberia, 6°27.8'N, 11°02.0'W, depth 68 m). The dimensions (L 0.33 mm, H 0.12 mm), the illustrations, and the shallow depths, however, indicate that the species was misidentified.

Nomenclatural remarks.—This is the species Brady (1880) originally described under the name *Macrocypris tenuicauda*. Puri and Hulings (1976) selected as lectotype for *Mx. tenuicauda* a specimen from *Challenger* station 24. That lectotype specimen is a juvenile of a species of *Macropyxis* (described above) and is not conspecific with the species illustrated by Brady or with the population at *Challenger* station 122. Thus, Puri and Hulings transferred the name *tenuicauda* to an entirely different, though luckily unnamed, species, leaving Brady's species with no name. I take pleasure in naming it now for Richard H. Benson in recognition of the excellent photomicrographs he prepared to illustrate the *Challenger* lectotypes (in Puri and Hulings, 1976) and in appreciation of the voluminous collections he loaned for this study.

Dimensions.—Holotype male 1869M, L 1.67 mm, H 0.65 mm; see also Graph 36. The male is shorter than most females and not as high in proportion to length. Size appears to increase with depth.

Diagnosis.—Carapace large, thick-shelled, asymmetrical, ventrally flattened, posteriorly caudate, compressed anteriorly and posteriorly; right valve lozenge-shaped to trapezoidal in lateral view, with broadly arched dorsal margin, sloping steeply to narrowly and obliquely rounded, truncate anterior margin; anteroventral dentiform corner distinct; ventral margin gently convex, nearly straight anteriorly, stepped or upswung posteriorly, rising steeply to prominent posteroventral dentiform corner; posterodorsal margin distinctly concave, sloping from indistinct, rounded posterodorsal corner to flared, elongated, caudate, truncate posterior angle; greatest height located at midlength; fused zone very broad, vestibules small, triangular; radial pore canals numerous, long, straight.

Palp of right male fifth limb with slender, sinuate hook recurved at 66°, two pegs of unequal size, and sensory seta; left palp with shorter hook recurved at 68°, longer ventral peg, and no sensory seta; ventral seta present but no dorsal seta. Palp of female fifth limb with mediodistal seta much longer than the other two, conspicuously feathered. Sixth limb slender with long mediodistal claw, dorsodistal and ventrodistal setae both very tiny. Seventh limb with long reflexed seta, short distal setae; dorsal edge of terminal podomere with numerous short hairs. Furca slender, tapering, with three short proximal setae; line of demarcation between proximal rod and terminal seta fairly distinct. Hemipenis approximately hemicircular, with bilobate anterior projections; copulatory tube short, curved. Zenker's organ with extremely short muscularized portion, greatly enlarged ovate anterior bulb; vas deferens arranged in an irregular double loop; sperm very thick, coarsely spiral.

Comparisons.—*Ms. bensoni* is much larger than *Ms. texana*, with more angulate dorsal margin, more convex ventral margin, and broader, more upturned caudal process. The large size, convex ventral outline, and absence of patch pattern distinguish it from *Ms. texana*. *Ms.* sp. 24 is smaller, less elongate, and less sinuate. The single specimen of *Ms.* sp. 47 from the Mozambique Channel is much larger, with a more domed dorsum and more pointed posterior angle. *Ms. elegantula* is distinctly smaller, with nearly straight ventral margins, but otherwise quite similar.

Remarks.—*Ms. bensoni* shows some variability of size and shape, especially in length of caudate posterior, within and between geographic populations. The size appears to increase with depth. Some *Challenger* specimens have a more bluntly truncated posterior angle, as do those illustrated by Sissingh (1972) from the Pleistocene of Greece, rather like *Ms.* sp. 24. The fossil identifications should be reconfirmed after the geographic variability of the living populations has been delimited.

Specimen 2023 is very fragile, with a narrow zone of concrescence, incompletely calcified, and probably had molted recently. The populations at AII-31-167 and AII-31-169A were received too late to be studied fully and are not included in Graph 36.

MACROSARISA CAPACIS new species

Graph 37; Figures 12.19,20, 13.19,20, 20.8, 23.25, 24.28, 31.1, 34.1, 42.4, 47.13, 68.9, 73.4,5, 80.22; Plates 34.1–6, 35.1–6, 72.6,7,16,17, 73.6–9,17–19, 80.10–12, 93.5,6, 106.12–15

Derivation of name.—From Latin *capax*, *capacis*, containing much, spacious, capacious; for the posteroventral, lateral swelling of the valves, and for the inflated vas deferens.

Material.—Nine carapaces containing dry soft parts, including 1 male and 8 females.

Types.—Holotype male specimen 2360M USNM 240623, paratypes USNM 240624–240628.

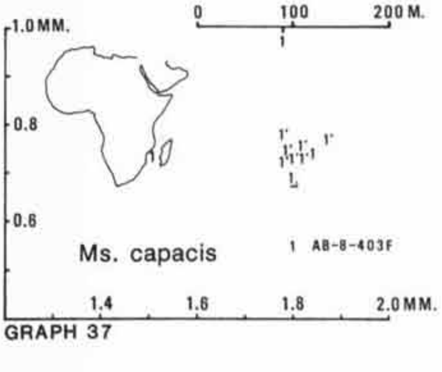
Type locality.—AB-8-403F, 19°09'S, 36°55'E, depth 88 m, near Beira, Mozambique.

Occurrence.—At AB-8-403F, 9 live specimens (1M, 8F).

Distribution.—Holocene; southeastern African continental shelf off Mozambique, depth 88 m.

Dimensions.—Holotype male 2360M RVL 1.80 mm, RVH 0.69 mm, LVL 1.80 mm, LVH 0.68 mm. See also Graph 37.

Diagnosis.—Carapace sinuously elongate-subtriangular in outline; anterodorsal and posterodorsal margins of right valve straight or gently curved, sloping steeply from distinct dorsal angle located at midlength; anterior margin bluntly truncate, angular, nearly square, with very tiny dentiform corner consisting only of two enlarged radial pore canals; broad anteroventral indentation in mouth region; middle sector of ventral margin nearly straight, meeting upswung, straight posteroventral sector at distinct obtuse angle of 165° to 170°; lateral flanks of carapace



GRAPH 37

swollen, obscurely bulging, with a swelling located just above this obtuse angle and extending dorsally to just below midheight; posterior angle located above venter, narrowly and obliquely truncate, slightly flared, about 52°; zone of concrescence broad, line of concrescence rather irregular; numerous straight and slightly curved radial pore canals, numerous false radial pore canals located in anteroventral and posteroventral regions.

Female fifth limb large, elongate, with only one, thick, short, straight mediodistal claw; other claws represented only by short, vestigial setae. Sixth limb slender with very long terminal claw; anterodistal and posterodistal setae very tiny, vestigial. Seventh limb large, with long reflexed seta, lined with fine hairs and ending in a slightly flared, bladelike tip; distal setae short, equal in length. Furcae large, thick, nearly straight, symmetrical; terminal setae not clearly demarcated from rami; proximal setae not visible. Hemipenis rounded-subtriangular with concave dorsal margin, convex ventral margin, and acute anterodorsal angle; copulatory tube short, straight. Zenker's organ rather short; terminal bulb ovoid-elongate, only slightly thicker than muscularized portion; vas deferens extremely thick, even wider than Zenker's organ, arranged in just one S-shaped loop.

Comparisons.—*Ms. capacis* is larger than most other species of this genus, and the bulging, angular posteroventral swelling is distinctive. The pointed posterior angle, tiny dentiform corners, tiny setae of the sixth and female fifth limbs, angulate hemipenis, and enlarged vas deferens show its relationship to *Macrosarisa*. It is most similar in carapace and soft-part characters to *Ms. hiulca*, which is smaller, more subtriangular in outline, and has sharply developed anterior and posterior dentiform corners.

Remarks.—The distinctively bulging posterolateral flanks of the carapace are more conspicuous in a tilted dorsal view (Plate 34.5) than in the true dorsal and lateral views. The anterior and posterior dentiform corners are minute and easily overlooked, consisting of hardly more than slightly enlarged radial pore canals, which do not interrupt the curving ventrolateral outline.

MACROSARISA ELEGANTULA
(Whatley and Downing, 1983)

Graph 42

Macrocypria elegantula Whatley and Downing, 1983, p. 353, pl. 1, fig. 14–16.
?*Macrocypris tenuicauda* Brady Crespin, 1943, p. 101.

Material.—Not seen. This evaluation is based on the illustrations of Whatley and Downing (1983).

Remarks.—Whatley and Downing (1983) recognized the general affinities of this species and mentioned the existence of similar undescribed species in their southwestern Pacific collections: "The present species appears to be intermediate between the genera *Macrocypris* and *Macrocypria* in having a very acuminate posterior margin and an elongate, narrow subrounded anterior margin. Due to its general similarity to other *Macrocypria* species from the southwest Pacific, however, it is included in that genus." They apparently did not notice the well-developed dentiform corner. They described this species from the Middle Miocene of Victoria, southeast Australia, and provided good SEM pictures. The nearly straight ventral margin distinguishes it from *Ms. bensoni*. The very elongate posterior angle is quite similar to that of *Ms.* sp. 24. It is likely that the reports by Crespin (1943) from the Oligocene and Miocene of Victoria apply to *Ms. elegantula* or a closely related form.

MACROSARISA EXQUISITA Kaye, 1964

Graph 38; Plates 32.9–13, 33.9–14, 72.10,18, 73.13,14, 81.24

Macrocypris exquisita Kaye, 1964, p. 42, pl. 4, fig. 12, 16.

Material.—Five fossil specimens.

Types.—Holotype BMNH Io.1270 and paratypes BMNH Io.1271–1274, in the collections of the Department of Palaeontology, British Museum (Natural History), labeled "*Macrocypris exquisita* Kaye, U. Gault, Burwell, Cambs."

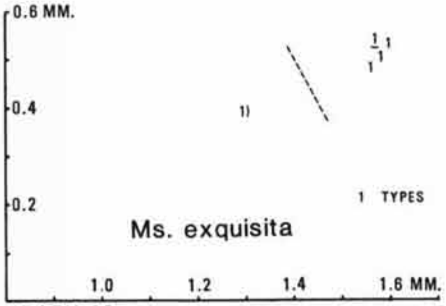
Type locality.—Lower Cretaceous (Albian), Upper Gault, Fisions brick pit, Burwell, Cambridgeshire, England.

Occurrence.—In BMNH Io.1270, 1 specimen; in BMNH Io.1271, 1 specimen; in BMNH Io.1272, 1 specimen; in BMNH Io.1273, 1 specimen; in BMNH Io.1274, 1 specimen.

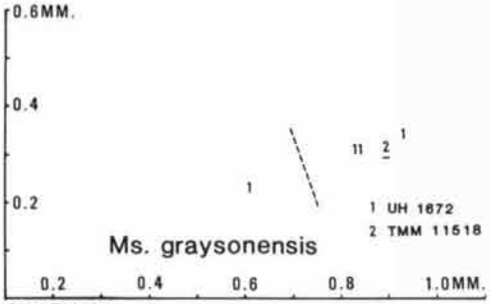
Distribution.—Cretaceous, England.

Dimensions.—Holotype Io.1270, RVL 1.57 mm, RVH 0.54 mm. See also Graph 38.

Diagnosis.—Carapace small, very elongate, asymmetrical; right valve with broadly arched dorsal margin, greatest height located anterior to midlength at rounded dorsal angle; anterior margin narrowly rounded to truncate, with inconspicuous but definite anteroventral dentiform corner; ventral margin sinuate, medially convex, with concave anteromedial and posteromedial segments; posterior end prolonged, tapering evenly to a very acute posterior angle;



GRAPH 38



GRAPH 39

fused zone fairly broad, vestibules deep and rounded, anterior radial pore canals straight.

Comparisons.—The sharply pointed posterior distinguishes *Ms. exquisita* from other Cretaceous and living species of the genus.

Remarks.—The dorsal and posterior regions are broken on some of the illustrated specimens (Io.1273, Io.1271). This species has very distinct anteroventral and posteroventral dentiform corners.

MACROSARISA GRAYSONENSIS (Alexander, 1929)

Graph 39; Plates 32.1–4, 33.1–4, 73.10

Macrocypris graysonensis ALEXANDER, 1929, p. 59, pl. 2, fig. 13,14; ALEXANDER, 1932, p. 364, 396; SHIMER and SHROCK, 1944, p. 683; HOWE and LAURENCICH, 1958, p. 391; CORYELL, 1963, p. 985; MANCINI, 1977, p. 342.

Probably not *Macrocypris graysonensis* Alexander BONNEMA, 1940, p. 107, pl. 2, fig. 27; RESCHER, 1968, p. 76.

Not *Macrocypris graysonensis* Alexander JAIN, 1961, p. 341; BHATIA et al., 1972, p. 37.

Material.—Five fossil specimens.

Types.—The holotype is a whole carapace, slide TMM 11518, in the Alexander Collection of the Texas Memorial Museum, University of Texas at Austin, labeled "*Macrocypris graysonensis* Alexander, n. sp., Holotype, Grayson, Cret., 11518, B 2907, 34, pl. 2, fig. 13–14, no. 92."

The new material for this species is deposited as USNM 438282–438285.

Type locality.—Lower Grayson Formation, Washita Group, Lower Cretaceous (Lower Cenomanian), exposed in high south-facing bluff on Denton Creek, two miles by road east of the Fort Worth-Denton highway, at a point 3.5 miles northeast of Roanoke, Denton County, Texas.

Occurrence.—In TMM 11518, 1 specimen; at UH 1672, 4 specimens.

Distribution.—Cretaceous (Cenomanian) of Texas.

Dimensions.—Holotype TMM 11518, L 0.89 mm, H 0.33 mm. See also Graph 39.

Diagnosis.—Carapace very small, elongate-oblong; right valve with broadly and unevenly arched dorsal margin, greatest height located anterior to midlength; anterior margin obliquely and bluntly truncate, ventrally projecting, with dentiform corner present but inconspicuous; ventral margin concave overall, slightly sinuate near midlength; posteroventral margin sloping downward to narrowly rounded, downturned, acute posterior angle. Internal characters not visible.

Comparisons.—*Ms. graysonensis* has a more broadly truncate anterior and a less acuminate posterior than *Ms. exquisita, Ms. simplex,* or *Ms. wrightii,* and it has a less sinuous ventral margin and more elongate shape than *Ms. siliqua.* Among living species, *Ms.* sp. 23 has a similarly streamlined but more elongate shape.

Remarks.—The species reported by Jain (1961) has left valve overlap, and Jain (1975) reidentified it as *Pontocyprella?* sp. indet.

MACROSARISA HIULCA new species

Graph 40; Figures 12.10,11, 13.10,11, 21.23, 24.32, 28.19,20, 29.8, 35.22, 44.6, 47.8, 68.7, 73.1,2, 76.7, 79.10–13; Plates 28.4–7, 29.4–7, 72.8,13–15,19, 73.11,12,20, 80.13, 91.5,6, 105.1,2

Derivation of name.—From Latin *hiulcus,* gaping, split open; for the very prominent dentiform corner, and for the constricted distal portion of the male copulatory organ.

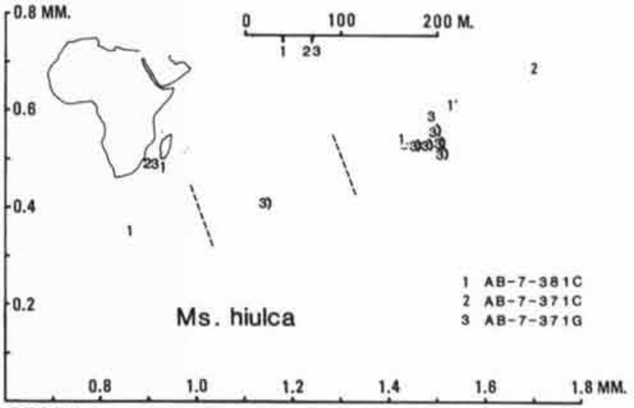
Material.—Four carapaces containing dry soft parts, including 1 male, 2 females, and 1 juvenile; plus 8 empty valves; for a total of 12 specimens.

Types.—Holotype male 2356M USNM 240629, paratypes USNM 240630–240633.

Type locality.—*Anton Bruun* cruise 7 station 381C, 33°13'S, 43°53'E, depth 40 m, Walterson Shoal.

Occurrence.—At AB-7-371C, 1 live specimen (1F); at AB-7-371G, 8 specimens; at AB-7-381C, 2 live plus 1 specimens (1M, 1F).

Distribution.—Holocene; on Walterson Shoal, south of Madagascar, in the southern Mozambique Channel, live at 40 m depth, known dead depth range 40 to 73 m.



GRAPH 40

Dimensions.—Holotype male 2356M, RVL 1.43 mm, RVH 0.54 mm, LVL 1.43 mm, LVH 0.51 mm. See also Graph 40. The male is slightly smaller than but similar in shape to the female.

Diagnosis.—Carapace transparent, thin-shelled, posteroventrally inflated; right valve elongate-subtriangular in lateral view, with high-arched dorsal margin, greatest height located at midlength at indistinct dorsal angle; anterior margin obliquely rounded, truncate, with prominent dentiform corner; ventral margin sinuous, with broad anteroventral indentation and prominent posteroventral convexity, posterior segment only slightly upswung or stepped; posterodorsal margin steeply sloping, nearly straight; posteroventral angle only slightly flared, acute; posterior dentiform corner inconspicuous; zone of concrescence broad, vestibules restricted, with numerous, straight to irregularly branching radial pore canals and false radial pore canals.

Palp of right male fifth limb with very slender hook recurved at 63°, slender pegs of unequal size; left palp with thick hook curved at 101° and greatly enlarged, unequal pegs; ventral seta present but no dorsal or sensory seta on either palp. Palp of female fifth limb has much reduced ventral, dorsodistal, and ventrodistal setae; mediodistal seta is thickened, straight, rodlike. Sixth limb slender, mediodistal claw very long; short ventrodistal seta is longer than the dorsodistal seta. Seventh limb with long reflexed seta and short distal setae. Furca large, tapering, straight, without visible proximal setae or line of demarcation of terminal setae. Hemipenis rounded-subtriangular in outline with rounded ventral margin and very broad, wedge-shaped anterior projection; copulatory tube V-shaped. Zenker's organ with short muscularized portion, anterior bulb not seen; vas deferens arranged in a tight, discoidal coil of four to six circles.

Comparisons.—In lateral outline *Ms. hiulca* resembles certain species of *Macroscapha,* but it is medially swollen and has a very large, prominent anteroventral dentiform corner. It is very similar to the Cretaceous species *Ms. siliqua* but smaller and more sinuate ventrally, especially posteroventrally, with slightly elevated rather than ventrally located posterior angle. *Ms. capacis* is larger and more sinuously rounded, with bulging posteroventral flanks and extremely tiny dentiform corners.

MACROSARISA MUENSTERIANA
(Jones and Hinde, 1890)

Graph 42; Plates 42.10–12, 43.10–12, 72.20

Bairdia siliqua var. *alpha* JONES, 1849, p. 25, pl. 5, fig. 16c–g.
Macrocypris? arcuata (Münster) JONES, 1870, p. 75, 77.
Macrocypris muensteriana JONES and HINDE, 1890, p. 10, pl. 2, fig. 45–47; HOWE and LAURENCICH, 1958, p. 393; KAYE, 1964, p. 43, pl. 4, fig. 9, 10; WEAVER, 1982, p. 27, pl. 4, fig. 11,12.

Material.—Two fossil specimens.

Types.—In the British Museum (Natural History), Department of Palaeontology, Lectotype BMNH In.51622, labeled "*Macrocypris muensteriana* Jones & Hinde, 1890, Detritus, Charing, Kent."

Type locality.—In the Chalk Detritus (Cenomanian, Upper Cretaceous), village of Charing, Kent, England.

Occurrence.—In BMNH In.51618, 1 specimen; in BMNH In.51622, 1 specimen.

Distribution.—Cenomanian, England. Weaver (1982) reported this species from several additional Cenomanian localities in southern England.

Dimensions.—Lectotype BMNH In.51622, L. 1.06 mm, H 0.46 mm. See also Graph 42.

Diagnosis.—Carapace small, inflated, elongate-oblong in lateral outline; dorsal margin broadly and evenly arched, without angle, greatest height located at midlength; anterior margin broadly and obliquely rounded, slightly truncate; distinct ventral indentation in mouth region, located unusually far forward; rest of ventral margin regularly convex, then abruptly upswung to sharply pointed posterior angle of about 70° to 80°; radial pore canals not visible.

Comparisons.—The upswung, pointed posterior angle of *Ms. muensteriana* is similar to that of *Ms. capacis,* though without the overhanging posterolateral bulge, while the truncate, angulate anteroventral margin is similar to though less exaggerated than some specimens of *Mh. turbida.*

Remarks.—The sharp anteroventral and posterior angles of the lateral outline of *Ms. muensteriana* are similar to those of other species of *Macrosarisa,* but dentiform corners are indistinct on these specimens. Good SEM pictures were published for this species by Weaver (1982).

MACROSARISA SILIQUA (Jones, 1849)

Graph 42; Plates 32.5–8, 33.5–8, 72.9

Cythere (Bairdia) siliqua JONES, 1849, p. 25, pl. 5, fig. 16a,d.
Macrocypris siliqua (Jones) JONES, 1870, p. 75, 77; JONES and HINDE, 1890, p. 9, pl. 2, fig. 38–41; ?CHAPMAN, 1898, p. 333; HOWE and LAURENCICH, 1958, p. 393; KAYE, 1964, p. 43, pl. 4, fig. 11, 14, 15, 18; ?RESCHER, 1968, p. 76; WEAVER, 1982, p. 28, pl. 4, fig. 9, 10; WILKINSON, 1988, pl. 3, fig. 5.

Material.—Four fossil specimens.

Types.—The lectotype is a single whole carapace catalogued as BMNH In.51617 in the collections of the Palaeontology Department, British Museum (Natural History). The paralectotypes are two fragmentary right valves catalogued as BMNH In.51619 and In.51620.

Type locality.—The lectotype is labeled "Detritus, Charing, Kent."

Occurrence.—In BMNH In.51617, 1 specimen; in BMNH In.51619, 1 specimen; in BMNH In.51620, 1 specimen; in BMNH Io.1276, 1 specimen (described by Kaye, 1964).

Distribution.—Cretaceous of Europe. Kaye (1964) and

Wilkinson (1988) reported this species from the Albian and Cenomanian of England and Ireland. Rescher (1968) reported it from the Upper Cretaceous of Germany. Weaver (1982) reported it from eight Cenomanian sections of southern England.

Dimensions.—Lectotype BMNH In.51617, L 1.70 mm, H 0.57 mm. See also Graph 42.

Diagnosis.—Carapace elongate-siliquose; dorsal margin broadly and evenly arched; anterior margin obliquely rounded, ventrally produced, with inconspicuous anteroventral dentiform corner; venter straight to slightly sinuate; posteroventral angle acute, located at venter, not truncate; internal characters not seen.

Comparisons.—*Ms. siliqua* is less elongate and less acutely terminated than *Ms. exquisita* or *Ms. graysonensis* but more so than *Ms. wrightii*. In shape it closely resembles the living *Ms. hiulca*, but it is larger, with less sinuous ventral margin, lacks the posteromedial convexity of the ventral margin, and has the posteroventral angle located at the venter rather than elevated above it.

Remarks.—Specimens BMNH In.51619 and Io.51620 are broken dorsally, which explains the unusual outlines in Plates 32.7,8. The dentiform corners are small but distinct.

MACROSARISA SIMPLEX (Chapman, 1898)

Graph 42; Plates 32.14, 33.15, 84.7,8

Macrocypris simplex CHAPMAN, 1898, p. 333, fig. 1a–c; KAYE, 1964, p. 44, pl. 4, fig. 13; HOWE and LAURENCICH, 1958, p. 394.

Not *Macrocypris simplex* Chapman CHAPMAN, 1903, p. 233, pl. 29, fig. 22a,b.

Material.—One fossil specimen.

Types.—According to Kaye (1964), the holotype is in the Sedgwick Museum, No. B40618 (not seen).

Type locality.—Cambridge Greensand, Swaffham.

Occurrence.—In BMNH Io.1275, one specimen (described by Kaye 1964).

Distribution.—Cretaceous; England.

Dimensions.—BMNH Io.1275, L 1.37 mm, H 0.42 mm. See also Graph 42.

Diagnosis.—Carapace extremely elongate, siliquose; dorsal margin gently arched, greatest height located at about one-third of length; anterior margin narrowly and obliquely rounded; ventral margin straight; posterior end tapering to acute, narrowly rounded angle, located ventrally; zone of concrescence narrow; dentiform corner and internal characters not seen.

Comparisons.—*Ms. simplex* differs from *Ms. siliqua, Ms. exquisita,* and *Ms. graysonensis* by the more gently and more evenly arched dorsal margin, straight venter, and more anterior location of greatest height.

Remarks.—No dentiform corner was seen. The tentative generic assignment is based on the very elongate shape and the narrow zone of concrescence. The species reported by Chapman (1903) under this name from the Cretaceous of South Africa may be *Paracypris* (?) *umzambaensis* Dingle, 1969.

MACROSARISA TEXANA new species

Graph 41; Figures 12.12, 13.12, 21.21,22, 23.22, 24.33, 50.12–14, 51.4–6; Plates 26.9–12, 27.10–13, 72.3,4,11, 73.4,5,15, 80.14–16, 81.25

Derivation of name.—For the State and former Republic of Texas, which, by the agreement under which it joined the United States, retains jurisdiction over the continental shelf where this species was collected.

Material.—Forty-one empty carapaces and valves.

Types.—Holotype 2020W USNM 240634, paratypes USNM 240635–240646.

Type locality.—UH 1617, West Flower Garden, depth 96 m, in the northwest Gulf of Mexico.

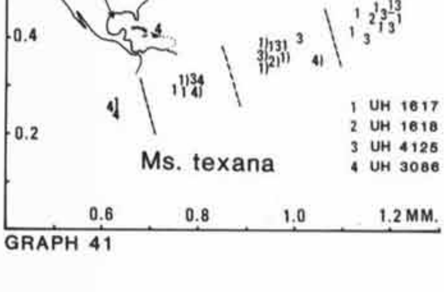
Occurrence.—At UH 1617, 20 specimens; at UH 1618, 2 specimens; at UH 3086, 9 specimens; at UH 4125, 10 specimens.

Distribution.—Holocene; Gulf of Mexico and off Puerto Rico, known dead depth range 86 to 96 m.

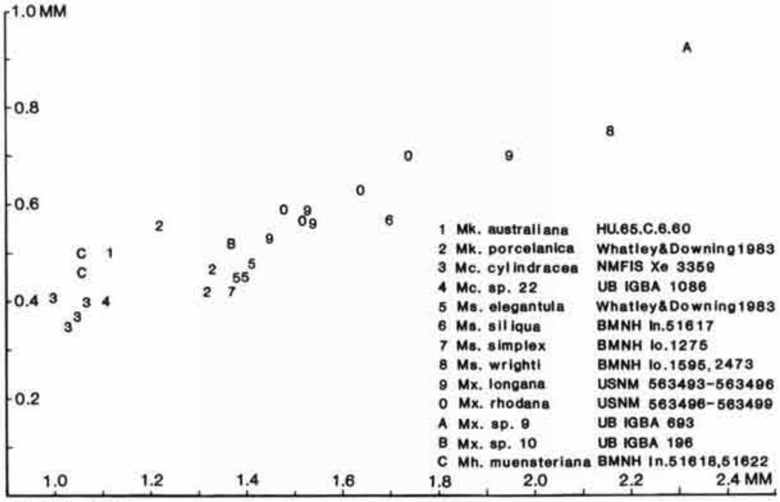
Dimensions.—Holotype 2020W, RVL 1.20 mm, RVH 0.47 mm, LVL 1.19 mm, LVH 0.44 mm. See also Graph 41.

Diagnosis.—Carapace small, thin-shelled, transparent, elongate, with two circular opaque spots in the middle of each valve; right valve elongate-subtriangular in lateral outline, with high, evenly arched dorsal margin, greatest height located just anterior to midlength; anterior margin narrowly and obliquely rounded, with inconspicuous anteroventral dentiform corner; ventral margin overall nearly straight to slightly concave, with slight medial sinuosity; posterodorsal margin steeply sloping, slightly concave; distinctly produced, flared, obliquely truncate posterior angle, with a dentiform corner, located at venter; zone of concrescence broad, vestibules broad, open; radial pore canals long, nearly straight to regularly, complexly branching. Left valve has the anterior dentiform corner located at about one-third height, rather than ventrally. Dimorphism not established.

Comparisons.—*Ms. texana* is similar in shape to *Ms. bensoni*



GRAPH 41



GRAPH 42

but differs by much smaller size, more acutely pointed posterior, less angular dorsal margin, and straight to indented ventral margin.

MACROSARISA WRIGHTII (Jones and Hinde, 1890)

Graph 42; Plates 32.15, 33.16

Macrocypris wrightii JONES and HINDE, 1890, p. 10, pl. 2, fig. 43, 44; HOWE and LAURENCICH, 1958, p. 394; ?GREKOFF and DEROO, 1956, p. 219.

Macrocypris wrightii Jones and Hinde KAYE, 1964, p. 44, pl. 4, fig. 17.

Not *Macrocypris wrightii* Jones and Hinde DUCASSE, 1973, unnumbered table; DUCASSE, 1974, p. 130; DUCASSE, 1975, fig. 1; MCKENZIE et al., 1979, p. 12; EGGER, 1910, p. 130, pl. 27, fig. 21, 22.

Not *Macrocypris* cf. *wrightii* Jones and Hinde DUCASSE, 1974, p. 130; OERTLI, 1970, unpaginated.

Material.—Two fossil type specimens.

Types.—Lectotype BMNH Io.1595, paralectotype BMNH Io.2473, in the Department of Palaeontology, British Museum (Natural History).

Type locality.—Upper Chalk of Magee, Antrim, northern Ireland.

Occurrence.—In BMNH Io.1595, 1 specimen; in BMNH Io.2473, 1 specimen.

Distribution.—Cretaceous; England, Ireland, and Spain.

Dimensions.—Lectotype BMNH Io.1595, LVL 2.46 mm, LVH 0.75 mm. See also Graph 42.

Diagnosis.—Carapace elongate-siliquose, right valve with broadly arched dorsal margin, convex and sinuate ventral margin; posterior margin sloping steeply to very acute, tapering posterior angle located near venter; greatest height located slightly posterior to midlength. Dentiform corner and internal characters not seen.

Comparisons.—*Ms. wrightii* differs from *Ms. exquisita* by the less prolonged posterior angle and more prolonged anterior end, as well as by the more posterior location of the greatest height.

Remarks.—Because no dentiform corner is visible on the specimens examined, the generic assignment is tentative.

MACROSARISA sp. 23

Graph 53; Figures 12.16, 28.44,45, 35.18, 44.1, 47.9, 68.3, 80.21; Plates 28.1–3, 29.1–3, 74.2,4, 83.12, 84.1, 91.7,8, 104.8,9

Material.—One male in alcohol, USNM 240647.

Occurrence.—At AII-31-155, one live specimen (1M).

Distribution.—Holocene; equatorial Atlantic Ocean, depth 3730–3783 m.

Dimensions.—Male 1415M, RVL 1.94 mm, RVH 0.63 mm. See also Graph 53.

Comparisons.—This thin-shelled, elongate-siliquose species with truncate anterior and posterior margins is more elongate and has a less angulate, less sinuous outline than any of the other living species. In fact, *Ms.* sp. 23 it is most similar to the Cretaceous species *Ms. graysonensis.* The male fifth limb has a thick, right-angled hook, recurved at 77° in the right limb and 105° in the left, two pegs of unequal size, a ventral but no sensory or dorsal seta; the left palp is smaller, with a much longer ventral peg, ventral and dorsal setae present but no sensory seta. The furcae are symmetrical, extremely long and slender, forceps-like, without visible proximal setae or line of demarcation between distal and proximal regions. The male hemipenis is rounded-subtriangular in outline, with a wedge-shaped, beaklike anterior extension and a short, straight copulatory tube, rather similar to that of *Ms. hiulca.* The Zenker's organ is fairly similar to that of *Ms. bensoni,* with a short muscularized portion and very large, ovate anterior bulb. The vas deferens is unique, very thick and stiff, not coiled or looped, shaped like an elongate question mark, and more than twice as long as the muscularized part of the Zenker's organ.

MACROSARISA sp. 24

Graph 76; Plates 27.7,8

Material.—Five empty carapaces and valves.

Occurrence.—In BMNH 1911.11.8.M.3071, 1 specimen; in BMNH 1911.11.8.M.3069, 4 specimens.

Distribution.—Holocene; coast of Norway, known depth range 38–96 m.

Dimensions.—Specimen 2315, L 1.47 mm, H 0.60 mm. See also Graph 76.

Comparisons.—These compressed, truncate specimens of *Ms.* sp. 24 closely resemble some of the *Challenger* specimens of *Ms. bensoni* in size and shape but are less elongate, less angulate, and less sinuous in lateral outline. Because the geographic variability of *Ms. bensoni* is not well understood, and no geographically intermediate populations are known, these specimens are treated as a separate species for the time being. The Cretaceous species *Ms. graysonensis* is similar in general shape but not as high and much smaller overall. Juveniles of *M. minna,* which occur on the same slides with this species, are much more inflated and very much more highly arched dorsally; they lack the dentiform corner.

Remarks.—Specimens of *Ms.* sp. 24 occur intermingled with juveniles of *M. minna* on two slides labeled *M. minna* in the Norman Collection. It is puzzling that this species appears not to have been recognized previously. Only two species of Macrocyprididae, *Macrocypris minna* and *Macrocypria sarsi,* have been reported from the coast of Norway hitherto.

MACROSARISA sp. 47

Graph 36; Figures 68.12, 80.23; Plates 28.8, 29.8, 70.6, 71.3,5,6

Macrocypris tenuicauda Brady (OTU 19) Maddocks, 1976, p. 42 [*part.*]; Maddocks, 1977, fig. 11 [*part.*].
Macrocypria (?) n. sp. 1 Maddocks, 1979, pl. 1, fig. 3 [*part.*].

Material.—One female in alcohol, USNM 240648.

Occurrence.—At AB-7-363D, 1 live specimen (1F).

Distribution.—Holocene; Mozambique Channel near Tulear, at a depth of 1605 m.

Dimensions.—Female 127F, RVL 2.30 mm, RVH 0.86 mm, LVL 2.24 mm, LVH 0.79 mm.

Remarks.—*Ms.* sp. 47 is similar to *Ms. bensoni* but much larger, with a more highly arched dorsal margin and a more elongate, more acutely pointed posterior angle.

Genus MACROSCAPHA new genus

Derivation of name.—Greek *macro-,* large, and Greek *skaphion* and Latin *scapha, -ae,* a light boat or skiff.

Type species.—*Macroscapha atlantica* new species.

Species included.—Listed by original binomen:

Macroscapha atlantica n. sp.; Holocene, Atlantic continental shelf of North America.
Macroscapha gyreae n. sp.; Holocene, Gulf of Mexico.
Macroscapha heroica n. sp.; Holocene, Patagonia.
Macrocypris inaequalis Müller, 1908; Holocene, Antarctica.
Macroscapha inaequata n. sp.; Holocene, Antarctica.
Macroscapha jiangi n. sp.; Holocene, southwestern Pacific Ocean west of New Zealand.
Macrocypris (Macrocyprina) marchilensis Hartmann, 1961; Holocene, Chile.
Macroscapha opaca n. sp.; Holocene, Patagonia.
Macroscapha sinuata n. sp.; Holocene, Antarctica.
Macrocypris tensa Müller, 1908; Holocene, Antarctica.
Macrocypris turbida Müller, 1908; Holocene, Antarctica.
Macroscapha sp. 25; Holocene, Drake Passage.
Macroscapha sp. 26; Holocene, Antarctica.
Macroscapha sp. 27; Holocene, Tasman Plateau.
Macroscapha sp. 28; Holocene, Tasman Plateau.
Macroscapha sp. 29; Holocene, Tasman Plateau and Tasman Sea.
Macroscapha sp. 30; Holocene, equatorial Atlantic Ocean off Brazil.
Macroscapha sp. 31; Holocene, Tasman Sea.
Macroscapha sp. 32; Holocene, Tasman Sea.

Geologic range.—Known so far only in the Holocene.

Geographic range.—Widely distributed in sublittoral and bathyal depths, but best represented in Antarctic and southern regions of the Southern Hemisphere. Only one typical species has been recognized, so far, in the Northern Hemisphere. Known live composite depth range 16 to 3694 m, dead from 9.3 m.

Diagnosis.—Carapace medium-sized to large, smooth, usually thin-walled, translucent to opaque, yellowish white or white, sometimes with cloudy central region, sometimes with a distinct layer of brown chitinous endocuticle lining the interior of the valves; carapace shape elongate-subtriangular to siliquose in lateral outline, valves fairly symmetrical; right valve nearly equilateral, smoothly arching to indistinct dorsal angle near midlength, without anterodorsal or posterodorsal angles; anterior margin narrowly rounded to obliquely truncate; ventral margin gently sinuate, with more or less distinct indentation in the mouth region, often with an angulate sinuosity or protuberance just anterior to the mouth region, nearly straight to gently convex behind to the mouth region; posterior angle located at venter or just above venter, narrowly rounded to truncate or obliquely flared; carapace elongate-ovoid in dorsal view, with greatest thickness located near midlength, tapering to gently rounded anterior and posterior ends; weakly sinuous valve contact line; duplicature broad, zone of concrescence narrow to moderately wide, broader in anteroventral and posterodorsal regions; radial pore canals numerous, straight or slightly curving, not branched; false radial pore canals may be numerous in anteroventral region; vestibules deep, unrestricted; no dentiform corners.

Antennule elongate, tapering, with long setae; podomeres II and III inflexibly articulated or fused, with complete or partial vestigial suture. Antenna elongate to very elongate, with short, stout, clawlike terminal setae of various lengths, often variably reduced; podomere III with fairly long sensory aesthetascs and 1 to 3 vestigial, variable, reduced swimming setae; podomere IV with 2 short to moderately long proximoventral setae. Podomeres I and II of maxillule palp separated by distinct, more or less flexible joint.

Male fifth limbs relatively large, very asymmetrical, with thick-walled palp; terminal hook elongate, tapering, recurved at angles varying from 12° to 72°; dorsal peg varying from small and triangular to very large, elongate, sinuously tapering and tusklike, often extending beyond terminal hook in one limb or both; distal seta present; dorsal seta very tiny or absent, often present on just one limb; ventrodistal region of palp sinuously indented, strongly chitinized, projecting as a thick, chitinous ridge, fold, or platform surrounding the insertion of the ventral peg, especially in left limb. Female fifth limb slender, mediodistal seta longest. Sixth limb large, with stout, curved terminal claw; anterodistal seta small, usually less than one-quarter as long as terminal claw; posterodistal seta variably developed, robust to vestigial, usually about one-third or less of length of terminal claw, but occasionally much longer or much shorter; dorsal edge of podomere II often bears tufts of fine hairs. Seventh limb thick, long, with long reflexed seta reaching back to podomere I, lined with dense comb of fine barbs or coarse hairs, which diminish in size distally; distal setae equal or unequal in length, usually quite short, never longer than the setae of podomere IV. Furcae large, symmetrical to very asymmetrical, curved, tapering; proximal setae large; terminal setae swollen, thickened, fused with rami, with or without a more or less conspicuous line of demarcation between seta and ramus. Hemipenis large, compressed, consisting of very thin lamellae; hemispherical to oblong to subtriangular in outline; ventral region may be curved inward, close-pressed around ventral region of body, likely to be folded under on dissection slide; a tongue-like accessory lamella may be present on ventral or dorsal margin; copulatory rod short, thick, slightly curved to straight. Zenker's organ long, thick, with terminal bulb of variable size and shape; vas deferens thick, usually arranged in three or four long, loose, oblong loops, which vary from half as long as to equal in length to the muscularized portion of the Zenker's organ.

Comparisons.—Species of *Macroscapha* are similar in many ways to those of *Macrocyprina,* and the differences between the two genera are rather subtle. On the whole, species of *Macroscapha* are larger, less transparent, and lack the conspicuous patch patterns found in virtually all species of *Macrocyprina.* The carapace shape is more elongate, more sinuate, and sometimes has angulate or truncate segments. The curvature of the lateral flanks of the carapace also is subtly irregular, with the anterior and posterior regions tending to be marginally compressed, and with a tendency for the central posteroventral region to be somewhat swollen in some species. These undulating contours contrast with the compact, continuously curving, oblong carapaces of *Macrocyprina.* The ventral indentation in the mouth region is more distinct in *Macroscapha,* with more pronounced overlap of the two valves here, and the anteroventral margin is usually distinctly angulate or sinuate. Locally widened regions of the zone of concrescence with conspicuous radial pore canals also are distinctive of *Macroscapha.* Some species of *Macrosarisa* approach *Macroscapha* in lateral outline but may be distinguished by the dentiform corners. Species of *Macroscapha* are most common on terrigenous clastic sediments and at greater depths than *Macrocyprina* species, which are characteristic of warm, shallow, carbonate environments. Except for the type species, which may be a recent migrant, most species of *Macroscapha* live in the southern Hemisphere.

MACROSCAPHA ATLANTICA new species

Graph 43; Figures 12.21,22, 13.21,22, 20.7, 24.29, 27.12,13, 31.24,25, 35.25, 43.5, 47.12, 52.30, 53.26, 57.25, 59.1, 62.8, 64.17, 69.1, 73.3,8, 77.7,9, 79.6,7; Plates 34.9–12, 35.9–12, 80.17,18, 95.10–15, 106.3–8

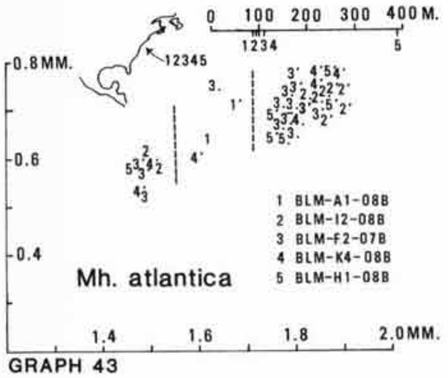
Derivation of name.—For the Atlantic continental shelf of North America.

Material.—418 specimens in alcohol, including males, females, and juveniles of two instars.

Types.—Holotype male 1982M USNM 240649, paratypes USNM 240650–240660. Additional paratypes are in the BLM collection at the Virginia Institute of Marine Science.

Type locality.—BLM-F2, 38°44.3'N, 73°09.2'W, depth 113 m.

Occurrence.—At 19 stations of the Bureau of Land Management Middle Atlantic Outer Continental Shelf Environmental Study, a total of 418 live specimens, as follows: at BLM-A1, 64 live specimens; at BLM-A2, 51 live specimens; at BLM-A3, 1 live specimen; at BLM-E2, 1 live specimen; at BLM-E4, 28 live specimens; at BLM-F1, 28 live



GRAPH 43

specimens; at BLM-F2, 142 live specimens; at BLM-F3, 1 live specimen; at BLM-F4, 1 live specimen; at BLM-G5, 3 live specimens; at BLM-G7, 5 live specimens; at BLM-H1, 8 live specimens; at BLM-I1, 10 live specimens; at BLM-I2, 26 live specimens; at BLM-I4, 2 live specimens; at BLM-K4, 40 live specimens; at BLM-L4, 3 live specimens; at BLM-L5, 4 live specimens. (Only 65 specimens in 5 subsamples, representing one seasonal collection at a station, were measured and determined for sex or instar, as follows: at BLM-A1, August 1977, 1F, 1W; at BLM-F2, March 1976, 17M, 15F, 3FJ–1, 1W; at BLM-H1, August 1977, 1M, 6F, 1J–1; at BLM-I2, August 1977, 6M, 4F, 2J–1; at BLM-K4, November 1977, 1M, 3F, 3FJ–1; these total 25M, 29F, 6FJ–1, 3J–1, 2W).

Distribution.—Holocene; middle Atlantic continental shelf of North America, known live depth range 75 to 460 m, most abundant near shelf edge.

Dimensions.—Holotype male 1982M, RVL 1.79 mm, RVH 0.71 mm, LVL 1.79 mm, LVH 0.69 mm. See also Graph 43.

Diagnosis.—Carapace elongate-arcuate in lateral outline, dorsal margin of right valve smoothly low-arched, without any angles or concavities, greatest height located at midlength; anterior margin obliquely truncate, angulate, downturned; broad ventral indentation in mouth region, remainder of ventral margin very gently convex or nearly straight; posterior angle narrowly rounded, only slightly upturned, about 50° to 55°. Zone of concrescence broad, uniform, line of concrescence somewhat irregular; radial pore canals numerous, straight or slightly curving; numerous false radial pore canals in anteroventral and posteroventral regions.

Male fifth limbs rather asymmetrical, with tapering terminal hook recurved at approximately 58° in right limb and 26° in left limb; ventral peg sinuously elongate; ventrodistal region indented, strengthened into flaring chitinous ridge; dorsal seta short, thick. Female fifth limb with slender, clawlike terminal setae, dorsodistal seta rather short, ventral seta of podomere IV rather long. Sixth limb long, slender; posterodistal seta thin, about one-third as long as terminal claw. Seventh limb large, with long reflexed seta lined with fine hairs, distal setae short. Furcae large, thick, curved, tapering, asymmetrical; with terminal setae well demarcated, accounting for more than one-third of length of furcae, and with two large proximal setae. Hemipenis oblong, scoop-shaped; copulatory rod short, straight. Zenker's organ moderately long, with slender muscularized portion; terminal bulb elongate, teardrop-shaped; vas deferens arranged in about four long, arcuate, tightly bent loops.

Comparisons.—*Mh. atlantica* is smaller, more elongate, and more sinuate than most other species of *Macroscapha*. Only *Mh. sinuata* is more elongate and more sinuate in outline, while *Mh. heroica* is proportionally higher with more angulate contours. The asymmetrical, yet gracefully tapering, pointed furcae are easily distinguished from the thick, blunt-tipped, less flexible furcae of *Mh. inaequata* and *Mh. inaequalis*. The broadly scoop-shaped hemipenis shows distant homologies with those of *Mh.* sp. 25, *Mh. inaequata, Mh. sinuata,* and *Mh. heroica* but lacks the ventral lobe and other detailed similarities. *Mh.* sp. 30 shares several of these distinctive characters and may be closely related to *Mh. atlantica.* No other species has such a narrow, elongate terminal bulb on the Zenker's organ, and the close-kinked, arcuate loops of the vas deferens may also be distinctive.

MACROSCAPHA GYREAE new species

Graph 44; Figures 12.13, 13.13, 20.4, 24.30, 52.12–15, 53.9,10; Plates 40.1,2, 41.1,2, 80.19

Derivation of name.—For the Texas A&M University Oceanographic Research Vessel *Gyre.*

Material.—Seventy-seven empty carapaces and valves.

Types.—Holotype 1509RV USNM 240661, paratypes USNM 240662–240671.

Type locality.—UH 1617, near the West Flower Garden Bank, northwest Gulf of Mexico, 24 October 1972, depth 96 m.

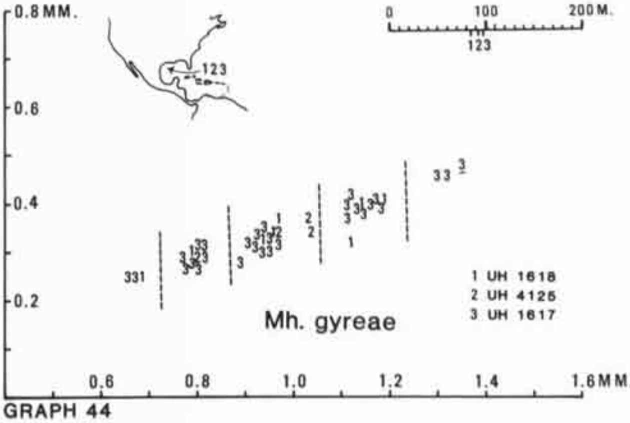
Occurrence.—At UH 1617, 56 specimens; at UH 1618, 13 specimens; at UH 4125, 8 specimens.

Distribution.—Holocene; Northwest Gulf of Mexico near the Flower Garden banks, known dead depth range 86–96 m.

Dimensions.—Holotype 1509, RVL 1.35 mm, RVH 0.48 mm. See also Graph 44.

Diagnosis.—Carapace small, elongate-siliquose in lateral outline; dorsal margin of right valve low-arched, curving smoothly, without dorsal angle; greatest height located just anterior to midlength; anterior margin very angulate, obliquely truncate, with distinct anterior angle; indistinct anteroventral indentation, remainder of ventral margin gently convex, posteriorly upswung without interruption to form a narrowly rounded, symmetrical posterior angle of about 35°; zone of concrescence of moderate width, radial pore canals straight, somewhat irregular.

Comparisons.—The tiny size and convex venter of *Mh. gyreae* are unusual for this genus, but the angulate-truncate



GRAPH 44

anterior margin is not unlike that of larger, more sinuous species, such as *Mh. sinuata*. The generic assignment is tentative.

MACROSCAPHA HEROICA new species

Graph 45; Figures 12.5,6, 13.5,6, 20.5, 23.17, 27.2,3, 31.26, 47.30, 52.22–25, 53.14–18; Plates 42.8,9, 43.8,9, 80.20, 93.12–16, 106.1,2

Derivation of name.—For the R. V. *Hero*.

Material.—Two specimens in alcohol, including one male and one female; and 176 empty carapaces and valves; for a total of 178 specimens.

Types.—Holotype male specimen 1462M USNM 240672, paratypes USNM 240673–240682 and KUMIP 1,124,308–1,124,576.

Type locality.—*Hero* cruise 69-5 station 214, 51°27.5'S, 74°03'W, depth 200 m.

Occurrence.—At H-69-5-53, 125 specimens; at H-69-5-57, 6 specimens; at H-69-5-201, 31 specimens; at H-69-5-210, 6 specimens; at H-69-5-212, 2 specimens; at H-69-5-213, 1 specimen; at H-69-5-214, 2 live specimens (1M, 1F); at H-69-5-219, 2 specimens; at H-69-5-220, 2 specimens; at H-69-5-259, 1 specimen.

Distribution.—Strait of Magellan and nearby fjords and channels of southern Chile, live at 421–512 m, known dead depth range 9.3 to 916.3 m.

Dimensions.—Holotype male specimen 1462M, RVL 1.98 mm, RVH 0.88 mm, LVL 1.98 mm, LVH 0.89 mm. See also Graph 45.

Diagnosis.—Carapace moderately large, oblong-subtriangular in lateral view, transparent except for elongate, central opaque patch; dorsal margin of right valve high-arched, smoothly convex, without angles or concavities, greatest height located at midlength; anterior margin obliquely truncate, angulate; broad ventral indentation in the mouth region, rest of ventral margin convex to nearly straight, somewhat upswung posteriorly to join the narrowly rounded, slightly flared posterior angle of about 50°–55°; zone of concrescence broad, radial pore canals numerous, straight.

Male fifth limbs rather asymmetrical, terminal hook recurved at about 36° in left limb; ventrodistal region projecting as thick chitinous ridge; ventral pegs short, thick. Female fifth limb has short, thick, curved, heavily barbed terminal claws. Furcae large, symmetrical, tapering gracefully to slender, curved points; proximal setae large, conspicuous. Hemipenis equant, oblong, with rounded margins, and ventral, thick, tonguelike, lamellar flap. Zenker's organ with narrow, elongate terminal bulb, narrow muscularized portion; vas deferens thick, arranged in three or four long, loose loops.

Comparisons.—*Mh. heroica* is similar in its sinuate, angulate outline to *Mh. sinuata* and *Mh. atlantica* but much less elongate and very much more highly arched than either. The barbs on the distal seta of the female fifth limb are like but even more prominent than those of *Mh. sinuata*. The tips of the furcae taper to sharper points than in *Mh. sinuata*. The hemipenis is like that of *Mh. sinuata* in many features but is more equant, with a slightly thicker ventral lobe.

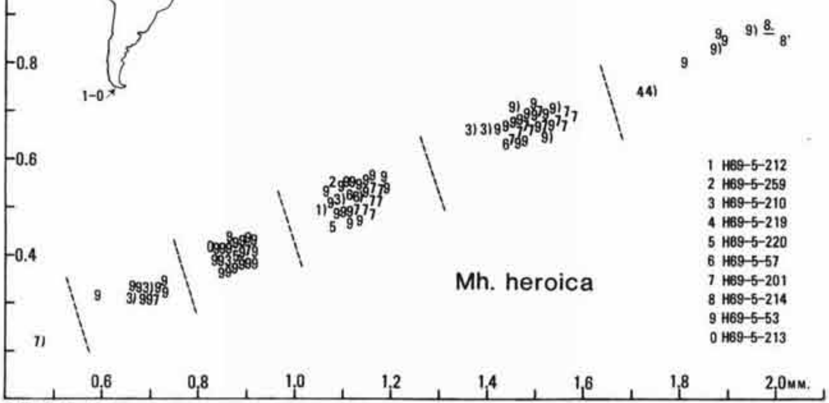
Remarks.—The sixth and seventh limbs are missing or fragmentary in the available live specimens.

MACROSCAPHA INAEQUALIS (Müller, 1908)

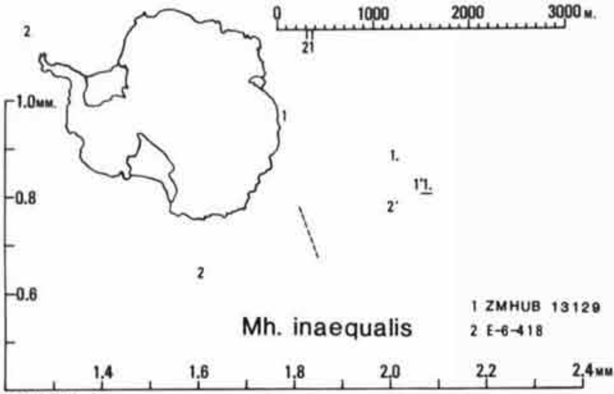
Graph 46; Figures 14.13,14, 15.14,15, 27.20,21, 31.8, 34.13, 42.5, 47.38, 69.2, 74.6, 77.8, 79.2; Plates 36.11,12, 37.11,12, 80.21, 93.1–4, 105.9–13, 111.10

Macrocypris inaequalis MÜLLER, 1908, p. 95, pl. 12, fig. 1–7; MÜLLER, 1912, p. 121.

Material.—Three syntype specimens and 2 others in alcohol, including 2 males, 2 females, and 1 juvenile; for a total of 5 specimens.



GRAPH 45



GRAPH 46

Types.—G. W. Müller's syntypes are in the Crustacea Division of the Zoological Museum of Humboldt University, Berlin, bearing the type-series catalog number 13129. This material consists of three glass slides, each with the carapace and soft parts of one dissected specimen, mounted in Canada balsam. All three slides are labeled "Gauss-Stat., 385 m., D. Südpolar-Exp." A male specimen, labeled "181" and "2.12.2," is here designated the lectotype and given my specimen number 1940M. The female, my specimen 1939F, and the remaining male, my specimen 1941M, are here designated paralectotypes.

The new material for this species is catalogued as USNM 240683–240684.

Type locality.—The Gauss-Station, 65°S, 90°E, 385 m, off the coast of Antarctica.

Occurrence.—In ZMHUB 13129, 3 live specimens (2M, 1F); at E-6-418, 2 live specimens (1F, 1J–1).

Distribution.—Holocene; Antarctic region, known live depth range 311 to 426 m.

Dimensions.—Lectotype male 1940M, RVL 2.08 mm, RVH 0.82 mm. See also Graph 46.

Diagnosis.—Carapace elongate-oblong in lateral outline, dorsal margin of right valve broadly and smoothly arched, without distinct dorsal angle, greatest height located just behind midlength; anterior margin narrowly and obliquely rounded, somewhat truncate; ventral margin slightly concave anteriorly, slightly convex medially, weakly sinuate, and only slightly upswung posteriorly; posterior angle narrowly rounded, located ventrally, about 45°; zone of concrescence narrow, radial pore canals straight.

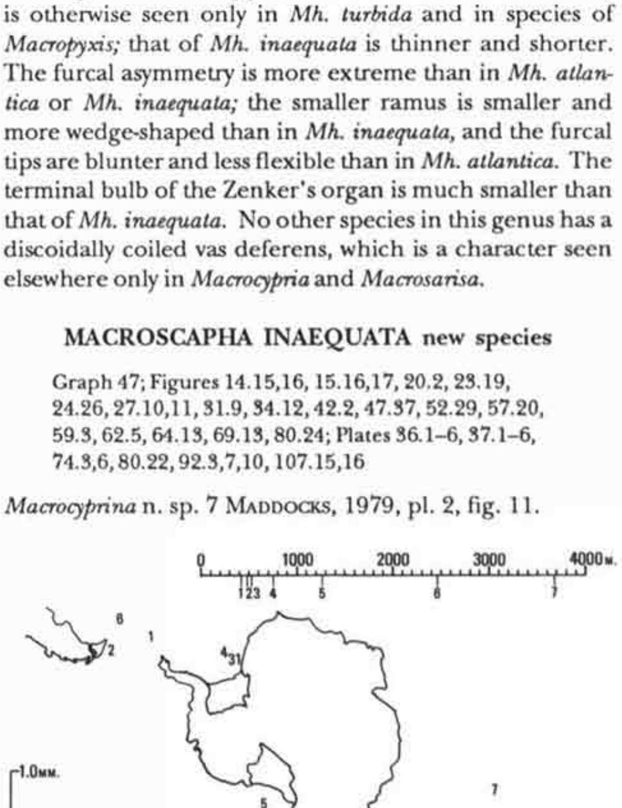
Male fifth limbs slender, elongate, with right-angled, straight-sided terminal hooks recurved at approximately 68° in right limb and 56° in left limb; dorsal peg triangular, ventral peg sinuously elongate, flanked by chitinous reinforcement ridges; tiny dorsal seta. Female fifth limb slender, elongate, with very long, flexible, tapering terminal setae, not clawlike. Sixth limb with well-developed posterodistal seta, about two-thirds as long as terminal claw, and anterodistal seta, about one-fourth as long as terminal claw. Seventh limb large, with long reflexed seta lined with fine hairs; distal setae of moderate length, unequal. Furcae very large, thick, irregularly tapering; both rami fused together for half the length of the larger ramus; smaller ramus wedge-shaped, only one-third as long as larger; large proximal setae, terminal seta not clearly demarcated. Hemipenis rounded right-triangular in outline, tapering to bluntly rounded anterodistal corner, with an additional, rounded-subtriangular, anterodorsal lamellar flap; copulatory tube moderately thick, long, straight. Zenker's organ with long muscularized portion and tiny, ovoid terminal bulb; vas deferens coiled into compact disk of about 3 whorls.

Comparisons.—*Mh. inaequalis* has nearly the same size and shape as *Mh. inaequata*, from which it differs by its more convex, more sinuous ventral margin, as well as by the nearly right-angled, triangular hemipenis. *Mh. marchilensis* is proportionally higher with a less truncate anterior margin, while *Mh. opaca* has a more acute posterior angle. Such a long posterodistal claw on the sixth limb is otherwise seen only in *Mh. turbida* and in species of *Macropyxis;* that of *Mh. inaequata* is thinner and shorter. The furcal asymmetry is more extreme than in *Mh. atlantica* or *Mh. inaequata;* the smaller ramus is smaller and more wedge-shaped than in *Mh. inaequata*, and the furcal tips are blunter and less flexible than in *Mh. atlantica*. The terminal bulb of the Zenker's organ is much smaller than that of *Mh. inaequata*. No other species in this genus has a discoidally coiled vas deferens, which is a character seen elsewhere only in *Macrocypria* and *Macrosarisa*.

MACROSCAPHA INAEQUATA new species

Graph 47; Figures 14.15,16, 15.16,17, 20.2, 23.19, 24.26, 27.10,11, 31.9, 34.12, 42.2, 47.37, 52.29, 57.20, 59.3, 62.5, 64.13, 69.13, 80.24; Plates 36.1–6, 37.1–6, 74.3,6, 80.22, 92.3,7,10, 107.15,16

Macrocyprina n. sp. 7 MADDOCKS, 1979, pl. 2, fig. 11.



GRAPH 47

Derivation of name.—Latin *inaequatus,* unequal; for the asymmetrical furca.

Material.—Fourteen specimens in alcohol, including 5 males, 6 females, 2 juveniles, and 1 of indeterminate sex.

Types.—Holotype male specimen 714M USNM 240685, paratypes USNM 240686–240698.

Type locality.—*Eltanin* cruise 6 station 350, 55°03'–55°00'S, 58°57'–58°51'W, depth 2452 m.

Occurrence.—At E-6-350, 5 live specimens (3M, 1F, 1FJ–1); at E-9-740, 3 live specimens (3F); at E-25-364, 1 live specimen (1MF?); at E-32-2025, 1 live specimen (1F); at GL-1-0001, 1 live specimen (1M); at GL-2-0001, 2 live specimens (1M, 1J); at GL-2-002, 1 live specimen (1F).

Distribution.—Holocene; Antarctic region, known live depth range 311 to 3694 m.

Dimensions.—Holotype male 714M, LVL 2.01 mm, LVH 0.83 mm. See also Graph 47.

Diagnosis.—Carapace elongate-subtriangular to oblong in lateral outline; dorsal margin of right valve evenly sloping anteriorly and posteriorly from indistinct dorsal angle located at midlength, slightly convex to nearly straight; anterior margin somewhat truncate, rounded, without distinct angles; ventral indentation prominent, remainder of ventral margin nearly straight; posterior angle very broadly rounded, about 40° to 45°; zone of concrescence broad, especially in dorsal and ventral portions; radial pore canals straight, indistinctly visible.

Male fifth limbs very asymmetrical, with thick, long terminal hook, recurved at about 40° in right limb and 26° in left limb; elongate, sinuous pegs; ventrodistal margin sinuate with thickened chitinous platform; no dorsal seta. Female fifth limb slender, with rather short, thick, rectilinear, clawlike terminal setae. Sixth limb with very long terminal claw; posterodistal seta about half as long as terminal claw; anterodistal seta about one-fifth as long as terminal claw. Seventh limb large, long, with long reflexed seta lined with dense fringe of short hairs; distal setae unequal, of moderate length. Furcae long, smoothly tapering, gently curved, asymmetrical, smaller ramus about three-fourths as long as longer ramus; proximal setae very thick, conspicuous; terminal setae well demarcated. Hemipenis rounded-subtriangular to nearly hemispherical, height greater than width; copulatory rod short, straight. Zenker's organ narrow, long, with elongate, ovoid terminal bulb; vas deferens fairly thick, arranged in about four long, loose loops.

Comparisons.—*Mh. inaequata* is the same size and nearly the same shape as *Mh. inaequalis,* with slightly more distinct dorsal angle, more broadly rounded posterior angle, and a more nearly hemicircular hemipenis. *Mh. turbida* is generally smaller and less elongate, while *Mh. tensa* and *Mh. opaca* are much more elongate, with more acute posterior angles and more angular outlines. *Mh. marchilensis* is a little smaller and less elongate, with more evenly rounded anterior and posterior margins. The posterodistal seta of the sixth leg is shorter and thinner than that of *Mh. inaequalis.* The furcae are more asymmetrical, thicker, and more bluntly terminated than those of *Mh. atlantica* and less asymmetrical than those of *Mh. inaequalis.* The deep, rounded, symmetrical hemipenis is easily distinguished from the subtriangular shape of *Mh. inaequata.* The terminal bulb of the Zenker's organ is much larger than that of *Mh. inaequalis,* and the vas deferens is loosely looped rather than discoidally coiled.

Remarks.—The illustrated female fifth limb (Figure 31.9) is pathological, with an extra seta on podomere II.

MACROSCAPHA JIANGI new species

Graph 48; Figures 12.1,2, 13.1,2, 52.36,37, 53.34,35; Plates 42.2–6, 43.2–6

Derivation of name.—For Jiang Ming-Jung, who helped as a graduate research assistant on this study.

Material.—Fifty-four empty carapaces and valves.

Types.—Holotype specimen 1922W USNM 240699, paratypes USNM 240700–240707 and KUMIP 1,123,894–1,123,935.

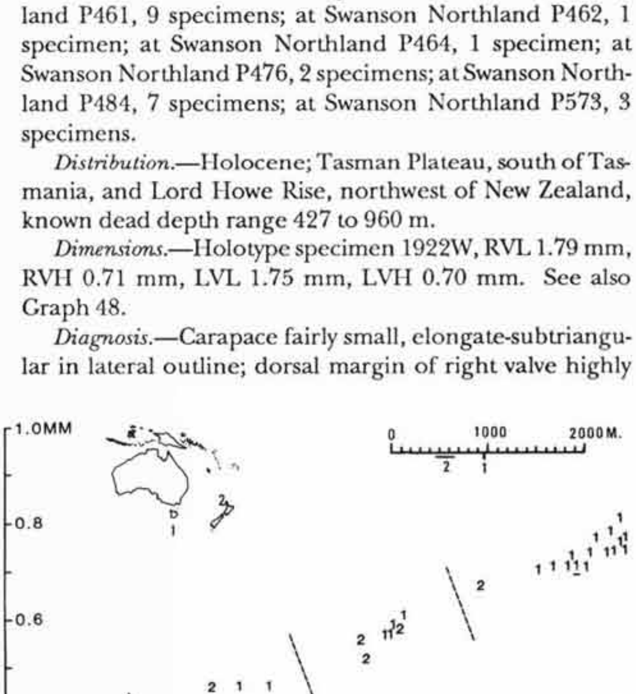
Type locality.—*Eltanin* cruise 39 station 32, 47°26.4'S, 148°17.2'E, depth 960 m.

Occurrence.—At E-39-32, 31 specimens; at Swanson Northland P461, 9 specimens; at Swanson Northland P462, 1 specimen; at Swanson Northland P464, 1 specimen; at Swanson Northland P476, 2 specimens; at Swanson Northland P484, 7 specimens; at Swanson Northland P573, 3 specimens.

Distribution.—Holocene; Tasman Plateau, south of Tasmania, and Lord Howe Rise, northwest of New Zealand, known dead depth range 427 to 960 m.

Dimensions.—Holotype specimen 1922W, RVL 1.79 mm, RVH 0.71 mm, LVL 1.75 mm, LVH 0.70 mm. See also Graph 48.

Diagnosis.—Carapace fairly small, elongate-subtriangular in lateral outline; dorsal margin of right valve highly



GRAPH 48

and broadly arched, indistinct dorsal angle located at midlength; anterior margin obliquely rounded; ventral margin gently sinuous with slight ventral indentation in mouth region, may be slightly upswung posteriorly; posterior angle narrowly and evenly rounded, slightly flared, about 40°–45°; zone of concrescence moderately wide, radial pore canals indistinctly visible.

Comparisons.—*Mh. jiangi* is slightly larger than most *Mh. turbida* and slightly smaller than *Mh. marchilensis*, with higher, more distinct dorsal angles and more acute posterior angles than either. The slight sinuosity of the posterodorsal margin separates it from *Mh. turbida* and *Mh. marchilensis*. It is much smaller, less sinuate, and more nearly triangular in outline than most other species.

MACROSCAPHA MARCHILENSIS (Hartmann, 1965)

Graph 53; Figures 12.3,4, 13.3,4, 27.1, 31.2, 35.26, 44.3, 47.10,11, 63.8; Plates 34.7,8, 35.7,8, 105.7,8

Macrocypris (Macrocyprina) marchilensis HARTMANN, 1965, p. 332, fig. 45–51.

Material.—Three type specimens.

Types.—In the Zoological Museum of the University of Hamburg, the holotype male UHZM K-27321a(FZ) is a plastic slide containing a right and left valve. Paratype female UHZM K-27321b(FZ) is a plastic slide containing a right and left valve. Paratype UHZM K-27321(Gl) is a tube of glycerin containing an undissected juvenile with decalcified carapace, the anterior and posterior halves of an undissected female body, several loose male and female appendages, and several decalcified carapace fragments. The hemipenis is missing, and there are not enough legs to complete one individual, although as many as three individuals appear to be represented in this tube.

Type locality.—"Mar Chile I" expedition, station 96, 39°59.9'S, 74°01.5'W, off Punta Galera, south of Valdivia, in southern Chile, depth 260 m.

Occurrence.—In UHZM K-27321, at least 3 live specimens (1M, 1F, 1J).

Distribution.—Holocene; off southern Chile, known live depth range 190 to 260 m. Hartmann (1965) reported five specimens at the type locality. He also reported one specimen each at "Mar Chile I" station 95 (39°59'S, 73°54'W, depth 162 m), station X1 (42°57'S, 72°57'W, depth 190 m), and station X2 (42°24'W, 72°57'W, depth 240 m), off southern Chile.

Dimensions.—Holotype male UHZM K-27321a(FZ), RVL 1.85 mm, RVH 0.81 mm, LVL 1.88 mm, LVH 0.79 mm. Paratype female UHZM K-27321b(FZ), RVL 1.76 mm, RVH 0.74 mm, LVL 1.76 mm, LVH 0.72 mm. See also Graph 53. Hartmann (1965) reported the following dimensions: males, L 1.75–1.85 mm, H 0.70–0.75 mm; females, L 1.90–1.95 mm, H 0.75–0.80 mm.

Diagnosis.—Carapace elongate-oblong in lateral outline, dorsal margin of right valve broadly arched, evenly curving, greatest height located at or behind midlength; anterior margin narrowly and obliquely rounded; ventral margin with distinct ventral indentation, posterior sector gently convex, slightly upswung posteriorly; posterior angle narrowly and evenly rounded, about 45°; zone of concrescence moderately wide, radial pore canals indistinctly visible.

Male left fifth limb small, straight-sided, with very short terminal hook recurved at about 63° in right limb; sinuous, elongate-triangular pegs inserted on strongly chitinous, projecting platform; no dorsal seta. Female fifth limb short, thick, with very short, rectilinear, clawlike setae. Sixth limb slender, with strongly bent, tapering terminal claw, short posterodistal seta and even shorter anterodistal seta. Seventh limb large, long, with long reflexed seta lined with thick comb of long hairs; distal setae short. Furcae of moderate size, symmetrical, slender, smoothly tapering, straight to gracefully curved; terminal setae weakly demarcated. Zenker's organ short, terminal bulb very small; vas deferens thick, arranged in about three loose loops, which are nearly as long as the muscularized portion of the Zenker's organ.

Comparisons.—*Mh. marchilensis* is larger than most *Mh. turbida* and slightly larger than *Mh. jiangi*, with more broadly rounded dorsal and posterior angles. It is smaller, less elongate, and less sinuate in outline than *Mh. heroica*, *Mh. tensa*, and *Mh. sinuata*, but less elongate and less sinuate than *Mh. atlantica*. Few species have so thick a vas deferens, and no other species has the loops of the vas deferens arranged in a single plane, so that the concentric loops increase in size outward. Hartmann (1965) illustrated an oblong hemipenis, which is not now present in the vial. It apparently is similar to that of *Mh. heroica* but more elongate, with a longer, sinuous copulatory rod.

MACROSCAPHA OPACA new species

Graph 49; Figures 14.1,2, 15.1,2, 27.18,19, 31.7, 34.8, 42.1, 47.36, 52.19, 53.13, 56.13, 57.19, 59.2, 62.2, 64.15, 68.14, 80.28; Plates 38.2–6,12, 39.2–6, 74.5,7–10, 92.1,2,4–6, 105.14–19, 112.4

?*Macrocyprina tensa* (Müller) HARTMANN, 1986, p. 173, pl. 5, fig. 6; HARTMANN, 1987, p. 132.

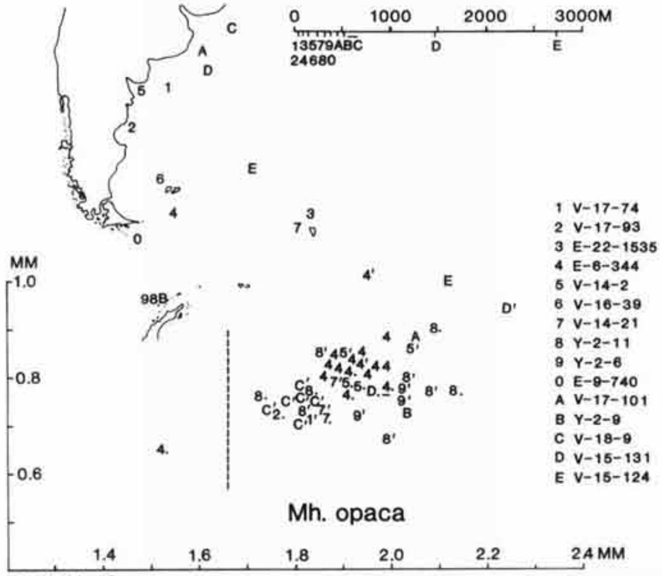
Derivation of name.—Latin *opacus*, shady, dark, obscure; for the opaque carapaces and consequent lack of information about marginal characters.

Material.—Seventy-six specimens in alcohol, including 28 males, 38 females, 6 juveniles, and 4 empty carapaces.

Types.—Holotype male specimen 1479M USNM 240708, paratypes USNM 240709–240732.

Type locality.—*Eltanin* cruise 6 station 355, 54°04'S, 58°46'–58°45'W, depth 119 m.

Occurrence.—At E-6-344, 36 live specimens (18M, 16F, 1FJ–1, 1MJ–1); at E-9-740, 1 live specimen, tentatively identified (1J); at E-22-1535, 3 live specimens, tentatively



GRAPH 49

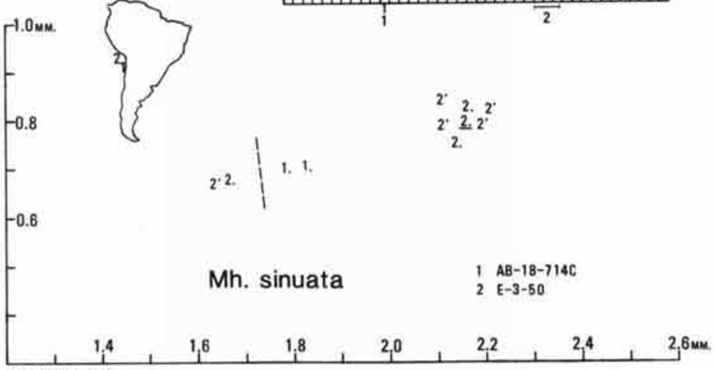
identified (1MJ–1, 1FJ–1, 1J); at V-14-2, 4 live specimens (2M, 2F); at V-14-21, 3 live specimens (1M, 2F); at V-15-124, 1 specimen; at V-15-131, 2 live specimens (1M, 1F); at V-16-39, 2 live specimens (1M, 1F); at V-17-74, 1 live specimen (1F); at V-17-93, 1 live specimen (1M); at V-17-101, 1 specimen; at V-18-9, 7 live plus 1 specimens (7F); at Y-2-6, 3 live specimens (3F); at Y-2-9, 1 specimen; at Y-2-11, 9 live specimens (4M, 5F).

Distribution.—Holocene; continental shelf and slope off Argentina, Cape Horn, Falkland Plateau, Burdwood Bank, and Palmer Archipelago of Antarctica, known live depth range 95 to 2738 m.

Dimensions.—Holotype male specimen 1479M, RVL 1.89 mm, RVH 0.78 mm, LVL 1.90 mm, LVH 0.81 mm. See also Graph 49.

Diagnosis.—Carapace elongate-subtriangular in lateral outline; dorsal margin of right valve high-arched, sloping steeply anteriorly and posteriorly from indistinct dorsal angle located at midlength; anterior margin narrowly rounded, obliquely truncate; ventral indentation prominent, angulate; posteroventral margin nearly straight, not upswung posteriorly; posterior angle narrowly rounded, ventrally located, about 45°; zone of concrescence very broad, radial pore canals numerous, straight.

Male fifth limbs very asymmetrical, with tapering, slender terminal hooks, recurved at 57° in right limb and 72° in left limb; very elongate, sinuously tapering, tusklike pegs and long dorsal seta. Female fifth limb large, thick, with very short, curved, clawlike setae; mediodistal and ventrodistal setae of equal length. Sixth limb with thick, curved terminal claw, posterodistal seta one-fourth as long as terminal claw, and short anterodistal seta. Seventh limb large, long; reflexed seta long, edged with a dense fringe of coarse barbs that diminish in size distally to fine hairs; distal setae unequal, of moderate size. Furcae long, thin, symmetrical, smoothly curved, tapering; proximal setae small, terminal setae not clearly demarcated. Hemipenis triangular with prominent, narrowly rounded angles and sinuous, concave margins; ventral tip curved inward and likely to be folded under; copulatory rod short, straight.



GRAPH 50

Zenker's organ long, moderately thick; terminal bulb very small, nearly spherical; vas deferens narrow, arranged in about three loose loops that are only slightly longer than half the length of the muscularized portion of the Zenker's organ.

Comparisons.—*Mh. opaca* is very similar in lateral outline to *Mh. tensa* but more elongate, with a more smoothly curving dorsal margin. It is smaller and more acutely terminated than *Mh. inaequalis* and *Mh. inaequata*. The concave, acutely triangular hemipenis is unique in shape, although distant homologies can be traced with *Mh. inaequata* and *Mh.* sp. 25. The Zenker's organ with small terminal bulb and the short-looped vas deferens closely resemble those of *Mh. tensa* and some specimens of *Mh. turbida*.

There is considerable variation in size and shape in this species. Particularly at stations Y-2-11 and V-15-131, the longest specimens approach *Mh. tensa* in size and shape. The two species are obviously closely related.

The "immature male" specimen identified as *Mh. tensa* by Hartmann (1986, 1987) might be an adult of *Mh. opaca*. It is possible that Hartmann's population includes some specimens of *Mh. opaca* as well as *Mh. tensa* (see discussion under that species below).

Remarks.—The tentatively identified specimens at E-9-740 and E-22-1535 are decalcified, fragmentary juveniles.

MACROSCAPHA SINUATA new species

Graph 50; Figures 14.3,4, 15.3,4, 20.3, 23.16, 24.25, 27.4,5,16,17, 31.3, 35.24, 43.1, 47.32, 52.20,21, 53.24,25, 56.8, 57.24, 59.6, 62.7, 64.16, 69.14, 80.26; Plates 36.7–10, 37.1,7–10, 63.15, 75.8, 80.23, 93.7–11, 106.9–11, 111.7,9

Macrocyprina n. sp. 5 MADDOCKS, 1979, pl. 2, fig. 5, 10, 12, 15.

Derivation of name.—Past participle of Latin *sinuo*, to bend, to wind, to swell out in curves; for the carapace shape.

Material.—Fourteen specimens in alcohol, including 4 males, 4 females, 5 juveniles, and 1 of indeterminate sex.

Types.—Holotype male specimen 845M USNM 240733, paratypes USNM 240734–240746.

Type locality.—*Eltanin* cruise 3 station 50, 16°12'–16°10'S, 74°41'W, depth 2599–2858 m.

Occurrence.—At E-3-50, 12 live specimens (2M, 4F, 1MF?, 2MJ–1, 3FJ–1); at AB-18B-714C, 2 live specimens tentatively identified (2M).

Distribution.—Holocene; Southeast Pacific Ocean off Peru and Chile, known live depth range 1025 to 2558 m.

Dimensions.—Holotype male specimen 845M, RVL 2.16 mm, RVH approximately 0.80, LVL 2.16 mm, LVH unmeasurable. See also Graph 50.

Diagnosis.—Carapace fairly large, elongate-sinuate in lateral outline; dorsal margin of right valve broadly arched, smoothly convex except for slight posterodorsal concavity, greatest height located slightly anterior to midlength; anterior margin obliquely truncate, angulate; ventral margin smoothly sinuous with prominent anteroventral indentation, convex elsewhere, posterior sector sharply upswung; posterior angle narrowly rounded, flared, located distinctly above venter, about 45° to 55°; zone of concrescence broad, radial pore canals numerous, with a few canals joining to form branching clusters located at the anterior and posterior angles.

Male fifth limbs with short, angular hook recurved at about 48° in right limb and 12° in left limb; ventral pegs elongate-triangular; no dorsal seta. Female fifth limb large, thick, with very short, thick, curved, thickly barbed, clawlike setae of nearly equal length. Sixth limb large with very long terminal claw, short posterodistal seta about one-fourth as long as terminal claw, and very short anterodistal seta. Seventh limb large, very long; reflexed seta thick, very long, lined with dense comb of fine hairs of diminishing size; distal setae very short. Furcae large, symmetrical, sinuously bowed, thick, tapering; terminal setae clearly demarcated, proximal setae large. Hemipenis oblong-subovate with broadly convex ventral and posterior margins, sinuously indented anterior margin; with tapering, tonguelike, lamellar ventral flap; copulatory rod fairly short, sinuous. Zenker's organ short, thin, with very thick, ovoid terminal bulb; vas deferens very thick, arranged in about three very long, loose loops.

Comparisons.—*Mh. sinuata* is very similar in shape to *Mh. heroica* except much more elongate. It also has less prominent barbs on the distal setae of the female fifth limb, less sharply pointed furcal tips, a slightly more elongate hemipenis, and a thinner ventral lobe on the hemipenis (especially in specimens 328M and 329M). In the holotype specimen (845M) the ventral lobe is located more posteriorly than in *Mh. heroica*, and the outline of the entire hemipenis is more oblong, approaching that of *Mh. atlantica*. *Mh. sinuata* also resembles *Mh. atlantica* in shape but is larger and more exaggerated. The ovate terminal bulb of the Zenker's organ is larger than that of any species except *Mh.* sp. 25.

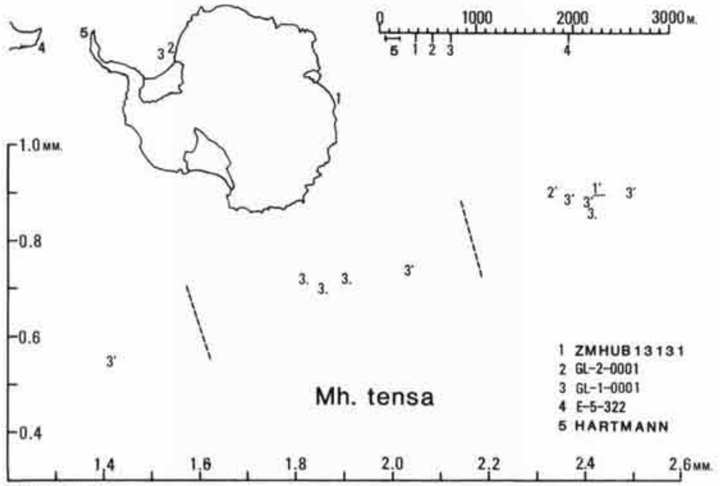
Remarks.—*Mh. sinuata* and *Mh. heroica* are very similar morphologically and have similar depth distributions but different geographic distributions.

MACROSCAPHA TENSA (Müller, 1908)

Graph 51; Figures 14.5–7, 15.5–7, 20.1, 23.20, 24.24, 27.22,23, 31.4, 34.11, 43.4, 47.39,40, 52.33–35, 53.31–33, 56.5,19, 57.23, 59.4,19, 62.9, 63.6, 64.14,35, 69.12, 80.25; Plates 38.7–11, 39.7–12, 75.1–4, 80.24, 83.10, 107.17–19

Macrocypris tensa MÜLLER, 1908, p. 96, pl. 12, fig. 8, 9; MÜLLER, 1912, p. 121.

?*Macrocyprina tensa* (Müller) MADDOCKS, 1979, pl. 1, fig. 16, 19; HARTMANN, 1986, p. 173, pl. 6, fig. 1, 2, text-fig. 87–89; HARTMANN, 1987, p. 132, fig. 73–76 [*part.*].



GRAPH 51

Material.—One type specimen and 19 specimens in alcohol, including 1 male, 8 females, and 10 juveniles; for a total of 20 specimens.

Types.—There are two slides catalogued as type-series 13131 in the Crustacea Division of the Zoological Museum of Humboldt University, Berlin. Each is labeled "Gauss-Exp." and has the valves and soft parts of one individual specimen imbedded in Canada balsam. The female specimen, labeled "*Macrocypris tensa* G. W. Müller, Gauss Stat., D. Südpolar-Exp., 178 f, 1.03," and bearing my specimen number 1935F, is here designated the lectotype.

The male specimen, labeled "*Macrocypris tensa,* 178 male, 8.02, 1403" and bearing my specimen number 1934M, does not belong to the same species and should not be considered a paralectotype of *Mh. tensa.* It is a specimen of *Mh. turbida* (Müller). Müller (1908) reported only a single female specimen and no male of this species.

The new material for this species is catalogued as USNM 240747–240758.

Type locality.—The Gauss-Station, 65°S, 90°E, depth 385 m, off the coast of Antarctica.

Occurrence.—In ZMHUB 13131, 1 live specimen (1F); at E-5-322, 1 live specimen (1F); at GL-1-0001, 17 live specimens (1M, 6F, 5MJ–1, 2FJ–1, 2J–1, 1FJ–2); at GL-2-0001, 1 live specimen (1F).

Distribution.—Holocene; Antarctic region. The live depth range in the material studied is from 385 to 2013 m. Hartmann (1986, 1987) reported it live at seven stations in the Scotia Sea and Palmer Archipelago from depths of 68 to 850 m.

Dimensions.—Holotype female specimen 1935F, RVL 2.42 mm, RVH 0.91 mm, LVL 2.42 mm, LVH 0.96 mm. See also Graph 51.

Diagnosis.—Carapace large, elongate-siliquose, subtriangular in lateral outline; dorsal margins of right valve sloping steeply away from distinct dorsal angle located at midlength; anterior margin narrowly and obliquely rounded, slightly truncate; anteroventral margin sinuate, with distinct ventral indentation; remainder of ventral margin straight to gently curving, only slightly upswung posteriorly; posterior angle acute, narrowly rounded, about 40°; zone of concrescence broad, radial pore canals indistinctly visible.

Male fifth limbs very asymmetrical, with tapering terminal hook recurved at about 41° in right limb and 29° in left limb, and with very elongate, sinuous, tusklike ventral pegs and short, thick dorsal seta. Female fifth limb large, elongate, with rather thick, blunt, clawlike setae. Sixth limb large, robust, with stout terminal claw; posterodistal seta about one-third as long as terminal claw, anterodistal seta short. Seventh limb large, long; reflexed seta thick, moderately long, reaching only to the middle of podomere II; thick reflexed seta, lined with dense comb of coarse barbs, which diminish distally into fine hairs; distal setae unequal, of moderate length. Furcae very large, symmetrical, thick, smoothly tapering; proximal setae large, terminal setae not clearly demarcated from rami. Zenker's organ long, moderately thick, with very small, spherical terminal bulb; vas deferens of moderate thickness, arranged in three or four loose loops, which are a little shorter than the muscularized portion of the Zenker's organ.

Comparisons.—The elongate, rectilinear, subtriangular carapace shape of *Mh. tensa* is like but more exaggerated than those of *Mh. inaequata, Mh. inaequalis, Mh. opaca,* and *Mh. marchilensis. Mh. tensa* is especially similar to *Mh. opaca* but considerably larger, with a straight or sinuate rather than concave ventral margin and a weakly convex rather than straight anterodorsal margin; the anterior end is also somewhat more prolonged. The Zenker's organ and vas deferens of *Mh. tensa* closely resemble those of *Mh. turbida* and *Mh. opaca.*

Hartmann's illustration (1987, fig. 76) of an adult male hemipenis of *Mh. tensa* shows strong homologies with that of *Mh. opaca,* differing chiefly in its rounded-triangular rather than acutely triangular outline. Hartmann's illustration of the left adult male fifth limb (1987, fig. 74) resembles that of *Mh. opaca* in shape of the slender terminal hook and in the sinuate, reinforced curvature of the ventral region of the main podomere, but the greatly enlarged, longer peg is like that of *Mh. tensa* as here interpreted. The illustration of the furca is approximately correct for either species but lacks the exceptionally slender, curved, forceps-like terminations of *Mh. tensa* as illustrated here. The reported carapace length of 2.07 to 2.20 mm (for the whole population according to Hartmann, 1986; for the adult males according to Hartmann, 1987) is distinctly smaller than Müller's Gauss-Station type and the Weddell Sea populations (see Graph 51), perhaps because of the lower latitude and shallower depth. However, these reported dimensions are approximately right though a little small for *Mh. opaca,* and it is of interest in this respect that the population of *Mh. opaca* at Y-2-11, not far from where Hartmann's material was collected, is especially variable in shape and size and yet unequivocally monospecific.

The "subadult male" identified as *Mh. tensa,* for which the hemipenis (Hartmann, 1987, fig. 77) and left valve (Hartmann, 1986, pl. 5, fig. 6) were illustrated, might be an adult male of *Mh. opaca.* Macrocypridid males do not have well-formed hemipenes until just before molting from the A–1 to the adult stage. Hartmann did not state whether this specimen was a molting A–1 or a just-molted adult and did not provide carapace dimensions or illustrations of the appendages to show their immaturity.

In the material studied, *Mh. tensa* and *Mh. opaca* are readily distinguishable. Both have broad geographic ranges, which overlap between Cape Horn and the Palmer Peninsula of Antarctica (Graphs 49, 51). It is concluded that they represent two separate though closely related species. Because *Mh. opaca* is very variable, and information about the male of *Mh. tensa* is scant, the exact delimitation of these two species must wait for description of additional material. It seems likely that specimens of *Mh. opaca* are included in Hartmann's (1986, 1987) populations of *Mh. tensa,* while others are correctly identified as *Mh. tensa.* If so, then *Mh. tensa* is both variable and very similar to *Mh. opaca.*

Remarks.—The hemipenis is missing from the only adult male specimen (861M), broken off at the joint with the supporting ventral branch of the furcal attachment. Perhaps it was lost during copulation, or perhaps by rough handling of the sample. Several such specimens were observed in the preserved collections of Macrocyprididae examined for this study.

MACROSCAPHA TURBIDA (Müller, 1908)

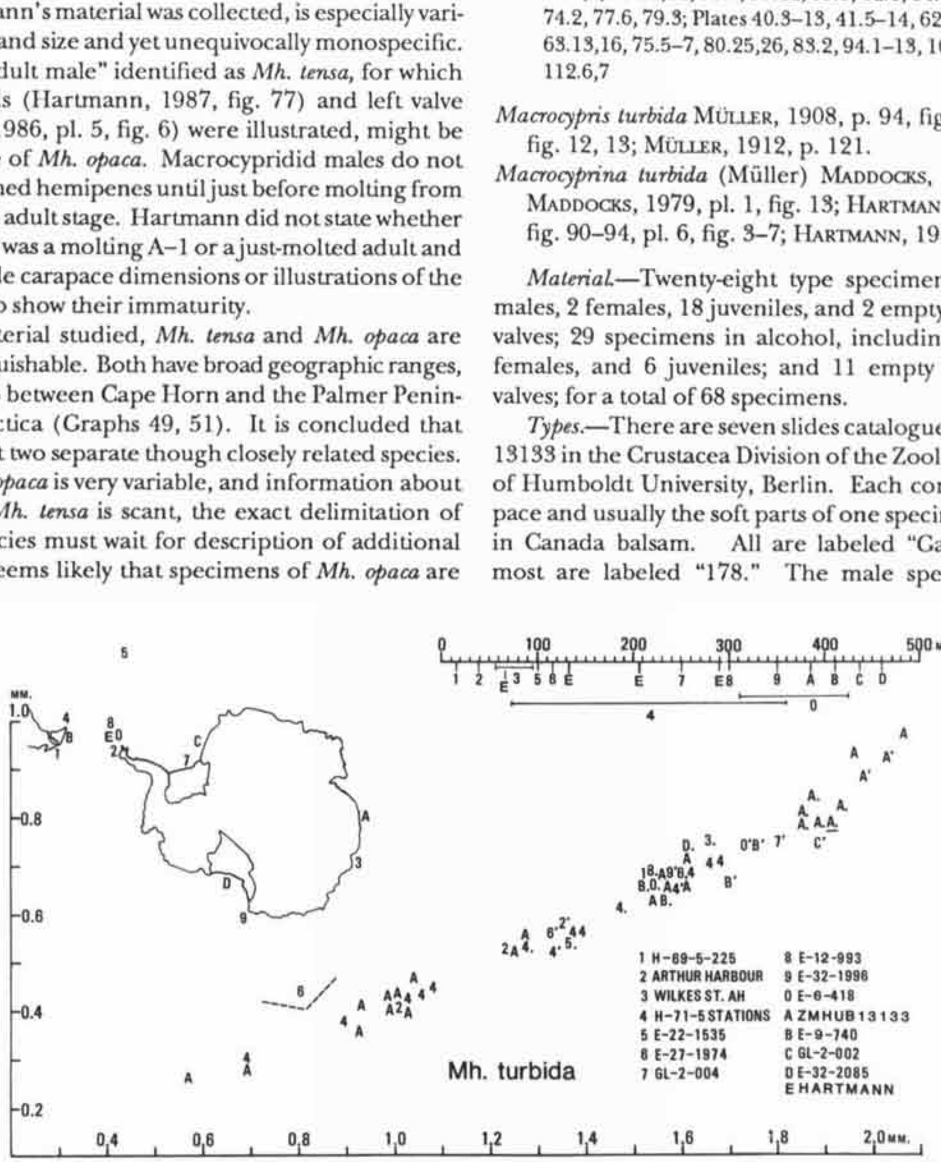
Graph 52; Figures 14.10–12, 15.11–13, 20.6, 23.18, 24.27, 27.6–9, 31.10,11, 34.10,15, 43.2,3, 47.33–35, 52.1,2, 53.11,12, 56.7, 57.22, 59.5, 62.1, 64.18, 69.3, 74.2, 77.6, 79.3; Plates 40.3–13, 41.5–14, 62.12, 63.13,16, 75.5–7, 80.25,26, 83.2, 94.1–13, 107.1–14, 112.6,7

Macrocypris turbida Müller, 1908, p. 94, fig. 11–14, pl. 12, fig. 12, 13; Müller, 1912, p. 121.

Macrocyprina turbida (Müller) Maddocks, 1977, fig. 1, 3; Maddocks, 1979, pl. 1, fig. 13; Hartmann, 1986, p. 174, fig. 90–94, pl. 6, fig. 3–7; Hartmann, 1987, p. 132.

Material.—Twenty-eight type specimens, including 6 males, 2 females, 18 juveniles, and 2 empty carapaces and valves; 29 specimens in alcohol, including 12 males, 11 females, and 6 juveniles; and 11 empty carapaces and valves; for a total of 68 specimens.

Types.—There are seven slides catalogued as type-series 13133 in the Crustacea Division of the Zoological Museum of Humboldt University, Berlin. Each contains the carapace and usually the soft parts of one specimen imbedded in Canada balsam. All are labeled "Gauss-Exp.," and most are labeled "178." The male specimen labeled



GRAPH 52

"2-4.12.1, 1364" and bearing my specimen number 1943M is here designated the lectotype. The other six slides are here designated paralectotypes and bear my specimen numbers 1942, 1944–1948. Also catalogued within this type-series is a jar containing three small vials, which contain 20 undissected paralectotype specimens in alcohol. Another specimen, catalogued in type series 13131 and mislabeled "*Macrocypris tensa*," bearing my specimen number 1934M, also belongs to *Mh. turbida*.

The new material for this species is catalogued as USNM 240759–240781 and KUMIP 1,124,298–1,124,307.

Type locality.—The Gauss-Station, 65°S, 90°E, depth 385 m, off the coast of Antarctica.

Occurrence.—In ZMHUB 13133, 26 live plus 2 specimens (6M, 2F, 5J–1, 2J–2, 7J–3, 2J–4, 2 undeterminable juveniles); in ZMHUB 13131, 1 live specimen (1M); at E-6-418, 3 live specimens (1M, 2F); at E-9-740, 4 live specimens (2M, 2F); at E-12-993, 1 live specimen (1M); at E-22-1535, 1 live specimen (1M); at E-27-1885, 1 live specimen (1F); at E-27-1974, 2 live specimens (1M, 1FJ–1); at E-32-1996, 1 live specimen (1FJ–1); at E-32-2085, 1 live specimen (1M); at GL-2-002, 1 live specimen (1F); at GL-2-004, 1 live specimen (1F); at H-69-5-225, 1 specimen; at H-71-5-15, 1 specimen; at H-71-5-20, 3 specimens; at H-71-5-22, 1 specimen; at H-71-5-24, 4 specimens; at H-71-5-25, 1 specimen; at H-71-5-874, 5 live specimens (3M, 1F, 1FJ–1); at H-71-5-893, 1 live specimen (1MJ–1); at Arthur Harbour Stat III, 3 live specimens (1F, 1J–1, 1J–2); at Wilkes Stat. AH, 1 live specimen (1M); in HU.13.CA.3.N.582-10, 2 live specimens (2F).

Distribution.—Holocene; Antarctic and Subantarctic regions, reaching as far north as Cape Horn, the Strait of Magellan, South Georgia, and Macquarie Island; known live depth range 16 to 494 m in the material studied. Hartmann (1986, 1987) reported it live from six stations in the Scotia Sea in 68 to 290 m depth.

Dimensions.—Lectotype male specimen 1943M, RVL 1.91 mm, RVH 0.79 mm, LVL 2.01 mm, LVH 0.891 mm. See also Graph 52. Size increases with depth, and the relatively small dimensions (L = 1.64–1.80 mm) reported by Hartmann (1986) fall within the ranges of the material studied here. Müller's Gauss-Station specimens are much larger than the others; indeed, A–1 instars at the Gauss-Station are as large as adults from most other stations, making it impossible to delineate instars by dotted lines on Graph 52 in the fashion of the other graphs.

Diagnosis.—Carapace fairly small, elongate-oblong in lateral outline, exact shape rather variable; dorsal margin broadly and continuously arched, without dorsal angle, greatest height located at midlength; anterior margin broadly and obliquely rounded, slightly truncate but not angulate; ventral margin gently sinuate to nearly straight, with small ventral indentation, not upswung posteriorly; posterior angle broadly and obliquely rounded, ocassionally somewhat truncate, about 40° to 50°; zone of concrescence narrow, with numerous, straight radial pore canals.

Male fifth limb asymmetrical; elongate-angulate terminal hook recurved at 35° to 48° in right limb and 39° to 52° in left limb; elongate-sinuate, tusklike dorsal and ventral pegs; left limb has small, thick dorsal seta and sinuate, ridged, ventrodistal platformlike ridge. Female fifth limb large, with rather short, thick, straight, tapering, clawlike setae. Sixth limb robust with stout, curved terminal claw; thick, long posterodistal claw, about two-thirds as long as terminal claw; anterodistal seta about one-fourth as long as terminal claw. Seventh limb slender, with long reflexed seta lined with fine hairs; distal setae short. Furcae thick, symmetrical, lined with fine barbs; terminal setae well demarcated, coarsely barbed or tuberculate; proximal setae large. Hemipenis rounded-subtriangular with sinuous, irregular margins; copulatory rod fairly long, straight. Zenker's organ long, very thick, with tiny, spherical terminal bulb; vas deferens fairly thick, arranged in three to four loose loops, which may be from half as long up to almost as long as the muscularized portion of the vas deferens.

Comparisons.—The elongate-oblong shape of *Mh. turbida* varies considerably among different geographic populations, as Hartmann (1986) also remarked. It always remains less elongate and less extreme than those of *Mh. inaequata* and *Mh. inaequalis*. The size also varies greatly, and A–1 instars at the Gauss-Station are as large as or even larger than adults at other stations. As a consequence, although growth stages are apparent for individual station-populations on Graph 52, it is not possible to isolate clusters by dashed lines as is done for other species. Such a long posterodistal claw on the sixth limb is seen elsewhere only in *Mh. inaequalis* and in species of *Macropyxis*. The barbed or tuberculate texture of the tips of the furcae is a consistent, diagnostic character. It should not be confused with the serrate line of very tiny, regularly arranged barbs along the middle-posterior edge of the ramus, which are usually too small to draw although consistently present in all Macrocyprididae (for representative illustration see *Mh.* sp. 25, Figure 47.31). The compact, rounded-subtriangular hemipenis with thick, long, straight copulatory rod shows structural homologies with that of *Mh. inaequalis*, which has an even larger, diagonally oriented copulatory rod.

MACROSCAPHA sp. 25

Figures 27.14,15, 35.21, 42.3, 47.31, 69.11, 80.27;
Plates 92.8,9, 105.3

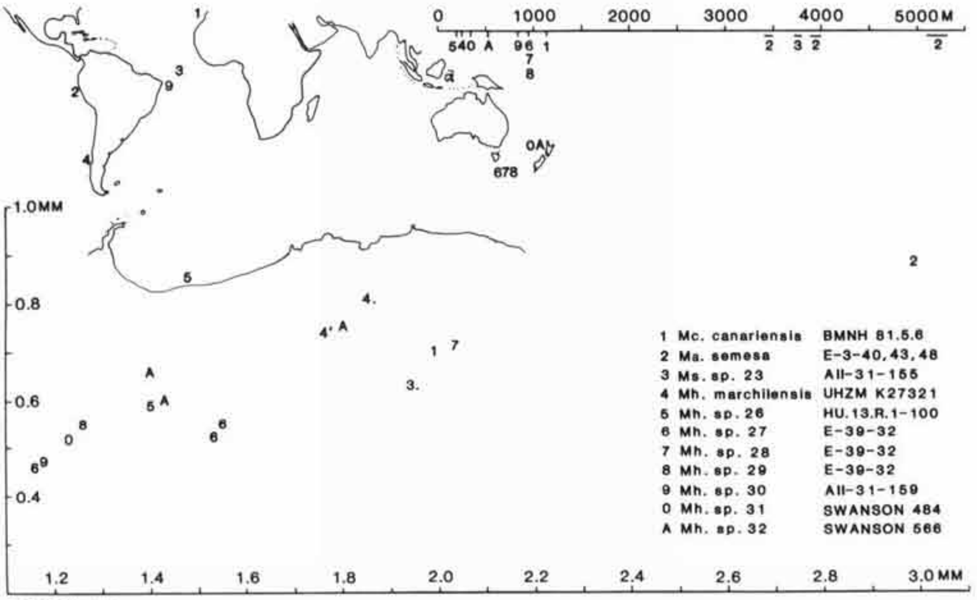
Material.—One poorly preserved male in alcohol, USNM 240782.

Occurrence.—At E-9-740, one live specimen (1M).

Distribution.—Holocene; Drake Passage south of Tierra del Fuego, depth 384–494 m.

Dimensions.—Fragmentary carapace could not be measured.

Comparisons.—The fragile, poorly calcified, newly molted carapace of *Mh.* sp. 25 was fairly similar in size and shape to *Mh. turbida* but had a more acute posterior angle. It



GRAPH 53

disintegrated before it could be measured and illustrated. The oblong hemipenis with its small, fingerlike ventral lobe and acute anterodorsal angle shows some similarity to both *Mh. opaca* and *Mh. heroica.* The very large, elongate, teardrop-shaped terminal bulb of the Zenker's organ resembles those of *Mh. inaequata* and *Mh. sinuata.* The vas deferens is thick, arranged in about three long, loose loops. The symmetrical, distally pointed furcae are lined with unusually large posteromarginal barbs.

MACROSCAPHA sp. 26

Graph 53; Figures 52.38, 53.36,37; Plates 58.6, 59.8

Macrocypris cf. *M. similis* Brady NEALE, 1967, p. 7, pl. 1, fig. s, t.

Material.—Six juvenile empty valves.

Occurrence.—In HU.13.R.12.1–100, 6 specimens.

Distribution.—Holocene; Halley Bay, Weddell Sea, Antarctica.

Dimensions.—HU.13.R.12.91, RVL 1.40 mm, RVH 0.59 mm. HU.13.R.12.93, LVL 1.40 mm, LVH 0.57 mm. See also Graph 53.

Remarks.—These specimens, described by Neale (1967), are late instars, with thin valves and thin, narrow, fragmentary inner lamellae. Instars of Macrocyprididae are difficult to identify, and these do not exactly match the available juveniles of any of the several Antarctic species of *Macroscapha.* They may be A–2 instars of *Mh. inaequata* or *Mh. opaca.*

MACROSCAPHA sp. 27

Graph 53; Figure 15.10; Plate 41.3

Material.—Three empty valves, USNM 240783–240784.

Occurrence.—At E-39-32, 3 specimens.

Distribution.—Holocene; south of Tasmania on the Tasman Plateau, depth 960 m.

Dimensions.—Specimen 2410, LVL 1.53 mm, LVH 0.52 mm. See also Graph 53.

Comparisons.—This elongate-siliquose left valve ends in a sharp 45° posterior angle. It is smaller, more elongate, and more streamlined than most species of *Macroscapha,* although the general shape is not unlike that of some specimens of *Mh. tensa* and *Mh. opaca.* It is here treated as a separate species until soft parts and geographically intermediate populations can be studied.

MACROSCAPHA sp. 28

Graph 53; Figure 13.16; Plate 41.4

Material.—One empty valve, USNM 240785.

Occurrence.—At E-39-32, one specimen.

Distribution.—Holocene; south of Tasmania on the Tasman Plateau, depth 960 m.

Dimensions.—Specimen 2408, LVL 2.03 mm, LVH 0.71 mm. See also Graph 53.

Comparisons.—This elongate-subtriangular left valve has a symmetrical, boat-shaped outline and flattened venter. It is much larger and proportionally higher than *Mh. gyreae* but has the same general shape.

MACROSCAPHA sp. 29

Graph 53; Figures 14.8, 15.8; Plates 42.7, 43.7

Material.—Four empty carapaces and valves, USNM 240786 and in the collection of Kerry Swanson.

Occurrence.—At E-39-32, 1 specimen; at Swanson Northland P476, 3 specimens.

Distribution.—Holocene; south of Tasmania on the Tasman Plateau, and west of New Zealand, known depth range 508–960 m.

Dimensions.—Specimen 2407, RVL 1.26 mm, RVH 0.55 mm, LVL 1.24 mm, LVH 0.53 mm. See also Graph 53.

Comparisons.—This sinuate-oblong carapace resembles that of *Mh. marchilensis* but is much smaller and ventrally more deeply indented. *Mh. jiangi,* which occurs at the same locality, is much larger, lacks this deep ventral indentation and has a more acute posterior angle. This shape and the broad zone of concrescence would also be appropriate for *Macrocyprina,* but there is no patch pattern.

MACROSCAPHA sp. 30

Graph 53; Figures 52.41, 53.40, 64.19

Material.—Twenty-nine specimens in alcohol, USNM 240787.

Occurrence.—At AII-31-159, one live specimen (1FJ–1); at AII-31-167, 13 live specimens; at AII-31-169A, 15 live specimens.

Distribution.—Holocene; equatorial Atlantic Ocean off Brazil, depth 834–839 m.

Dimensions.—Juvenile female specimen 1418F–1, RVL 1.17 mm, RVH 0.47 mm, LVL 1.17 mm, LVH 0.47 mm. See also Graph 53.

Comparisons.—The carapace and asymmetrical, distally pointed furcae of *Mh.* sp. 30 resemble those of juveniles of *Mh. atlantica.* However, it is treated as a separate species until adults or geographically intermediate populations can be studied.

Remarks.—The material at AII-31-167 and AII-31-169A was received too late to be studied and is not included in Graph 53.

MACROSCAPHA sp. 31

Graph 53; Plates 42.1, 43.1

Material.—One empty carapace.

Occurrence.—At Swanson Northland P484, one specimen.

Distribution.—Holocene; west of New Zealand, depth 350 m.

Dimensions.—Specimen 2423W, RVL 1.23 mm, RVH 0.52 mm, LVL 1.23 mm, LVH 0.50 mm. See also Graph 53.

Comparisons.—*Mh.* sp. 31 is very similar in shape to *Mh.* sp. 29, which occurs at a nearby locality, but it has a narrower, more sinuously flared posterior angle and a less deeply indented ventral margin. *Mh. jiangi* is much larger, more triangular, and more narrowly terminated anteriorly and posteriorly. This specimen is best treated as a separate species until soft parts or large populations can be studied.

MACROSCAPHA sp. 32

Graph 53; Figures 14.9, 15.9; Plates 38.1, 39.1

Material.—Four empty carapaces and valves, USNM 240789 and in the collection of Kerry Swanson.

Occurrence.—At Swanson Northland P566, 4 specimens.

Distribution.—Holocene; west of New Zealand, depth 514 m.

Dimensions.—Specimen 2427, RVL 1.80 mm, RVH 0.75 mm, LVL 1.80 mm, LVH 0.74 mm. See also Graph 53.

Comparisons.—This subovate-oblong carapace has evenly, bluntly rounded anterior and posterior margins and a broad zone of concrescence, characters that would also be appropriate for *Macrocyprina.* It resembles *Mh. inaequalis* in shape but is smaller, proportionally higher, and more narrowly produced anteriorly. It has more rounded contours than most *Mh. turbida. Mh. jiangi* is the same size but more narrowly terminated anteriorly and posteriorly and more triangular in lateral outline.

Genus MACROCYPRINA Triebel, 1960

Macrocyprina TRIEBEL, 1960, p. 118 [*part.*]; MORKHOVEN, 1963, p. 88 [*part.*]; MADDOCKS, 1977, p. 153 [*part.*].

Type species.—*Macrocyprina propinqua* TRIEBEL, 1960.

Species included.—Listed by original binomen:

Macrocyprina propinqua Triebel, 1960; Holocene, Bonaire.
Macrocypris africana Müller, 1908; Holocene, South Africa.
Macrocyprina barbara n. sp.; Holocene, California.
Macrocyprina belizensis n. sp.; Holocene, Belize.
Macrocyprina bermudae n. sp.; Holocene, Bermuda.
Macrocyprina bonaducei n. sp.; Holocene, Gulf of Aqaba.
Macrocyprina caiman n. sp.; Holocene, Cayman Islands.
Macrocyprina captiosa n. sp.; Holocene, Madagascar.
Cytherideis (Cytherideis) decora Brady, 1866 (*nomen dubium*).
Macrocypris dispar Müller, 1908; Holocene, South Africa.
Macrocyprina hartmanni n. sp.; Holocene, Australia.
Macrocyprina hawkae n. sp.; Holocene, Bahamas and West Indies.
Macrocyprina hortuli n. sp.; Holocene, Gulf of Mexico.
Macrocyprina jamaicae n. sp.; Holocene, Jamaica.
Cytherideis maculata Brady, 1866 (*nomen dubium*).
Macrocyprina madagascarensis n. sp.; Holocene, Madagascar.
Macrocyprina moza n. sp.; Holocene, Madagascar.
Macrocyprina noharai n. sp.; Holocene, Okinawa.
Macrocyprina okinawae n. sp.; Holocene, Okinawa.
Macrocyprina parcens n. sp.; Pleistocene, California.
Macrocyprina quadrimaculata n. sp.; Holocene, Great Barrier Reef.
Macrocypris schmitti Tressler, 1954; Holocene, Florida.
Macrocyprina skinneri Kontrovitz, 1976; Holocene, Gulf of Mexico.
Macrocypris succinea Müller, 1894; Pleistocene–Holocene, Mediterranean.
Macrocyprina swaini n. sp.; Holocene, Gulf of California.
Macrocyprina vargata Allison and Holden, 1971; Holocene, Clipperton Island.
Macrocyprina sp. 33; Holocene, Tasmania.
Macrocyprina sp. 34; Holocene, New Zealand.
Macrocyprina sp. 35; Holocene, Tasmania.
Macrocyprina sp. 36; Holocene, New Zealand.

Macrocyprina sp. 37; Holocene, U.S. Virgin Islands.
Macrocyprina sp. 38; Holocene, Jamaica.
Macrocyprina sp. 39; Holocene, Cuba.
Macrocyprina sp. 40; Holocene, Atlantic continental shelf off South Carolina.
Macrocyprina sp. 41; Holocene, Cuba.
Macrocyprina sp. 42; Holocene, Madagascar.
Macrocyprina sp. 43; Holocene, Madagascar.
Macrocyprina sp. 44; Holocene, U.S. Virgin Islands.
Macrocyprina sp. 45; Holocene, west of New Zealand.
Macrocyprina sp. 48; Holocene, Colon Harbour, Panama.

Geographic range.—Worldwide, known composite depth range live 1 to 232 m, dead to 427 m. Species of this genus are especially well represented in warm, shallow water between 0 and 40 m depth. The majority are known from tropical carbonate environments associated with coral reefs, but a few species live in the clastic sedimentary environments of continental shelves at midlatitudes.

Geologic range.—Only Pleistocene and Holocene species were studied, but it is likely that examination of appropriate environments will yield many older Cenozoic and perhaps Cretaceous species as well. The genus is well represented in Oligocene, Miocene, and younger faunas (McKenzie, 1967a), according to reports of "*Mn. decora*," "*Mn. maculata*," and *Mn.* spp.

Diagnosis.—Carapace small, relatively thin-shelled, transparent in fresh specimens, with three or more circular to irregular, opaque, white patches (brown in living animal) in the central lateral region of each valve, with additional opaque patches in the anteroventral and posteroventral regions; lateral outline oblong, with more or less strongly arched dorsal margin, rounded posteroventral angle, distinct anteroventral indentation; elongate-ovate to strongly compressed in dorsal view, with gently tapering to nearly parallel flanks and narrowly rounded anterior and posterior ends; stragulum and dorsal valve-contact line weakly sinuous and inconspicuous; lower group of adductor muscle scars dorsoventrally compressed and diagonally elongated; anterior zone of concrescence moderately wide, especially anteriorly and posteriorly, with shallow but only moderately restricted vestibule; numerous, irregularly arranged, short, curved radial pore canals and false pore canals.

Antennule slender, tapering, with setae of moderate length; podomeres II and III inflexibly articulated or fused with complete or partial vestigial suture. Antenna sturdy, fairly slender, with sturdy but short, clawlike terminal setae; podomere III with long sensory aesthetascs and 3 vestigial swimming setae of variable lengths; podomere IV with 2 short- to medium-length proximoventral setae; the 2 anterodistal setae of podomere IV may be short and thin or may be missing. Podomeres I and II of maxillule palp separated by a conspicuous, flexible joint.

Male fifth limbs small with long dorsal setae; right limb with more or less right-angled hook; left limb with smaller, more strongly recurved hook or with much reduced, nearly straight hook. Female fifth limb with fairly short, thick distal claws, the mediodistal claw longest. Dorsodistal claw of sixth limb varies from half as long to nearly as long as mediodistal claw; ventrodistal claw one-fifth to one-half as long as mediodistal claw. Recurved seta of seventh limb long, lined with a comb of fine setae; distal setae short to very short. Furcae large, very thick, rigid, symmetrical. Hemipenes hemicircular, oblong, or subtriangular in outline, with an additional subtriangular, oblong or tongue-shaped anterodorsal lamellar flap, often with additional accessory lamellar extensions or complex chitinous protuberances; copulatory rod short to fairly long, straight or curved. Zenker's organ with long muscularized portion and spherical terminal bulb; vas deferens arranged in three or four loose loops that are about as long as the muscularized portion.

Remarks.—Sars (1923, p. 57) first pointed out that *Mn. succinea* should be separated from *Macrocypris* and *Macrocypria* as a third genus.

MACROCYPRINA PROPINQUA Triebel, 1960

Graph 54; Figures 16.1,2, 17.1,2, 21.19, 23.1, 24.36, 28.1,2, 31.16, 35.7, 45.5, 47.24, 69.4, 74.5, 77.1; Plates 44.7–12, 45.7–11, 62.11, 80.27, 96.1–3, 109.4,5, 112.15

Macrocyprina propinqua Triebel, 1960, p. 119, pl. 14, fig. 7–10, pl. 15, fig. 11–17, pl. 16, fig. 18–24.
Not *Macrocyprina propinqua* Triebel Teeter, 1975, p. 424, fig. 4j, 5b; Valentine, 1971, p. 6.

Material.—Nine paratype specimens.

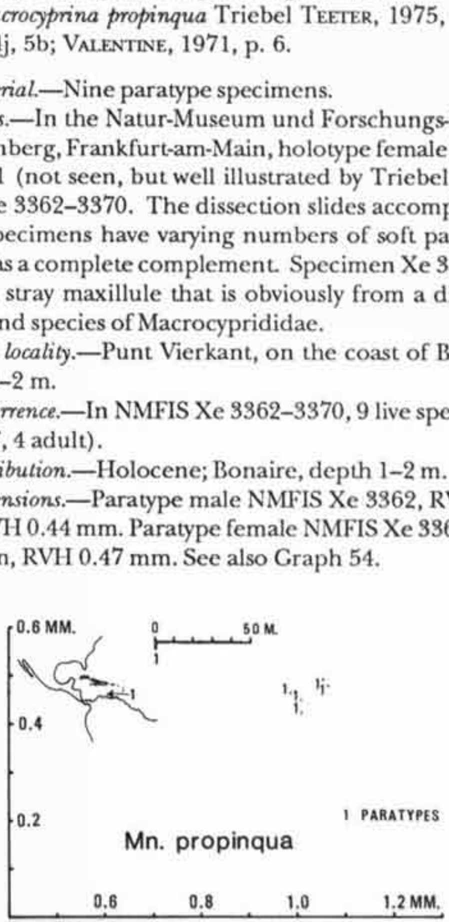
Types.—In the Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt-am-Main, holotype female NMFIS Xe 3361 (not seen, but well illustrated by Triebel); paratypes Xe 3362–3370. The dissection slides accompanying these specimens have varying numbers of soft parts, but none has a complete complement. Specimen Xe 3362 has a third, stray maxillule that is obviously from a different genus and species of Macrocyprididae.

Type locality.—Punt Vierkant, on the coast of Bonaire, depth 1–2 m.

Occurrence.—In NMFIS Xe 3362–3370, 9 live specimens (3M, 2F, 4 adult).

Distribution.—Holocene; Bonaire, depth 1–2 m.

Dimensions.—Paratype male NMFIS Xe 3362, RVL 1.00 mm, RVH 0.44 mm. Paratype female NMFIS Xe 3364, RVL 1.05 mm, RVH 0.47 mm. See also Graph 54.

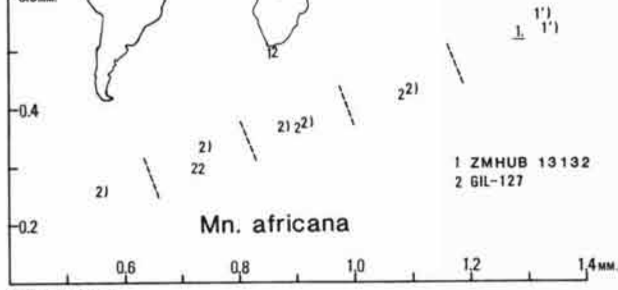


GRAPH 54

Diagnosis.—Carapace very small, ovate-oblong in lateral view; dorsal margin broadly and gently arched; anterior margin broadly rounded and slightly truncate; ventral margin with rather shallow ventral indentation, not upswung posteriorly, broadly rounded posterior angle of about 50°; zone of concrescence broad, vestibules correspondingly restricted.

Male fifth limbs very asymmetrical; right limb with sinuate podomere II, just one elongate peg, one very long dorsal seta, and a short, right-angled, tapering distal hook recurved at 85°; left limb with slender podomere II, one acutely pointed peg, a long dorsal seta, and a tiny, nearly straight, acutely pointed distal hook curved at 158°. Female fifth limb slender with slender terminal claws. Sixth limb with dorsodistal claw nearly as long as mediodistal claw. Recurved seta of seventh limb with very tiny hairs and spatulate distal tip. Furcae long, slender, gracefully tapering, curved, with small proximal setae. Hemipenis crescent-shaped, with straight dorsal margin, obliquely arcuate, convex ventral margin, and bluntly rounded anterodorsal margin, and with additional lobate anterodorsal accessory lamella; copulatory rod short, straight. Zenker's organ with small terminal bulb; vas deferens arranged in three loose loops as long as the Zenker's organ.

Comparisons.—*Mn. propinqua* is similar in size and shape to *Mn. hortuli* but more gently arched dorsally, with a more narrowly rounded posterior angle, a shallower ventral indentation, a broader zone of concrescence and a more irregular line of concrescence; the male fifth limbs are more elongate and lack one of the ventral pegs. *Mn. skinneri, Mn. belizensis, Mn. schmitti,* and *Mn. hawkae* are larger or much larger, with more highly arched dorsal margins, slightly concave posterodorsal margins, and slightly flared posterior angles. The male fifth limbs of *Mn. propinqua* are similar to those of *Mn. skinneri* and *Mn. schmitti* but more reduced and distally more tapering, without the grotesque specializations of *Mn. hawkae. Mn. caiman* is the same height but shorter, with a deeper ventral indentation, slightly upswung posteroventral margin, and obliquely truncate, more narrowly rounded anterior margin. *Mn. bermudae* is smaller and more elongate with a deeper, broader ventral indentation and thicker, less tapered male fifth limbs. The hemipenis of *Mn. propinqua* is more elongate than that of any other species studied, although the structure of the anterior end shows close homology with such other Caribbean species as *Mn. bermudae, Mn. hortuli,* and *Mn. skinneri.*



GRAPH 55

Remarks.—*Mn. propinqua* was thoroughly and accurately illustrated by Triebel (1960). The species recorded by this name in Belize by Teeter (1975) is *Mn. belizensis.*

MACROCYPRINA AFRICANA (Müller, 1908)

Graph 55; Figures 16.43,44, 17.42, 21.1, 28.10,11, 31.22, 35.16, 45.15, 47.17, 52.16–18, 53.19–22, 69.5, 74.3, 77.2, 79.4; Plates 54.8,9, 55.8,9, 96.12,13, 108.1,2, 112.3

Macrocypris africana MÜLLER, 1908, p. 97, pl. 12, fig. 10, 11, 14–17; MÜLLER, 1912, p. 121; HARTMANN and HARTMANN-SCHRÖDER, 1975, p. 360, table 4.

Not *Macrocypris africana* Müller TRESSLER, 1949, p. 341, fig. 23; TRESSLER, 1954, p. 433; HULINGS, 1967c, p. 94.

Material.—Three type specimens, including 1 male and 2 females; plus 10 juvenile carapaces and valves; for a total of 13 specimens.

Types.—Müller's syntypes consist of three glass slides, type-series catalog number 13132, in the Crustacea Division of the Zoological Museum of Humboldt University, Berlin. Each slide has the valves and soft parts of one specimen mounted in Canada balsam. All are labeled "Simonstown, D. Südpolar Exp., Gauss-Exp. 222., 1-4.7.03." The male specimen bearing my specimen number 1937M is here designated the lectotype. The female specimens bearing my specimen numbers 1936F and 1938F are here designated paralectotypes.

The new material for this species is catalogued as USNM 240790–240797.

Type locality.—Near Simonstown, South Africa. Müller did not give the exact location and depth.

Occurrence.—In ZMHUB 13132, 3 live specimens (1M, 2F); at GIL 127, 10 specimens, tentatively identified.

Distribution.—Holocene; South Africa. Hartmann and Hartmann-Schröder (1975) listed this species in their Table 4, but they did not find any additional specimens in their coastal South African collections (Gerd Hartmann, personal communication).

Dimensions.—Lectotype male ZMHUB 13132, my specimen number 1937M, as mounted, RVL 1.28 mm, RVH unmeasurable. See also Graph 55. Müller (1908) reported the length of the female as 1.35 mm and of the male as 1.25 mm.

Diagnosis.—Carapace oblong-subtriangular in lateral outline, nearly equilateral; anterior and posterior margins obliquely rounded; ventral indentation broad, shallow; posteroventral margin not upswung, posterior angle of about 40°.

Male fifth limbs small, arcuate-elongate, fairly symmetrical; both limbs with very long podomere II, slender distal hooks recurved at 57° in right limb and 03° in left limb, two small, tapering pegs, small ventral seta, and moderately large dorsal seta. Female fifth limb robustly proportioned with rather short claws; dorsodistal claw longer than mediodistal claw. Dorsodistal claw of sixth limb about four-fifths as long as mediodistal claw. Recurved seta of seventh limb long; proximal section of plume lined with numerous fine hairs, which abruptly give way to a few very coarse, thick barbs, diminishing in size to distal tip. Furcae rather long, gracefully curved, with long proximal setae. Hemipenis lobate, rounded-subtriangular in outline; anterior portion consists of two slightly overlapping, equant lamellar extensions; copulatory rod short, straight. Zenker's organ without distinct terminal bulb (or damaged); vas deferens arranged in three short loops, about one-third as long as Zenker's organ.

Comparisons.—Mn. africana is slightly smaller than *Mn. dispar*, with more narrowly rounded anterior and posterior margins, shallower ventral indentation, and slightly more distinct dorsal angle. It also has thinner male fifth limbs with more tightly recurved distal hooks, as well as much larger anterior lamellar flaps on the hemipenis. *Mn. okinawae* is larger, with a more triangular shape, an upswung posteroventral margin, and a more pointed posterior angle.

Remarks.—The uncertainly identified specimens at GIL 127 are juvenile valves.

Tressler (1949, 1954) reported three specimens of this species from Loggerhead Key, off the Tortugas, Florida. This material is USNM 88859, a glass vial filled with alcohol, which is empty except for wisps of chitinous fragments that cannot be identified. According to Tressler's illustration and dimensions, it may have been a late instar of *Macrocyprina hawkae*, which is common in the Florida Keys.

MACROCYPRINA BARBARA new species

Graph 56; Figures 16.14,15, 17.14,15, 28.38,39, 31.13, 35.2, 45.9, 47.28, 54.24,25, 55.24,25, 56.32, 57.21, 59.9,18, 62.11, 64.22,39, 69.9, 74.7, 77.5, 79.1; Plates 56.8,9, 57.8,9, 90.1–3,15, 109.6,9

Macrocyprina pacifica (LeRoy) SWAIN, 1969, p. 456 [*part.*]; SWAIN and GILBY, 1974, p. 283, pl. 2, fig. 3–5 [*part.*].

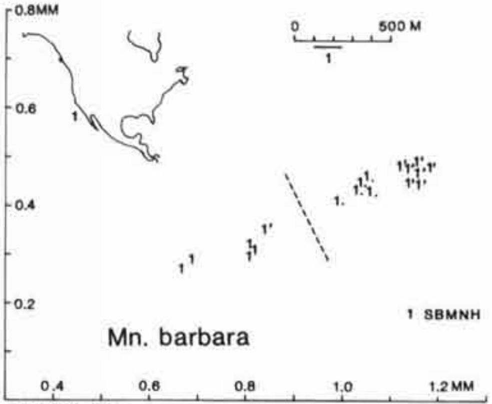
Derivation of name.—Latin *barbarus*, strange, foreign; for the Santa Barbara Museum of Natural History, which collected and loaned the material.

Material.—Eighteen specimens in alcohol, including 5 males, 7 females, and 6 juveniles.

Types.—Holotype male 2400M USNM 239150, paratypes USNM 239151–239153; and SBMNH 35107–35109.

Type locality.—SBMNH Chevron/Pt. Arguello Field Project station 29, 34°31'27"N, 120°46'01"W, depth 732 feet (232 m), 31 August 1982.

Occurrence.—At SBMNH 1, 11 live specimens (2M, 6F, 3J–1); at SBMNH 14, 3 live specimens (2M, 1J); at SBMNH 28, 3 live specimens (1F, 2J); at SBMNH 29, 1 live specimen (1M).



GRAPH 56

Distribution.—Holocene; off southern California, known live depth range 95 to 232 m.

Dimensions.—Holotype specimen 2400M, RVL 1.06 mm, RVH 0.44 mm, LVL 1.03 mm, LVH 0.41 mm. See also Graph 56.

Diagnosis.—Carapace small, elongate, greatest height located slightly anterior to midlength; anterior margin broadly rounded and slightly truncate; ventral indentation very shallow; ventral margin sinuous, not upswung posteriorly; posterior angle broadly rounded, about 50° to 60°, not inflated, may be slightly truncate; central opaque pattern consists of a single, narrow, elongate patch.

Male fifth limbs very small, asymmetrical, rectilinear, with slender ventral pegs and short dorsal seta; distal hook short, rapidly tapering, curved at 87° in right limb and 125° in left limb. Dorsodistal claw of fifth limb about half as long as mediodistal claw. Recurved seta of seventh limb rather short, reaching only to middle of podomere II, lined with fine hairs that decrease in size distally. Furcae fairly robust, gracefully curved. Hemipenis elongate, teardrop-shaped, with broadly rounded anterior margin; copulatory rod fairly short, straight. Zenker's organ with tiny terminal bulb; vas deferens arranged in four loops, as long as the Zenker's organ.

Comparisons.—Mn. barbara is much smaller than *Mn. parcens* but somewhat similar in shape and patch pattern; it is also a little more elongate posteriorly. *Mn. swaini* and *Mn. vargata* are smaller but proportionally higher, with deeper ventral indentation, more highly arched dorsal margin, and three or more discrete opaque spots. *Mn. barbara* also differs from *Mn. swaini* by its more elongate hemipenis with thinner, less conspicuous copulatory rod, and its larger, less sinuate male fifth limb.

Remarks.—Swain's (1969) and Swain and Gilby's (1974) concept of "*Macrocyprina pacifica*" included at least three species. Their figure 3 compares favorably with *Mn. barbara* except for the somewhat angular outline, which may be an artifact of illustration. Their figure 4 is a juvenile. The records from off Baja California and the Gulf of California probably apply to *Mn. swaini*. The records off Santa Catalina Island and La Jolla, California, including these two illustrated specimens, probably apply to *Mn. barbara*. Their figure 5 illustrates the adductor muscle scars of a species of *Paracypris*. See Appendix II for a discussion of *Paracypris pacifica* LeRoy, which belongs to the Paracypridinae and not to the Macrocyprididae (see also Maddocks, 1988b). See also remarks under *Mn. swaini*, below.

MACROCYPRINA BELIZENSIS new species

Graph 57; Figures 16.8, 17.7, 21.17, 23.6, 24.40, 54.21–23, 55.22,23; Plates 50.5,6,11,12, 51.6,12, 80.28

Macrocyprina propinqua Triebel TEETER, 1975, p. 424, fig. 4j, 5b.

Derivation of name.—For the country of Belize.

Material.—One juvenile carapace with dry fragments of soft parts, provided by James Teeter; and 79 empty carapaces and valves; for a total of 80 specimens.

Types.—Holotype specimen 1828RV USNM 240798, paratypes USNM 240799–240809; and KUMIP 1,124,577–1,124,642.

Type locality.—UH 2742, near Caye Chappel, Belize, depth 7 m.

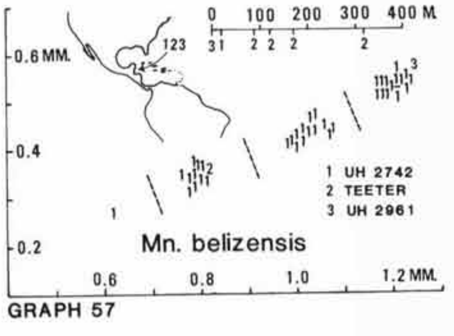
Occurrence.—At UH 2742, 78 specimens; at UH 2961, one specimen; from James Teeter, one live specimen (1FJ).

Distribution.—Holocene; Belize, known dead depth range 1 to 7 m.

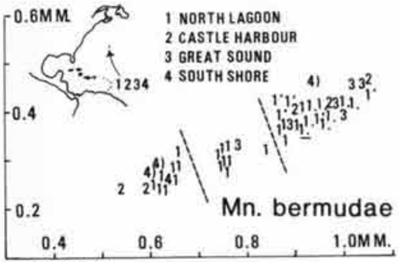
Dimensions.—Holotype specimen 1828, RVL 1.21 mm, RVH 0.54 mm. See also Graph 57. Teeter (1975) reported the adult length for this species as 1.20 to 1.38 mm.

Diagnosis.—Carapace oblong in lateral outline; dorsal margin high-arched; anterior margin broadly and evenly rounded; ventral indentation deep, broad; posteroventral margin gently up-curved; posterior angle of about 48° very broadly rounded and flared; slight posterodorsal sinuosity. Carapace has three large, irregular opaque spots, two of which reach the dorsal margin, additional large opaque patches located anteroventrally and posteroventrally. Zone of concrescence very broad, anterior vestibule correspondingly small.

Comparisons.—*Mn. belizensis* is slightly larger than *Mn. schmitti* but much smaller than *Mn. hawkae;* it is similar to these species but less exaggerated in shape, more elongate, and has a smaller middle opaque spot.



GRAPH 57



GRAPH 58

MACROCYPRINA BERMUDAE new species

Graph 58; Figures 16.21, 17.21, 21.11, 23.2, 24.38, 28.21,22, 31.14, 35.5, 45.2, 47.29, 54.8–10, 55.8–10, 68.10, 80.35; Plates 46.3–6, 47.3–6, 62.9,10, 76.1–8, 80.29,30, 97.5,6, 109.12–14, 112.8

Macrocyprina sp. MADDOCKS and KORNICKER, 1985, p. 285, fig. 91.

Macrocyprina propinqua Triebel (OTU 21) MADDOCKS, 1976, p. 42.

Derivation of name.—For the island of Bermuda.

Material.—Eighteen specimens in alcohol, including 9 males, 8 females, and 1 juvenile; and 70 empty carapaces and valves; for a total of 88 specimens.

Types.—Holotype male specimen 1759M USNM 240810, paratypes USNM 240811–240829; and KUMIP 1,124,643–1,124,673.

Type locality.—UH 1497, sand between patch reefs in North Lagoon near North Rock, Bermuda, depth 1–2 m.

Occurrence.—At UH 1497, 18 live plus 25 specimens (9M, 8F, 1J–1); at UH 1499, 17 specimens; at UH 1504, 1 specimen; at UH 1510, 2 specimens; at UH 1549, 8 specimens; at UH 1556, 3 specimens; at UH 1558, 3 specimens; at UH 1559, 5 specimens; at UH 1564, 1 specimen; at UH 1565, 2 specimens; at UH 1571, 3 specimens.

Distribution.—Holocene; in North Lagoon, Castle Harbour, and on the South Shore of Bermuda, live at depth of 1 to 2 m and dead at depth range of 1 to 18 m.

Dimensions.—Holotype male specimen 1497M, RVL 0.92 mm, RVH 0.36 mm, LVL 0.89 mm, LVH 0.34 mm. See also Graph 58.

Diagnosis.—Carapace elongate-oblong in lateral outline; dorsal margin broadly and smoothly arched, with obscurely indicated posterodorsal angle; greatest height located at midlength; anterior margin narrowly and evenly rounded; ventral indentation deep and somewhat angulate; posteroventral margin not upswung posteriorly; posterior margin broadly and obliquely rounded, forming somewhat truncate angle of about 72°; zone of concrescence fairly wide; patch pattern consisting of three variable spots.

Male fifth limbs very asymmetrical, with tiny pegs and long dorsal seta; distal hook robust and recurved at 66° in right limb, reduced almost to nothing and curved at 151° in left limb. Female fifth limb slender with fairly long claws. Dorsodistal claw of sixth limb about two-thirds as long as mediodistal claw. Recurved seta of seventh limb rather short, reaching only to middle of podomere II, lined with very fine hairs decreasing in size distally. Furcae rather short, straight, rapidly tapering, with small proximal setae. Hemipenis oblong with rounded outlines, with short lobate anterodorsal lamellar flap; copulatory rod fairly short, irregularly bent. Zenker's organ with very small terminal bulb; vas deferens arranged in three loose loops, almost as long as Zenker's organ.

Comparisons.—Mn. bermudae is much smaller and more elongate than most other species. It is somewhat similar in shape to *Mn. hortuli,* which also occurs in Bermuda, but is smaller and more elongate, with a more angulate, truncate posterior and dorsal outline and deeper ventral indentation; it also has less tapering male fifth limbs and a slightly less elongate hemipenis with a lobate rather than triangular anterodorsal lamellar flap. *Mn. caiman, Mn.* sp. 44, and *Mn. succinea* are proportionally higher and less equilateral, with more highly arched dorsal margins and more tapering posterior angles. *Mn. succinea* also has more sinuate, more tapering male fifth limbs. *Mn. vargata* is similar in size and in its angulate anterior and posterior outlines but is more highly arched dorsally, with a more or less distinct dorsal angle but no posterodorsal angle.

MACROCYPRINA BONADUCEI new species

Graph 59; Figures 16.33, 17.32, 21.9, 23.12, 24.44; Plates 54.3,4, 55.2,3, 81.1

?*Macrocypris* sp. BONADUCE et al., 1980, p. 144.

Derivation of name.—For Gioacchino Bonaduce, who collected and loaned the specimens.

Material.—Nineteen empty valves.

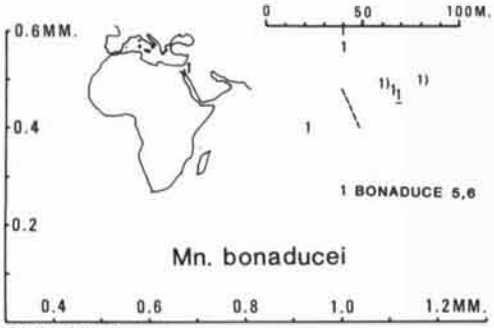
Types.—Holotype 2264RV USNM 240830, paratypes USNM 240831–240835.

Type locality.—Bonaduce 5, Gulf of Aqaba, Sansone II, station 1, southeast coast of Sinai between Sharm-el-Sheikh and Na'ama, at Fiasko Reef, depth 40 m.

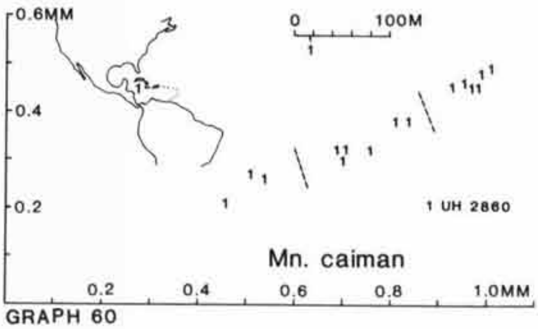
Occurrence.—At Bonaduce 5, 5 specimens; at Bonaduce 6, 14 specimens.

Distribution.—Holocene; Gulf of Aqaba, known dead depth range 15–40 m.

Dimensions.—Holotype 2264, RVL 1.11 mm, RVH 0.47 mm. See also Graph 59.



GRAPH 59



GRAPH 60

Diagnosis.—Carapace elongate-subtriangular in lateral outline, inequilateral; dorsal margin steeply arched with more or less distinct dorsal angle, located at or slightly anterior to midlength; anterior margin evenly rounded and slightly truncate; ventral indentation fairly deep, broad, angulate; posteroventral margin slightly upswung; posterior margin broadly and obliquely rounded, posterior angle slightly truncate, about 45° to 50°; zone of concrescence irregularly broad; patch pattern consisting of four irregular, small scars.

Comparisons.—Mn. bonaducei is slightly higher and more broadly rounded anteriorly and posteriorly than *Mn. captiosa,* with smaller, separate, opaque spots and a less angulate ventral indentation. It is much smaller than *Mn. okinawae,* with a less prominent dorsal angle and less narrowly terminated posterior end. It is larger, less elongate, and more deeply indented ventrally than the species reported as "*Macrocypris* sp." by Bonaduce et al. (1976), which is another species of *Macrocyprina* that also occurs in the Gulf of Aqaba.

MACROCYPRINA CAIMAN new species

Graph 60; Figures 16.19, 17.20; Plates 44.5,6, 45.6

Derivation of name.—Spanish *caiman,* of Arawakan and Cariban origin, the American alligator, to be treated as an indeclinable Latin noun; for the Cayman Islands, where the species lives.

Material.—27 empty carapaces and valves.

Types.—Holotype specimen 2418RV USNM 240836, paratypes USNM 240837–240838.

Type locality.—UH 2860, Grand Cayman Island, off south end, in coralline sand, depth 18 m.

Occurrence.—At UH 2860, 27 specimens.

Distribution.—Holocene; Grand Cayman Island, in coralline sand, depth 18 m.

Dimensions.—Holotype specimen 2418, RVL 0.97 mm, RVH 0.45 mm. See also Graph 60.

Diagnosis.—Carapace small, inequilateral in lateral outline; dorsal margin high-arched, smoothly curving; anterior margin narrowly rounded; ventral margin moderately indented, only slightly upswept posteriorly; posterior angle of about 45° broadly rounded, slightly flared; zone of concrescence broad, vestibules correspondingly small; patch pattern of three variable spots.

Comparisons.—*Mn. caiman* is much smaller and proportionally higher than most other species. It is most similar in size and shape to *Mn.* sp. 44 of St. Croix but has a more evenly and narrowly rounded anterior margin and tapers to a narrower posterior angle. *Mn. hawkae, Mn. schmitti,* and *Mn. belizensis* are much larger and more elongate, with more sinuously flared posterior angles and more evenly rounded anterior margins, and they also tend to have larger, more irregular opaque spots. *Mn. propinqua* is slightly larger and more elongate, with a more broadly rounded, truncate anterior margin and less flared posterior angle.

MACROCYPRINA CAPTIOSA new species

Graph 61; Figures 16.34,35, 17.33,34, 21.5, 24.43, 28.27–30, 31.6, 35.13, 45.11, 47.15, 68.16, 80.33; Plates 52.7–9, 53.8–10, 81.2,3, 96.14–17, 108.5,6,8,9

Derivation of name.—Latin *captiosus,* fallacious, deceptive; because adults are the same size and nearly the same shape as juveniles of *Mn. madagascarensis,* with which they occur.

Material.—Eleven valves and carapaces, including 4 with fragmentary, dry soft parts.

Types.—Holotype male specimen 2351M USNM 240839, paratypes USNM 240840–240847.

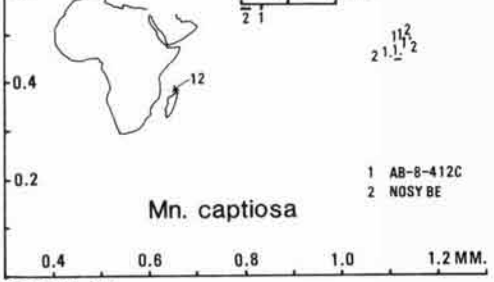
Type locality.—*Anton Bruun* cruise 8 station 412C, 12°47'S, 47°42'E, depth 23 m, near Nosy Be, Madagascar.

Occurrence.—At AB-8-412C, 4 live plus 2 specimens (3M, 1F); at Nosy Be 230, 1 specimen; at Nosy Be 366, 2 specimens; at Nosy Be 381, 2 specimens.

Distribution.—Holocene; Nosy Be, Madagascar, known live at 1 m and dead depth range 1 to 23 m.

Dimensions.—Holotype male specimen 2351M, RVL 1.12 mm, RVH 0.46 mm, LVL 1.10 mm, LVH 0.47 mm. See also Graph 61.

Diagnosis.—Carapace elongate-subtriangular; dorsal margin high-arched, smoothly curving, broadly domed; anterior margin fairly broadly and evenly rounded; ventral indentation deep, angular; posteroventral margin straight or nearly so, not upswung posteriorly; posterodorsal margin steeply sloping or slightly sinuate; posterior angle narrowly rounded, slightly flared, about 50°; zone of concrescence broad, irregular; patch pattern consisting of three irregular spots, which may be joined by a central, less opaque streak.



GRAPH 61

Male fifth limbs with small pegs, long dorsal seta, and narrow distal hook recurved at 89° in right limb and 42° in left limb. Female fifth limb of average proportions with rather short, very thick distal claws; dorsodistal claw about half as long as exceptionally thick mediodistal claw. Seventh limb with recurved seta lined proximally with fine hairs, which abruptly give way at about midlength to four coarse barbs, after which the barbs decrease regularly in size to fine distal hairs. Furcae fairly short, thin, bowed only near tips. Hemipenis rounded-subtriangular in outline, with nearly straight posterior and slightly concave anterior margins, anterodorsal margin bluntly rounded; copulatory rod fairly long, curved. Zenker's organ with long muscularized portion, very small terminal bulb; vas deferens arranged in about eight long loose loops, varying in size from two-thirds as long to as long as Zenker's organ.

Comparisons.—Adults of *Mn. captiosa* are the same size as the A–1 instar of *Mn. madagascarensis* but can be distinguished by the much more deeply indented ventral margin, the more narrowly rounded anterior margin, and the less flared posterior angle; also the male fifth limbs are less robust and less angulate. *Mn. moza,* which also occurs near Nosy Be, is even smaller, has a nearly straight ventral margin with almost no ventral indentation, a more angulate posterior margin, and more robust, angulate male fifth limbs. *Mn. okinawae* is much larger with a distinct dorsal angle and more sinuous contours. *Mn. africana* is larger, less deeply indented ventrally, proportionally more elongate, and has similarly elongate male fifth limbs but more recurved distal hooks. The sinuate-subtriangular hemipenis without accessory lamellar flaps is unique and diagnostic.

MACROCYPRINA DECORA (Brady, 1866)

Cytherideis (Cytherideis) decora Brady, 1866, p. 366, pl. 57, fig. 13a–c.

Not *Macrocypris decora* (Brady) Brady, 1880, p. 44, pl. 1, fig. 3a–d, pl. 6, fig. 8a, b; Brady, 1890, p. 492; A. Scott, 1905, p. 370; Chapman, 1907, p. 6; Brady, 1911, p. 595; Müller, 1912, p. 122; Chapman, 1914, p. 29; Chapman, 1915, p. 37; Chapman, 1916, p. 351; Chapman, 1919, p. 20; Chapman, 1926, p. 128; Chapman and Crespin, 1928, p. 168; Chapman, 1941, p. 194; Crespin, 1941, p. 254; Crespin, 1943, p. 101; Crespin, 1944, p. 17; van den Bold, 1946, p. 65, pl. 1, fig. 14; Key, 1954, p. 219, pl. 3, fig. 10, pl. 6, fig. 4; Tressler, 1954, p. 432; van den Bold, 1958, p. 397, pl. 1, fig. 2; van den Bold, 1963, p. 365; Benson, 1964, p. 416; van den Bold, 1965, p. 386; Baker and Hulings, 1966, p. 119, pl. 3, fig. 15; Hulings, 1967c, p. 94; Bhatia et al., 1972, p. 37; Ishizaki, 1977, table 4; De Deckker and Jones, 1978, p. 132; Khosla, 1978, p. 262, pl. 2, fig. 10; Hanai et al., 1980, p. 120; Zhao and Wang, 1988, fig. 5, 7.

Not *Macrocyprina decora* (Brady) VAN DEN BOLD, 1968, p. 19.

Not *Macrocypris* sp. cf. *M. decora* (Brady) HORNIBROOK, 1952, p. 16; EAGAR, 1971, p. 54.

Not *Macrocypris* sp. aff. *M. decora* (Brady) VAN DEN BOLD, 1971, p. 336, 338; VAN DEN BOLD, 1973, table 1; VAN DEN BOLD, 1975, table 1.

Material.—No authentic material could be located.

Types.—No primary types of this species are present in the G. S. Brady cabinet of the Hancock Museum, Newcastle-upon-Tyne. The slide labeled "*Cytherideis maculata* & *decora* (Brady), Australia, West Indies" contains only a single specimen, a juvenile left valve that is much more elongate than Brady's illustrations. Two other slides labeled "*Macrocypris decora* Brady" contain material from *Challenger* stations 122 and "Nares Harbour, Admiralty Islands" of Brady (1880).

Type locality.—Brady (1866) reported it as "Australia, 17 fathoms (Prof. Juke's soundings)." The exact location of this sounding is not known.

Dimensions.—Brady (1866) reported a length of 1.05 mm for this species.

Remarks.—Brady (1866) stated that this species was "closely related to *Cythere minna* Baird," except smaller and with a less acute posterior angle. In later papers it is clear that Brady's concept of this species was equivalent to the total present contents of the genus *Macrocyprina*. He subsequently reported it worldwide, from material that represents many different species of *Macrocyprina*. Later authors also have designated a great many distinct species of *Macrocyprina* by this name. McKenzie (1967b, unpublished manuscript) assigned the species to *Macrocyprina* in his list of the G. S. Brady cabinet.

It is perplexing, therefore, to note that Brady's original illustrations (1866, pl. 47, fig. 13a–c) appear to represent a paracypridine rather than a macrocypridid ostracode. Figure 13a shows that the greatest height is located distinctly behind midlength, which is found in no other *Macrocyprina* but is possible for a paracypridine or cytheracean. The muscle-scar pattern was described by Brady as "lucid spots arranged in an obliquely transverse row near the centre of the carapace"; his figure 13c shows this clearly. This pattern is most easily interpreted as the cytheracean vertical row of four scars, but the lateral outline is unusual for a cytheracean. Alternatively, a small dot below and behind this row of scars in Brady's illustration can be interpreted as an indistinct, imperfectly seen scar, in which case the scar pattern could be that of the Subfamily Paracypridinae, with the posterior two scars drawn as one scar by the artist. Other features of the drawing are also puzzling. Numerous normal pore canals have been represented as dots; the pores of Paracypridinae are often large enough to draw in this conspicuous manner, but those of Macrocyprididae never are. No patch pattern is drawn, a character invariably seen in fresh specimens of *Macrocyprina* but not in Paracypridinae. Brady described the surface as "smooth, with scattered hairs," and yet the setae associated with the normal pore canals of Macrocyprididae are so tiny that they can be seen only under the SEM or at extremely high magnification. Lines at the anterior and posterior margins may be intended to indicate long, complexly branching radial pore canals, as seen from the exterior in reflected light. Such regularly arranged bundles of canals are not known in *Macrocyprina* but would be appropriate for the paracypridine genus *Paracypris* and its relatives. Brady's figure 13b, labeled as an interior view, shows an extremely narrow calcified inner lamella, too narrow for the adult or any of the last five instars of *Macrocyprina*. In most Paracypridinae, on the other hand, the calcified inner lamella is extremely narrow or very fragile until the adult stage. Brady's figure 13c, a dorsal view of this right valve, seems to show an adont hinge appropriate for Paracypridinae, rather than the distinctive macrocypridid hinge, and it certainly lacks the sinuous curvature of the dorsal valve-contact line that characterizes Macrocyprididae. In sum, the characters of the original illustrations are most appropriate for *Paracypris* or a related genus of Paracypridinae.

Apparently, there is no type material, and the type locality was not specified precisely enough to be recollected for topotypes. The concept associated with *Mn. decora* has been as broad as the entire genus *Macrocyprina*, which may contain hundreds of living species, and no taxonomist with a narrow concept for species of *Macrocyprina* has referred any material to this species. None of the known Australian or West Indian species of *Macrocyprina* resemble Brady's illustration.

The International Code of Zoological Nomenclature expressly forbids the designation of neotypes except when strictly necessary to conserve stability. That is not the case here. Past usage of the name *decora* can hardly be described as stable, nor are there other than sentimental reasons to retain Brady's name. I recommend that *Macrocyprina decora* (Brady, 1866) be ignored as a *nomen dubium* and that no further material be referred to this species.

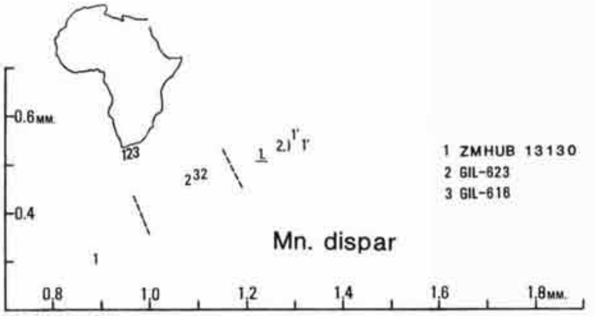
MACROCYPRINA DISPAR (Müller, 1908)

Graph 62; Figures 16.41,42, 17.40,41, 21.2, 28.17,18, 31.23, 35.15, 45.16, 47.18, 52.28, 53.23, 69.7, 74.4, 77.3, 79.5; Plates 54.10–12, 55.10–12, 96.7,8, 109.1,2, 112.2

Macrocypris dispar MÜLLER, 1908, p. 96, pl. 13, fig. 1–7; MÜLLER, 1912, p. 121; HARTMANN and HARTMANN-SCHRÖDER, 1975, p. 360, table 4.

Material.—Four type specimens, including 1 male, 2 females, and 1 juvenile; and four empty valves; for a total of 8 specimens.

Types.—Müller's syntypes include three dissection slides, type-series 13130, in the Zoological Museum of the Humboldt University of Berlin. Each has the soft parts and valves of one specimen imbedded in Canada balsam. Each



GRAPH 62

slide is labeled "*Macrocypris dispar,* (13130), 1741, Gauss-Exp., 217, 1-4.7.03." There are two females and one male, labeled correctly on the slides, rather than one female and two males as reported by Müller. The male, bearing my specimen number 1933M, is here chosen as the lectotype. The females, bearing my specimen numbers 1931F and 1932F, are here designated paralectotypes. In addition, there is a vial labeled "Nr. 13130, *Macrocypris dispar* G. W. Müller, Simonstown, Deutsche Südpolar Exp., 217-1-4.7.4." This vial contains one undissected, juvenile, paralectotype specimen with decalcified carapace in alcohol.

The new material for this species is catalogued as USNM 240848–240850.

Type locality.—Near Simonstown, South Africa. Müller did not give the exact location or depth.

Occurrence.—In ZMHUB 13130, 4 live specimens (1M, 2F, 1J); at GIL 616, 1 specimen tentatively identified; at GIL 623, 3 specimens tentatively identified.

Distribution.—Holocene; South Africa. Hartmann and Hartmann-Schröder (1975) listed this species in a table but found no additional specimens in their coastal South African collections (Gerd Hartmann, personal communication).

Dimensions.—Lectotype male specimen 1933M, RVL 1.23 mm, RVH 0.52 mm, LVL 1.23 mm, LVH 0.46 mm. See also Graph 62. Müller reported a length of 1.25 mm for both male and female.

Diagnosis.—Carapace subovate-oblong in lateral view; dorsal margin highly arched, smoothly curving; anterior margin moderately and evenly rounded; ventral indentation broad; posteroventral margin curving upward to a very broadly and obliquely rounded posterior angle of about 50°, not flared; zone of concrescence fairly narrow, even; patch pattern consists of a broad, high, roughly triangular central opaque region.

Male fifth limbs fairly large, elongate, with elongate pegs, long dorsal setae, and blunt distal hooks recurved at 56° in right limb and 37° in left limb. Female fifth limb slender with comparatively long claw on podomere IV; dorsodistal claw rather long and mediodistal claw rather short, so that all four claws terminate at nearly the same position. Sixth limb with rather slender claws; dorsodistal claw about half as long as mediodistal claw. Seventh limb with very long, recurved seta, lined proximally with fine hairs, in midsection with more widely spaced, coarser barbs, and distally with fine hairs again. Furcae fairly robust, straight, bowed near tips, with long proximal setae. Hemipenis oblong with sinuously indented anterior margin, with small anteroventral and larger anterodorsal lobate lamellar extensions; copulatory rod long, curved. Zenker's organ with very tiny terminal bulb; vas deferens arranged in three loose loops that are as long as Zenker's organ.

Comparisons.—*Mn. dispar* is smaller than *Mn. africana* but fairly similar in carapace shape, differing in the more broadly, more evenly rounded anterior and posterior margins and the deeper ventral indentation; it also has slightly thicker male fifth limbs with less recurved distal hooks and has much smaller anterodorsal and anteroventral lamellar extensions on the hemipenis. The scalloped anterior profile of the hemipenis is unique among the species studied.

Remarks.—The small number of adult specimens available for study makes it difficult to diagnose this species on carapace characters. The tentatively identified specimens in the GIL samples are juveniles.

Müller (1908, p. 97, pl. 13, fig. 6, 7) remarked on some small differences between the male and female furcae, such as sizes of proximal setae, stating that sexual dimorphism of the furca was unknown in Macrocyprididae and rare in other ostracodes. Sexual dimorphism is now demonstrated in the furcae of *Macrocypris* and *Macromckenziea* and suspected in some species of other genera (see Figures 46 and 47). Nevertheless, as Müller pointed out, more than four specimens will be needed to evaluate the significance of the variability in *Macrocyprina dispar.* In any case, the posterior setae are very tiny and often obscured by the edge of the ramus, so their absence from a drawing is not always significant.

MACROCYPRINA HARTMANNI new species

Graph 76; Figures 16.26,27, 17.26,27, 21.3, 23.11, 24.45, 28.25,26, 31.20, 35.14, 45.12, 47.19, 52.26,27, 53.1,2, 56.22, 57.14, 59.7,24, 62.3, 63.16, 64.21,37, 68.17, 80.34; Plates 50.3,4, 51.4,5, 81.4, 84.5, 96.9,10, 109.20–24, 112.1,10

Derivation of name.—For Gerd Hartmann, who collected and loaned the specimens.

Material.—Six specimens in alcohol, including 1 male, 2 females, 2 juveniles, and 1 empty valve.

Types.—Holotype male specimen 2130M UHZM (FZ)K-33987, (DP)K-33987A; paratypes UHZM K-33988–K-33992.

Type locality.—UHZM K-31358, Goode Beach, Frenchmans Bay, near Albany, southwestern Australia, September–October 1975.

Occurrence.—In UHZM K-31358, 5 live plus 1 specimens (1M, 2F, 2J).

Distribution.—Holocene; near Albany, southwest Australia.

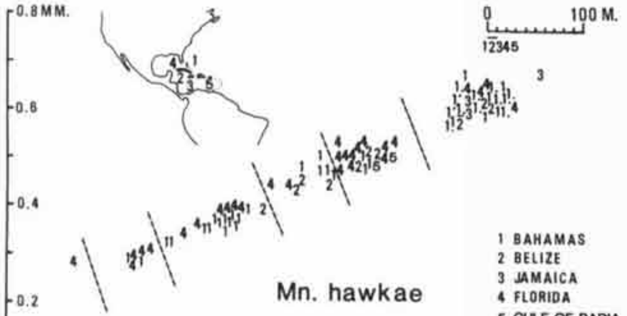
Dimensions.—Holotype male specimen 2130M, RVL 1.22

mm, LVH 0.51 mm, LVL 1.21 mm, LVH 0.52 mm. See also Graph 76.

Diagnosis.—Carapace of moderate size, elongate-oblong in lateral outline; dorsal margin low-arched, smoothly curving; anterior margin narrowly but evenly rounded; ventral margin deeply indented, rather angulate; posteroventral margin straight, not upswung posteriorly; posterior angle narrowly and obliquely rounded, not flared, about 50° to 58°; zone of concrescence broad, irregular, vestibules slightly constricted; patch pattern consists of three irregular opaque spots connected by a less opaque, linear central band.

Male fifth limbs somewhat asymmetrical, with elongate ventral pegs and dorsal setae; short distal hook recurved at 64° in right limb and 79° in left limb. Female fifth limb very slender and elongate, with long, slender claws. Sixth limb with dorsodistal claw more than four-fifths as long as mediodistal claw. Seventh limb with short recurved seta, reaching about to the middle of podomere II, lined with long fine hairs proximally, which thicken and lengthen in midsection before decreasing again in size toward the distal tip. Furcae long, slender, gracefully curved with conspicuous proximal setae and well-demarcated terminal portions. Hemipenis elongate, with scoop-shaped, folded, subtriangular, ventral lamellar extension, and an overlapping anterodorsal lamellar lobe; copulatory rod short, nearly straight. Zenker's organ long, thick, without differentiated terminal bulb; vas deferens arranged in short loops, less than half as long as Zenker's organ.

Comparisons.—*Mn. hartmanni* is distinguished from most other species by its elongate shape and acutely tapering posterior end. It is slightly smaller than *Mn. quadrimaculata,* with a more deeply indented, less sinuous ventral margin and more evenly rounded anterior margin. *Mn.* sp. 35 is even more elongate and has a more narrowly rounded anterior margin, although the patch and color patterns are quite similar. The scoop-shaped, triangular lobe that fits around both sides of the ventral margin of the hemipenis is unique among the species studied. Somewhat similar ventral lamellar extensions are developed in *Mh. sinuata, Mh. heroica,* and *Mx. adunca,* but these are only two-dimensional lamellae that do not actually wrap around both the inner and outer faces of the ventral margin. The folded, overlapping ventral tip that is seen in some photographs of *Mh. opaca* results from compression of this curved, ventral, lamellar structure by the cover glass of the dissection mount and is not homologous with these lobate lamellae of *Mn. hartmanni.*



GRAPH 63

MACROCYPRINA HAWKAE new species

Graph 63; Figures 16.11,12, 17.11,12, 21.15, 23.7, 28.14–16, 31.18, 35.10, 45.7, 47.20, 54.11–14, 55.11–13, 69.8, 80.30; Plates 48.1–6, 49.1–6, 81.5, 97.15–18, 109.16,17

Derivation of name.—For Lois Hawk, who helped as a graduate research assistant in this study.

Material.—Thirteen dry carapaces and valves with dried remains of body and appendages; and 203 empty ones; for a total of 216 specimens.

Types.—Holotype male specimen 1817M USNM 240851, paratypes USNM 240852–240874; HVH 10880–10891; KUMIP 1,124,674–1,124,763.

Type locality.—UH 2371, near Man O' War Cay, Bahamas, in about 5 m of water.

Occurrence.—At UH 2371, 13 live plus 51 specimens (11M, 2F); at UH 2376, 5 specimens; at UH 2638, 5 specimens; at UH 2648, 3 specimens; at UH 2740, 89 specimens; at UH 2742, 17 specimens; at UH 2744, 5 specimens; at UH 2963, 1 specimen; at UH 2973, 2 specimens; at Fithian st. 1040, 1 specimen; at Fithian st. 1041, 1 specimen; at Fithian st. 1047, 1 specimen; at Fithian st. 1055, 1 specimen; at Fithian st. 1076, 2 specimens; at Fithian st. 1108, 1 specimen; at Fithian st. 1109, 1 specimen; at Fithian st. 1185, 4 specimens; at Fithian st. 1189, 2 specimens; at Fithian st. 1200, 2 specimens; at Fithian st. 1202, 5 specimens; at Fithian st. 1203, 1 specimen; at Fithian st. NT, 3 specimens.

Distribution.—Holocene; Bahamas, Jamaica, Florida Keys, Belize, Honduras, and Gulf of Paria, known live at 1 m, dead depth range 1 to 183 m.

Dimensions.—Holotype male specimen 1817M, RVL 1.34 mm, RVH 0.60 mm. See also Graph 63.

Diagnosis.—Carapace large, elongate-oblong in lateral outline; dorsal margin highly and evenly arched; anterior margin broadly and evenly rounded; ventral indentation deep, sinuate; posteroventral margin not upswung or only slightly so; posterodorsal margin slightly concave; posterior angle broadly rounded and slightly flared, about 50°; zone of concrescence very broad, anterior vestibule slightly constricted; patch pattern of three large, irregular scars, middle scar tending to fuse with a dorsal opaque spot.

Male fifth limbs very asymmetrical. Right limb large, robustly proportioned, with thick ventral pegs, long dorsal seta, and thick, angulate distal hook recurved at 78°. Left limb bizarre, highly specialized; podomere II sinuously flared and bell-shaped distally, terminating in an ovate distal surface densely armed with short spines or tubercles, and with small ventral pegs, but with distal hook almost totally reduced, represented only by vestigial, triangular extension. Female fifth limb robustly proportioned, with short, thick claws. Sixth limb with rather short, thick dorsodistal and mediodistal claws of nearly equal length. Furcae tapering, curved at tips. Hemipenis oblong, with broad, blunt, irregularly lobate anterior lamellar extension; copulatory rod fairly short, straight. Zenker's organ long, with tiny terminal bulb; vas deferens arranged in three loose loops about as long as Zenker's organ.

Comparisons.—Mn. hawkae is larger than *Mn. schmitti* and *Mn. belizensis* but similar in shape and patch pattern; it differs by its proportionally higher, more exaggerated, sinuate shape and especially by the slightly concave posterodorsal margin. *Mn. propinqua* and *Mn. caiman* are even smaller, with more narrowly rounded, more truncate anterior and posterior margins and shallower ventral indentation. The hemipenis is fairly similar to that of *Mn. schmitti* but deeper, with a deeper, broader, irregular anterior extension. The grotesque, vestigial, brushlike, hirsute male left fifth limb is unique.

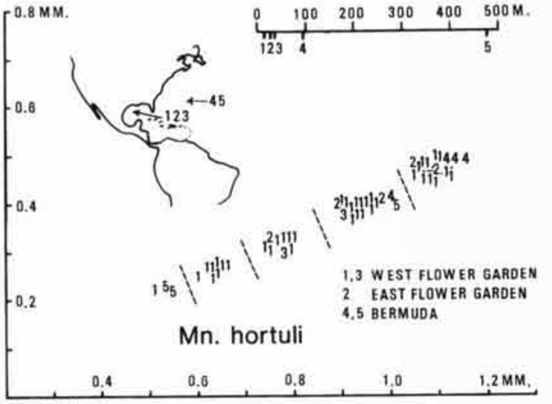
MACROCYPRINA HORTULI new species

Graph 64; Figures 16.3,4, 17.3,4, 21.10, 23.3, 24.37, 28.12,13, 31.17, 35.6, 45.3, 47.21, 54.17–20, 55.16–19, 68.8, 80.36; Plates 46.1,2,7, 47.1,2,7,8, 77.1,2, 81.6–8, 97.1–4, 109.3,7,8, 112.9

Macrocyprina sp. MADDOCKS, 1974, p. 208, pl. 1, fig. 14–16, 19.

Derivation of name.—Latin *hortulus, -i,* a little garden; named for the East and West Flower Gardens, two shelf-edge coralline banks in the northwestern Gulf of Mexico.

Material.—Four specimens in alcohol, including 3 males and 1 female; and 96 empty carapaces and valves; for a total of 100 specimens.



GRAPH 64

Types.—Holotype male specimen 1762 USNM 240875, paratypes USNM 240876–240877; and KUMIP 1,124,764–1,124,780.

Type locality.—UH 2433, West Flower Garden, sand flat among coral masses, depth 21–24 m.

Occurrence.—At UH 166, 4 specimens; at UH 1220, 19 specimens; at UH 1264, 1 live plus 4 specimens (1M); at UH 1494, 1 specimen; at UH 1495, 16 specimens; at UH 1510, 3 specimens; at UH 1511, 1 specimen; at UH 1559, 1 specimen; at UH 1571, 5 specimens; at UH 1613, 1 live plus 14 specimens (1M); at UH 1617, 3 specimens; at UH 1985, 7 specimens; at UH 2018, 18 specimens; at UH 2433, 2 live specimens (1M, 1F).

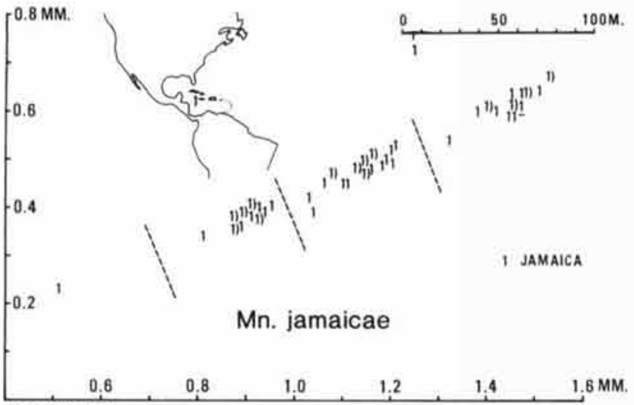
Distribution.—Holocene; East and West Flower Gardens, northwestern Gulf of Mexico, and Bermuda; known live depth range 21 to 27 m, dead from 5 to 96 m.

Dimensions.—Holotype male specimen 1762M, RVL 1.08 mm, RVH 0.46 mm, LVL 1.06 mm, LVH 0.46 mm. See also Graph 64.

Diagnosis.—Carapace fairly small, oblong in lateral outline, subequilateral; dorsal margin low-arched without any angles; anterior margin narrowly rounded, slightly truncate; ventral margin broadly indented; posteroventral margin not upswung; posterior angle broadly and obliquely rounded, slightly truncate, not flared, about 55° to 60°; patch pattern of three small spots; zone of concrescence of moderate width.

Male fifth limb slender, with tiny pegs and long dorsal seta; right limb with gracefully tapering distal hook recurved at 81°; left limb with distal hook much reduced, acutely tapering, and curved at 142°. Female fifth limb slender with slender claws. Sixth limb with dorsodistal claw nearly as long as mediodistal claw. Recurved seta of seventh limb short, reaching only to the middle of podomere II, lined with fine hairs that decrease regularly in size. Furcae tapering to blunt tips, only slightly curved, with tiny proximal setae. Hemipenis oblong, with small, triangular anterodorsal lamellar extension; copulatory rod fairly long, sinuate. Zenker's organ very long, with small terminal bulb; vas deferens arranged in three loose loops that are nearly as long as Zenker's organ.

Comparisons.—Mn. hortuli is only slightly smaller than *Mn. skinneri* but is proportionally less high, with a lower dorsal margin and less tapering posterior. *Mn. bermudae* is somewhat similar in shape but much smaller and even more elongate; it also has more compact, reduced male fifth limbs. *Mn. propinqua* is a little smaller, with a higher-arched dorsal margin, narrower posterior angle, and broader, more irregular zone of concrescence, as well as more sinuous, more acutely tapering male fifth limbs. The hemipenis of *Mn. hortuli* is very similar in its structure to that of *Mn. bermudae* and *Mn. skinneri,* with only slight differences in proportions. *Mn. schmitti, Mn. belizensis,* and *Mn. hawkae* are much larger, with more sinuate, inequilateral outlines, and more reduced, specialized male fifth limbs.



GRAPH 65

MACROCYPRINA JAMAICAE new species

Graph 65; Figures 16.32, 17.30, 21.14, 23.8, 24.41, 54.37,38, 55.20,21; Plates 50.7–10, 51.8–11, 81.9,10

Derivation of name.—For the island of Jamaica.

Material.—Forty-five empty carapaces and valves.

Types.—Holotype specimen 1835RV USNM 240900, paratypes USNM 240901–240913; and KUMIP 1,124,781–1,124,787.

Type locality.—UH 2648, Jamaica, fore-reef sand near Negril, depth 1 m.

Occurrence.—At UH 2638, 7 specimens; at UH 2645, 15 specimens; at UH 2648, 23 specimens.

Distribution.—Holocene; Jamaica, in coralline sand, known dead depth range 1 to 6 m.

Dimensions.—Holotype specimen 1835, RVL 1.47 mm, RVH 0.61 mm. See also Graph 65.

Diagnosis.—Carapace large, elongate-subtriangular in lateral outline, with sinuous contours; dorsal margin steeply arching to more or less distinct dorsal angle, located at or slightly posterior to midlength; anterior margin broadly and obliquely rounded, slightly truncate; ventral margin sinuate, with small ventral indentation; posteroventral margin slightly upswung; posterior angle broadly and evenly rounded, truncate and slightly flared, about 40°; patch pattern of three irregular spots, anterior spot tending to divide; zone of concrescence broad, irregular.

Comparisons.—*Mn. jamaicae* is larger than any other known Caribbean species and easily distinguished by the elongate, subtriangular, subequilateral shape and nearly straight, weakly sinuate ventral margin. *Mn. madagascarensis* is similar but smaller and more elongate, with a more prolonged posterior angle. *Mn. noharai* is smaller and more elongate, with a more broadly and deeply indented ventral margin and a more pointed, upturned posterior angle.

MACROCYPRINA MACULATA (Brady, 1866)

Cytherideis (Cytherideis) maculata Brady, 1866, p. 367, pl. 57, fig. 12a,b.

Not *Macrocypris maculata* (Brady) Brady, 1868c, p. 179; Brady, 1867–1871, p. 152; Brady, 1880, p. 44, pl. 1, fig. 2a–d; A. Scott, 1905, p. 370; Müller, 1912, p. 124; T. Scott, 1912, p. 581, pl. 14, fig. 1, 2; Chapman, 1915, p. 51; Chapman and Crespin, 1928, p. 168; Tressler, 1954, p. 433; Benson, 1964, p. 403; van den Bold, 1966, p. 46, pl. 1, fig. 3; Hulings, 1967c, p. 94; Ishizaki, 1977, table 4; van den Bold, 1977, p. 182; De Deckker and Jones, 1978, p. 133; Hanai et al., 1980, p. 120.

Not *Macrocyprina maculata* (Brady) Bhatia et al., 1972, p. 37.

Material.—No useful material could be located for this species.

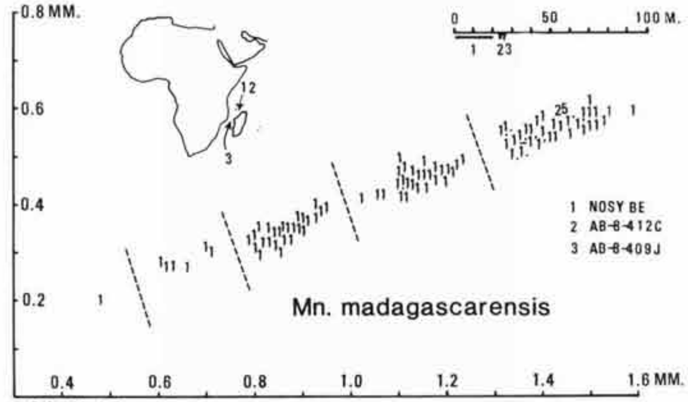
Types.—There is just one slide for this species in the G. S. Brady cabinet in the Hancock Museum, Newcastle-upon-Tyne. It is labeled "*Cytherideis maculata* & *decora* (Brady), Australia, West Indies." It contains only one specimen, an opaque, juvenile left valve, on which the patch pattern and marginal features cannot be seen (see Plate 51.7). As the specimen is quite useless for determining to which of the many Australian and West Indian species of *Macrocyprina* this name should apply, I am not designating it as the lectotype of either species.

Type locality.—Unknown. Brady (1866) reported it as "Australia, West Indies."

Dimensions.—For the juvenile specimen in the Brady collection, LVL 1.01 mm, RVH 0.43 mm. Brady (1866) reported a length of 1/23 inch (1.16 mm).

Remarks.—There has never been any consensus among later workers or even among Brady's own later papers as to the diagnostic characters of this species, except that it was obviously an elongate species of *Macrocyprina*. Brady's (1866) original illustrations clearly show three opaque spots, but the illustrated specimen apparently has not survived. Brady's (1880) specimens and illustrations belong to other species of *Macrocyprina*. Later workers have used the name *maculata* for several different species of *Macrocyprina* and for very young juveniles of other macrocypridid genera. The single juvenile reported by this name by van den Bold (1966) from Colon Harbour, Panama, is fairly similar in size, proportions, and anterior shape to the Hancock Museum specimen but has a slightly more broadly rounded anterior margin and a more elongated, pointed posterior end. See *Mn.* sp. 48, described below (Plate 59.7). These small but significant differences, the absence of adults, and the uncertainty of provenance for Brady's species prevent identification of these specimens.

None of the well known West Indian species of *Macrocyprina* of this size are sufficiently elongate to have provided the illustrations of Brady (1866). Of the named species described in this report, *Macrocyprina hartmanni* and *Mn. skinneri* are the most similar in size and shape, but there is no evidence that either is the species Brady meant to describe. Usage of *maculata* has not been stable, and only sentiment urges retention of Brady's name. Common



GRAPH 66

sense concludes that *Mn. maculata* should be ignored as a *nomen dubium.*

MACROCYPRINA MADAGASCARENSIS new species

Graph 66; Figures 16.39,40, 17.38,39, 28.8,9, 31.21, 35.12, 45.13, 47.16, 52.39,40, 53.38,39, 57.13, 59.10,23, 62.10, 63.14, 64.20,36, 68.6, 80.29; Plates 52.1–3, 53.1–3,7, 63.17, 77.7–9, 81.11,12, 95.1–6,9, 108.12,16–20, 111.8, 112.13

Species MA Maddocks, 1966, p. 64, fig. 50.
Macrocyrina n. sp. (OTU 20) Maddocks, 1976, p. 42.

Derivation of name.—For the island of Madagascar.

Material.—Sixty-six specimens in alcohol, including 11 males, 11 females, and 44 juveniles; and 432 empty carapaces and valves; for a total of 498 specimens.

Types.—Holotype male specimen 1757M USNM 240914, paratypes USNM 240915–240957; KUMIP 1,000,097, 1,124,788–1,124,921.

Type locality.—Nosy Be 362, washings of green calcareous alga, Lac du Cratère, Nosy Be, Madagascar, 22 July 1964.

Occurrence.—At AB-8-409J, 1 specimen; at AB-8-412C, 1 specimen; at JR-29, 3 live specimens (2M, 1F); at Nosy Be 019, 4 specimens; at Nosy Be 020, 8 specimens; at Nosy Be 023, 1 specimen; at Nosy Be 068, 1 live specimen (1J); at Nosy Be 070, 6 specimens; at Nosy Be 079, 1 live specimen (1J–3); at Nosy Be 089, 1 live specimen (1J–3); at Nosy Be 094, 2 specimens; at Nosy Be 095, 1 live specimen (1J–3); at Nosy Be 117, 2 specimens; at Nosy Be 127, 1 specimen; at Nosy Be 155, 1 live specimen (1F); at Nosy Be 158, 1 live specimen (1J–3); at Nosy Be 159, 2 live specimens (2J); at Nosy Be 212, 9 live specimens (2M, 1F, 2J–1, 1J–2, 3J–3); at Nosy Be 219, 1 live specimen (1J–2); at Nosy Be 220, 11 live specimens (1F, 2J–1, 4J–2, 4J); at Nosy Be 229, 1 live specimen (1J–2); at Nosy Be 230, 2 live specimens (1F, 1J–1); at Nosy Be 248, 8 specimens; at Nosy Be 249, 1 specimen; at Nosy Be 270, 9 live specimens (1M, 2MJ–1, 2FJ–1, 4J); at Nosy Be 271, 1 live specimen (1J–1); at Nosy Be 275, 1 live specimen (1J–2); at Nosy Be 276, 2 live specimens (1F, 1J–2); at Nosy Be 277, 2 live specimens (1M, 1F); at Nosy Be 327, 4 specimens; at Nosy Be 329B, 1 specimen; at Nosy Be 344, 3 specimens; at Nosy Be 353, 1 live specimen (1J–2); at Nosy Be 359, 10 live specimens (3M, 3F, 2J–1, 2J–2); at Nosy Be 361, 7 specimens; at Nosy Be 362, 1 live specimen (1M); at Nosy Be 363, 1 live specimen (1M); at Nosy Be 366, 27 specimens; at Nosy Be 381, 5 specimens; at Nosy Be 382, 4 specimens; at Nosy Be 394, 5 specimens; at Nosy Be 395, 1 specimen; at Nosy Be 400, 26 specimens; at Nosy Be 401, 23 specimens; at Nosy Be 403, 1 specimen; at Nosy Be 404, 6 specimens; at Nosy Be 405, 1 specimen; at Nosy Be 419, 2 specimens; at Nosy Be 427, 2 live specimens (1F, 1J–1); at Nosy Be 465, 6 specimens; at Nosy Be 466, 1 specimen; at Nosy Be 472, 16 specimens; at Nosy Be 473, 1 specimen; at Nosy Be 474, 1 specimen; at Nosy Be 474A, 1 specimen; at Nosy Be 477, 1 specimen; at Nosy Be 478, 4 specimens; at Nosy Be 480, 4 specimens; at Nosy Be 484, 1 specimen; at Nosy Be 487, 1 specimen; at Nosy Be 491, 160 specimens; at Nosy Be 496, 51 specimens; at Nosy Be 497, 20 specimens; at Nosy Be 498, 7 specimens; at Nosy Be 504, 3 specimens; at Nosy Be 508, 1 specimen; at Nosy Be 521, 1 live specimen (1J–2); at Nosy Be 528, 2 specimens.

Distribution.—Holocene; Nosy Be, Madagascar. Live animals were found in washings of calcareous and noncalcareous algae, live coral heads, coralline debris, sponges, and other invertebrates of the fringing reefs, in depths of 1 to 2 m. Empty carapaces and valves are common in reef sands and rare in nearby sandy muds; known dead depth range, 1 to 40 m.

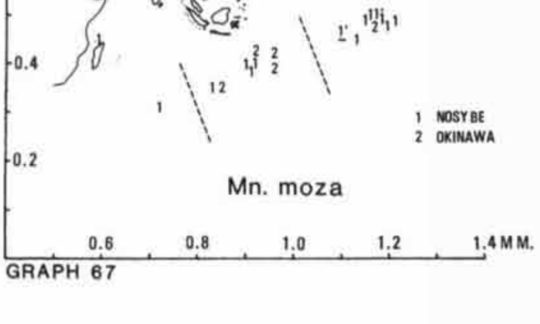
Dimensions.—Holotype male specimen 1757M, RVL 1.36 mm, RVH 0.54 mm, LVL 1.36 mm, LVH 0.53 mm. See also Graph 66.

Diagnosis.—Carapace elongate-oblong in lateral outline, subequilateral, with sinuous contours; dorsal margin broadly but irregularly arched, greatest height located at or slightly behind midlength; anterior margin broadly but obliquely rounded, somewhat truncate; ventral margin weakly sinuate, nearly straight, with or without faint ventral indentation, slightly or not at all upswung posteriorly;

posterodorsal margin nearly straight; posterior angle very broadly rounded, truncate, about 45°; patch pattern of three or four small spots; zone of concrescence fairly broad, irregular; vestibules may be slightly restricted.

Male fifth limbs large, robustly proportioned, not very asymmetrical, with thick pegs, long dorsal setae, and thick, angulate distal hook recurved at 60° in right limb and 49° in left limb. Female fifth limb robust with short thick claws, mediodistal and ventrodistal claws the same length. Sixth limb with tufts of fine hairs on the dorsal surface of podomere II; distal claws rather short and thin, dorsodistal claw about half as long as mediodistal claw. Recurved seta of seventh limb short, reaching only to middle of podomere II, lined with a proximal comb of very fine hairs of regularly decreasing size; these are abruptly interrupted by about four large, sharp barbs, which are followed again by a comb of regularly decreasing barbs to fine distal hairs. Furcae slender, gracefully bowed, with long proximal setae. Hemipenis ovoid, with a thick, projecting anteroventral ridge and other, complex, heavily chitinized anterodorsal protuberances; copulatory rod short, straight. Zenker's organ with very large terminal bulb and rather short muscularized portion; vas deferens arranged in about eight loose loops, about equal in length to Zenker's organ.

Comparisons.—*Mn. madagascarensis* is much larger, more elongate, and more nearly equilateral than either *Mn. moza* or *Mn. captiosa,* which have more deeply indented ventral margins and more tapered posteriors. *Mn. madagascarensis* has larger, more robust, more nearly symmetrical male fifth limbs than most other species of the genus, which are quite similar to those of *Mn. moza* but much larger and more angulate than those of *Mn. captiosa.* The hemipenis of *Mn. madagascarensis* is similar to that of *Mn. moza* but differs in details of the anterodorsal structures, particularly in having thicker projecting anterodorsal and anteroventral ridges separated by a concave region, whereas the corresponding ridges in *Mn. moza* are shorter, and the intervening surface is convex. *Mn. quadrimaculata* is similar but smaller and slightly more elongate, with more pointed posterior angle and more deeply and broadly indented ventral margin. *Mn. jamaicae* is smaller and proportionally higher, with a more evenly rounded posterior angle and more distinct ventral indentation.



GRAPH 67

MACROCYPRINA MOZA new species

Graph 67; Figures 16.37, 17.36, 21.4, 23.10, 24.42, 28.6,7, 31.5, 35.11, 45.14, 47.14, 69.6, 80.31; Plates 52.4–6, 53.4–6, 81.13–15, 95.7,8, 108.3,4,7

Derivation of name.—For the Mozambique Channel; to be treated as an indeclinable Latin noun.

Material.—Thirty carapaces and valves, including one with dry remains of female soft parts.

Types.—Holotype female specimen 2344F USNM 240958, paratypes USNM 240959–240972.

Type locality.—Nosy Be 270, Madagascar, washings of dead coral behind the fringing reef near the beach at the village of Ambatoloaka, water depth 1–2 m.

Occurrence.—At Nosy Be 020, 1 specimen; at Nosy Be 023, 1 specimen; at Nosy Be 094, 1 specimen; at Nosy Be 220, 1 specimen; at Nosy Be 230, 10 specimens; at Nosy Be 248, 1 specimen; at Nosy Be 270, 1 live plus 2 specimens (1F); at Nosy Be 465, 2 specimens; at Nosy Be 474, 1 specimen; at Nosy Be 474A, 1 specimen; at Nosy Be 478, 3 specimens; at Nohara Okinawa station 20, 5 specimens tentatively identified (?).

Distribution.—Holocene; Nosy Be and neighboring islets, Madagascar, and perhaps Okinawa; known live depth range in Madagascar 1 to 2 m, dead to 16 m.

Dimensions.—Holotype female specimen 2344F, RVL 1.10 mm, RVH 0.47 mm, LVL 1.08 mm, LVH 0.46 mm. See also Graph 67.

Diagnosis.—Carapace fairly small, elongate-oblong in lateral outline, inequilateral; dorsal margin broadly arched, with indistinct dorsal and posterodorsal angles, greatest height located at or slightly anterior to midlength; anterior margin evenly rounded, slightly truncate; ventral margin nearly straight except for small but distinct ventral indentation; posteroventral margin not upswung posteriorly; posterior angle narrowly and obliquely rounded, truncate, slightly flared, about 50°; patch pattern of three irregular scars; zone of concrescence of moderate width, irregular, vestibules somewhat restricted.

Male fifth limbs robust, nearly symmetrical, with large ventral pegs and thick, angulate distal hook recurved at 57° in right limb and 49° in left limb. Female fifth limb slender, with thick, fairly short claws. Sixth limb with tufts of fine hairs along dorsal surface of podomere II; dorsodistal claw about two-thirds as long as mediodistal claw. Recurved seta of seventh limb short, reaching only slightly beyond middle of podomere II; lined proximally by extremely fine hairs, too tiny to draw; interrupted by about five very large, angular barbs, which decrease in size distally into fine hairs again. Furcae rather large, slender, curved at tips. Hemipenis ovoid, with projecting, triangular, chitinous anterodorsal and anteroventral ridges and complexly lobate anterior margin; copulatory rod short, nearly straight.

Comparisons.—*Mn. moza* is much smaller and less elongate than *Mn. madagascarensis,* with more narrowly rounded posterior angle and more smoothly curving contours; also with shorter, slightly more sinuate distal hooks on the male fifth limbs, as well as thinner projecting anterodorsal and anteroventral ridges on the hemipenis, separated by a lobate anterior margin. *Mn. captiosa* and *Mn. bonaducei* are similar in general size and shape but have deeper, broader ventral indentations, somewhat upswung posteroventral margins, and more tapered posterior regions; *Mn. captiosa* also has much smaller, less angulate male fifth limbs and a sinuate-triangular hemipenis without projecting anterior ridges.

MACROCYPRINA NOHARAI new species

Graph 68; Figures 16.30,31, 17.29, 21.6, 23.13, 24.46, 52.8–11, 53.3–5, 68.11; Plates 54.1,2, 55.1, 81.16

Derivation of name.—For Mr. Tomohide Nohara, who collected and loaned these specimens.

Material.—One female carapace with dry soft parts, and 18 empty carapaces and valves; for a total of 19 specimens.

Types.—Holotype female specimen 2058F USNM 240973, paratypes USNM 240974–240979, additional paratypes in the personal collection of Mr. Nohara.

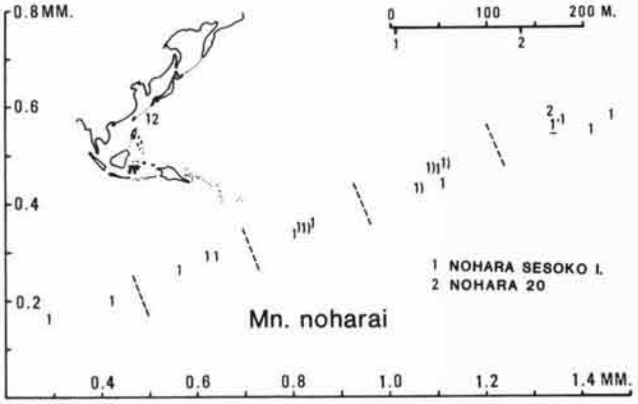
Type locality.—Nohara sample, Sesoko Island, Okinawa, near biological station of Ryukyu University, six samples of sand from fringing reef, depth less than 5 m.

Occurrence.—At Nohara Sesoko Island, 1 live plus 17 specimens (1F); at Nohara station 20, 1 specimen.

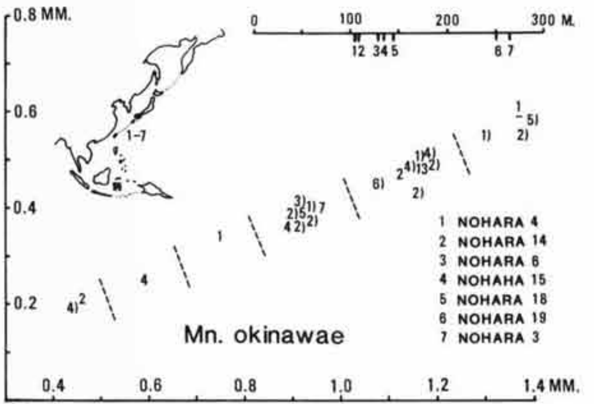
Distribution.—Holocene; fringing reef and continental shelf of Okinawa, known dead depth range 1 to 135 m.

Dimensions.—Holotype female specimen 2058F, RVL 1.34 mm, RVH 0.56 mm. See also Graph 68.

Diagnosis.—Carapace fairly large, elongate-subovate in lateral outline, subequilateral; dorsal margin very broadly and smoothly arched, without any angles; anterior margin broadly but obliquely rounded, obliquely truncate; ventral margin sinuous, with broad but shallow ventral indentation, upswung posteriorly; posterior angle located distinctly above venter, narrowly but evenly rounded, about 45°; anterior zone of concrescence moderately wide, irregular, widened in anterodorsal and anteroventral region; posterior zone of concrescence very wide, both vestibules slightly restricted; patch pattern of three large, irregular spots, the posterior and middle spots tending to fuse.



GRAPH 68



GRAPH 69

Comparisons.—*Mn. noharai* is smaller and more elongate than *Mn. okinawae,* with more truncate anterior margin and without any dorsal angle. It has a deeper ventral indentation and more smoothly curving contours than *Mn. madagascarensis* or *Mn. jamaicae.*

MACROCYPRINA OKINAWAE new species

Graph 69; Figures 16.29, 17.28, 52.3–7, 53.6–8; Plates 54.7, 55.7

Derivation of name.—For the island-group of Okinawa.

Material.—Twenty-five dry specimens.

Types.—Holotype specimen 2068 USNM 240980, paratypes 240981–240989, additional paratypes in the personal collection of Mr. Tomohide Nohara.

Type locality.—Nohara Okinawa continental shelf station 4, 27°16'5"N, 124°50'5"E, depth 106 m.

Occurrence.—At Nohara station 3, 1 specimen; at Nohara station 4, 6 specimens; at Nohara station 6, 2 specimens; at Nohara station 14, 8 specimens; at Nohara station 15, 5 specimens; at Nohara station 18, 2 specimens; at Nohara station 19, 1 specimen.

Distribution.—Holocene; Okinawa continental shelf, known dead depth range 106 to 250 m.

Dimensions.—Holotype specimen 2068, RVL 1.37 mm, RVH 0.61 mm. See also Graph 69.

Diagnosis.—Carapace oblong-subtriangular in lateral outline, inequilateral; dorsal margin highly and somewhat irregularly arched, with fairly distinct dorsal angle located at or slightly behind midlength; anterior margin rather narrowly but evenly rounded; ventral indentation distinct; posteroventral margin gently upswung posteriorly; posterior angle narrowly but evenly rounded, not truncate or flared, about 45°; zone of concrescence moderately wide; no patch pattern visible.

Comparisons.—*Mn. okinawae* is roughly the same size as *Mn. noharai* but less elongate and more subtriangular, with a distinct dorsal angle but no posterodorsal angle. *Mn. dispar* and *Mn. africana* have more broadly rounded anterior and posterior margins and deeper ventral indentations.

MACROCYPRINA PARCENS new species

Graph 70; Figures 16.13, 17.13, 21.7; Plates 56.10, 57.10

Derivation of name.—Latin *parcens,* sparing, niggardly; because no soft-part characters are known.

Material.—Twenty-seven fossil specimens.

Types.—Holotype specimen 2266RV USNM 240990, paratypes 240991–240994.

Type locality.—UH 2741, Lower Pleistocene, San Pedro Sands Formation, Timms Point, California.

Occurrence.—At UH 2741, 25 specimens; at UH 3049, 2 specimens.

Distribution.—Lower Pleistocene, San Pedro Formation, California.

Dimensions.—Holotype specimen 2266RV, RVL 1.40 mm, RVH 0.61. See also Graph 70.

Diagnosis.—Carapace fairly large, subovate-subtriangular in lateral outline; dorsal margin high-arched, with indistinct dorsal angle located at midlength; anterior margin broadly and evenly rounded, slightly truncate; ventral margin deeply and broadly indented, slightly sinuate, not upswung posteriorly; posterior margin very broadly and evenly rounded, slightly truncate, about 45°; zone of concrescence of moderate width, fairly regular; patch pattern of three indistinct opaque spots connected by broad, triangular, less opaque region.

Comparisons.—*Mn. parcens* is much larger and proportionally higher than *Mn. barbara,* with more distinct dorsal angle and ventral indentation. It is much larger and more elongate than *Mn. swaini* and *Mn. vargata,* with less prominent ventral indentation and more broadly and evenly rounded anterior and posterior margins.

MACROCYPRINA QUADRIMACULATA new species

Graph 71; Figures 16.25, 17.25, 52.31,32, 53.27–30; Plate 45.12

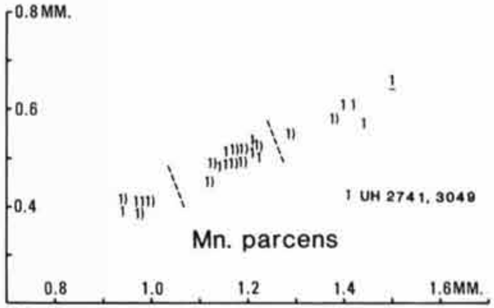
Derivation of name.—Latin *quadri-,* four, plus *maculatus,* spotted, stained; for the four opaque patches of the carapace.

Material.—Twenty-five empty carapaces and valves.

Types.—Holotype specimen 1699RV USNM 240995, paratypes USNM 240996–240999, 239050–239061, and in the personal collection of V. R. Labutis.

Type locality.—Labutis GBR 1305, Great Barrier Reef, 23°17'S, 151°38'E, depth 20 m.

Occurrence.—At Labutis GBR 1305, 20 specimens; at Labutis GBR 1306, 3 specimens; at Labutis GBR 1369, 1 specimen; at Labutis GBR 1374, 1 specimen.



GRAPH 70

Distribution.—Holocene; southern part of the Great Barrier Reef, known dead depth range 20 to 40 m.

Dimensions.—Holotype specimen 1699RV, RVL 1.03 mm, RVH 0.43 mm. See also Graph 71.

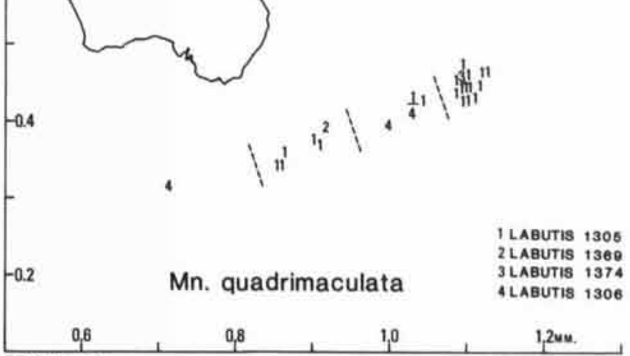
Diagnosis.—Carapace elongate-oblong in lateral outline; dorsal margin very smooth, low-arched, without any angles; anterior margin narrowly and obliquely rounded, truncate; ventral margin broadly and shallowly indented; posteroventral margin gently upswung; posterior angle abruptly truncate, about 60°; zone of concrescence broad, irregular, anterior and posterior vestibules somewhat restricted; patch pattern of four irregular spots.

Comparisons.—*Mn. quadrimaculata* is similar in size and general proportions to *Mn. hartmanni* but has a more narrowly rounded anterior margin, a shallower ventral indentation, an upswung posteroventral margin, and a truncate, angulate posterior angle. *Mn. noharai* has a more sharply, obliquely truncate anterior margin and more acutely tapering, flared posterior angle.

Remarks.—Most of the available specimens are juveniles.

MACROCYPRINA SCHMITTI (Tressler, 1949)

Graph 72; Figures 16.9,10, 17.8–10, 21.16, 23.5, 28.3–5, 35.9, 45.1, 47.22, 54.4–7, 55.4–7, 69.10, 74.1, 77.4, 79.9; Plates 48.7–12, 49.7–12, 77.6, 97.11–14, 109.18,19



GRAPH 71

Macrocypris schmitti Tressler, 1949, p. 341, fig. 17–20; Tressler, 1954, p. 433; Puri, 1960, p. 133; Hulings, 1967c, p. 94.

?*Macrocypris* sp. cf. *M. schmitti* Tressler Hulings, 1967a, p. 639, fig. 2c, 3g.

Macrocyprina skinneri Kontrovitz, 1976, p. 58 [*part.*; not pl. 1, fig. 2].

Material.—Eight live type specimens, including 2 males, 2 females, and 4 juveniles; plus 272 valves and carapaces, including 3 males with dry body and appendages; for a total of 280 specimens.

Types.—Holotype male USNM 88847, paratypes USNM 88852 (six specimens) and USNM 168088 (a dissected male with my specimen number 1538M).

Additional material for this species is deposited as USNM 239062–239077 and KUMIP 1,124,922–1,125,020.

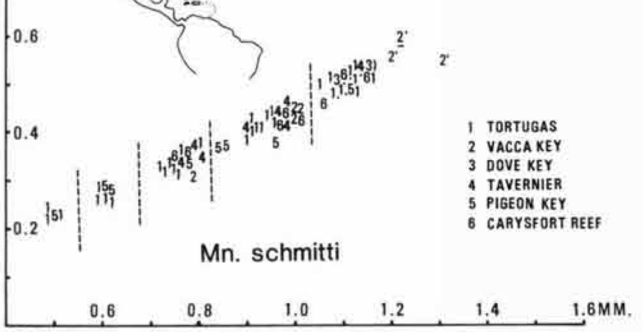
Type locality.—West side of Loggerhead Key, Tortugas, Florida, coll. W. L. Schmitt, June 26, 1931.

Occurrence.—In USNM 88847, 1 live specimen (1M); in USNM 88852, 6 live specimens (2F, 3J–1, 1J–2); in USNM 168088, 1 live specimen (1M); at UH 1295, 20 specimens; at UH 1297, 18 specimens; at UH 2738, 116 specimens; at UH 2739, 2 live plus 101 specimens (2M); at UH 2740, 1 live plus 12 specimens (1M); in HVH 9440, 1 specimen; in HVH 9441, 1 live specimen (1M).

Distribution.—Holocene; Florida Keys, in coralline sands, known live and dead depth range 1 to 5 m. Puri (1960) also reported the species from Key Largo, Florida.

Dimensions.—The carapace of the holotype is decalcified. Tressler (1949) reported its dimensions as L 1.22 mm, H 0.60 mm. See also Graph 72.

Diagnosis.—Carapace medium-sized, subovate-oblong in lateral outline, inequilateral; dorsal margin broadly, evenly, and highly arched; anterior margin broadly and evenly rounded; ventral margin deeply and broadly indented; posteroventral margin not upswung; posterodorsal margin steeply sloping, straight or very slightly concave; posterior angle very broadly and obliquely rounded, flared, about 50°; patch pattern of three irregular lateral spots plus anterior and posteroventral spots; zone of concrescence very wide, irregular; anterior vestibule somewhat restricted.



GRAPH 72

Male fifth limbs slender, very asymmetrical, with tiny elongate pegs and long dorsal seta; distal hook recurved at 82° in right limb but much reduced and nearly straight at 151° in left limb. Dorsodistal claw of sixth limb about two-thirds as long as mediodistal claw. Recurved seta of fifth limb fairly long, lined with very fine hairs of diminishing size distally. Furcae rather short, nearly straight, with well-demarcated tips. Hemipenis oblong with sinuate outline, with obliquely truncate, sinuate anterior margin and projecting anterodorsal corner; copulatory rod fairly long, sinuate. Zenker's organ long with medium-sized terminal bulb; vas deferens arranged in three loose loops that are longer than the Zenker's organ.

Comparisons.—*Mn. schmitti* is smaller than *Mn. hawkae* and *Mn. belizensis* but very similar in shape, with somewhat more elongate proportions and less sinuous, less exaggerated contours. The hemipenis is similar to that of *Mn. hawkae* but lacks the irregularly lobate anterior extension. *Mn. skinneri* has a more angulate-truncate posterior angle and nearly straight ventral margin; it also has more compact, more reduced male fifth limbs.

Remarks.—The specimens from Vaca Key, Florida, identified as *Mn. skinneri* by Kontrovitz (1976) belong to *Mn. schmitti.*

MACROCYPRINA SKINNERI Kontrovitz, 1976

Graph 73; Figures 16.5–7, 17.5,6, 21.18, 23.4, 24.39, 28.33–35, 31.19, 35.8, 45.8, 47.23, 54.1–3, 55.1–3, 69.15, 80.32; Plates 46.8–12, 47.9–12, 58.4, 59.5, 97.7–10, 109.10,11, 112.14

Macrocyprina skinneri Kontrovitz, 1976, p. 58, pl. 1, fig. 2, 3.

Macrocyprina? sp. Howe and van den Bold, 1975, pl. 3, fig. 3.

Pontocypris sp. Hall, 1965, p. 28, pl. 1, fig. 1–6.

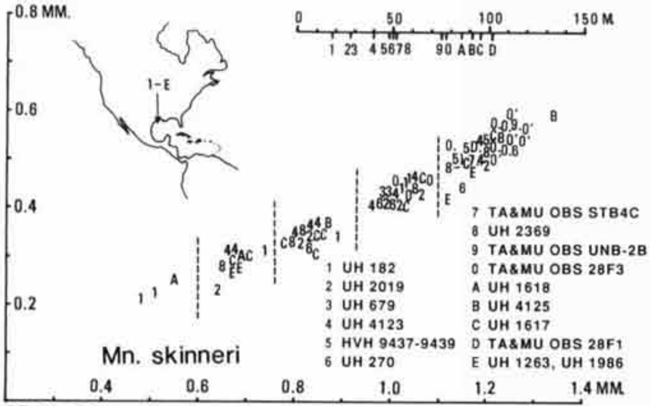
Material.—Three type specimens; 30 specimens in alcohol, including 16 males, 11 females, and 3 juveniles; and 220 empty carapaces and valves; for a total of 253 specimens.

Types.—The holotype left valve HVH 9437 and two paratypes HVH 9438–9439 are in the H. V. Howe Ostracod Collection at Louisiana State University. The remaining paratypes, HVH 9440–9441, belong to *Macrocyprina schmitti* (Tressler) (see above).

The new material for this species is catalogued as USNM 239078–239103 and KUMIP 1,125,021–1,125,065.

Type locality.—Kontrovitz Louisiana continental shelf station 97, 28°29.4'N, 92°08.4'W, depth 48 m.

Occurrence.—In HVH 9437, 1 specimen; in HVH 9438, 1 specimen; in HVH 9439, 1 specimen; in HVH 9739, 1 specimen; at UH 182, 11 specimens; at UH 270, 18 specimens; at UH 679, 5 specimens; at UH 1263, 20 speci-



GRAPH 73

mens; at UH 1617, 57 specimens; at UH 1618, 3 specimens; at UH 1986, 7 specimens; at UH 2019, 28 specimens; at UH 2369, 40 specimens; at UH 4123, 25 specimens; at UH 4125, 4 specimens; at TA&MU OBS STB4C, 1 live specimen (1M); at TA&MU OBS UNB-2B, 1 live specimen (1M); at TA&MU OBS 28F1, 1 live specimen (1M); at TA&MU OBS 28F3, 27 live specimens (13M, 11F, 3J); in UMMP 48679, 1 specimen.

Distribution.—Late Pleistocene to Holocene, Northwest Gulf of Mexico, on the Texas–Louisiana continental shelf and Mississippi Delta, and off Sapelo Island, Georgia; known live depth range 50 to 101 m, dead from 18 m. The specimens from Vaca Key, Florida, identified as this species by Kontrovitz (1976) belong to *Mn. schmitti.*

Dimensions.—Holotype HVH 9437, LVL 1.14 mm, LVH 0.50 mm. See also Graph 73.

Diagnosis.—Carapace elongate-oblong in lateral outline, subequilateral; dorsal margin broadly and evenly low-arched, with indistinct dorsal angle, greatest height located slightly anterior to midlength; anterior margin broadly and evenly rounded, somewhat truncate; ventral margin broadly and deeply indented, not upswung posteriorly; posterior margin narrowly and obliquely rounded, somewhat truncate, about 50°; zone of concrescence of moderate width, regular, vestibules open; patch pattern of three rather small spots.

Male fifth limbs small, asymmetrical, with thick, angulate distal hook recurved at 61° in right limb, greatly reduced and curved at 153° in left limb. Female fifth limb slender with thick terminal claws. Sixth limb with tufts of fine hairs along dorsal surface of podomere II and with rather thick terminal claws; dorsodistal claw about three-fourths as long as mediodistal claw. Recurved seta of moderate length, lined with fine hairs of regularly decreasing size. Furcae slender, arched, tapering to fine tips. Hemipenis oblong, with convex anteroventral margin and lobate anterodorsal lamellar extension; copulatory rod short, straight. Zenker's organ long, with tiny terminal bulb; vas deferens arranged in three loose loops that are as long as the Zenker's organ.

Comparisons.—*Mn. skinneri* is only slightly larger than *Mn. hortuli* and very similar, but proportionally higher, with more tapered posterior angle, and with shorter distal hooks on the male fifth limb. It is much larger and more elongate than *Mn. propinqua,* with narrower zone of concrescence, smaller opaque spots, and shorter, thicker distal hooks on the male fifth limb. *Mn. schmitti, Mn. belizensis,* and *Mn. hawkae* are larger or much larger, with more sinuous outlines, larger opaque spots, flared posterior angles, and more sinuous male fifth limbs. The hemipenis has essentially the same structure as that of *Mn. hortuli* and *Mn. bermudae,* differing by its slightly more elongate proportions and smoothly curved anterior margin.

Remarks.—The SEM illustrations of the type specimens by Kontrovitz (1976, pl. 1, fig. 2, 3) exaggerate their length slightly (Kontrovitz, personal communication), a common hazard in SEM micrography. The published dimensions are accurate, however.

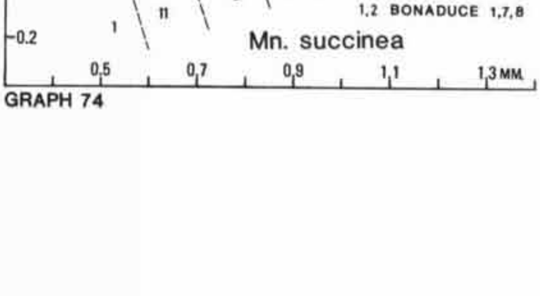
Specimen HVH 9739, reported by Howe and van den Bold (1975) from Mississippi mudlumps, is a single right valve, very similar in shape to the smallest adults of *Mn. skinneri* at UH 2369 though differing in minute details from those of other samples. It falls within the range of geographic variability seen in *Mn. skinneri* on the Texas continental shelf.

Hall's (1965) specimen UMMP 488679 is a juvenile left valve of *Macrocyprina.* It is exactly the same size and very nearly the same shape as specimen 1903J–2 (an A–2 instar) of *Mn. skinneri.*

MACROCYPRINA SUCCINEA (Müller, 1894)

Graph 74; Figures 16.17,18, 17.18,19, 21.12, 23.9, 24.47, 28.23,24, 31.15, 35.1, 45.6, 47.26, 54.15,16, 55.14,15, 56.9,30, 59.8,25, 62.6, 63.11, 64.38, 68.13, 80.37; Plates 44.1–4, 45.1–4, 81.17, 96.4–6, 108.10,11,13–15

Macrocypris succinea MÜLLER, 1894, p. 242, text-fig. 8, p. 54, text-fig. 5, p. 67, text-fig. 5, p. 71; pl. 1, fig. 3–4; pl. 13, fig. 8–26, 28; pl. 33, fig. 1–21; pl. 35, fig. 1; pl. 36, fig. 13, 23, 29, 47, 53; pl. 37, fig. 22–25, 30, 39, 46, 47, 52, 54, 55,



GRAPH 74

67; pl. 38, fig. 6, 8, 25, 33–40, 55, 74; pl. 40, fig. 26; MÜLLER, 1912, p. 120; DE BUEN, 1916, p. 7; TRIEBEL, 1960, p. 109, 199; REYS, 1961a, p. 60; REYS, 1961b, p. 62; PURI, 1963, p. 2; REYS, 1964, p. 187; ROME, 1964, p. 209; PURI et al., 1964, p. 168; REYS, 1965, p. 260; PURI et al., 1969, p. 377, 384; BONADUCE and MASOLI, 1970, p. 48; PURI, 1974, p. 146; ?BONADUCE and PUGLIESE, 1975, p. 130; SISSINGH, 1976, p. 282; ATHERSUCH, 1976, p. 346; NASCIMENTO, 1983, table 1, fig. 3–24; BONADUCE et al., 1983, table 2; VAN HARTEN and DROSTE, 1988, p. 724, 726, 727.

Material.—Forty-five specimens in alcohol, including 8 males, 11 females, 20 juveniles, and 6 empty carapaces and valves.

Types.—The three syntype specimens (not examined) are catalogued as No. 9173 in the Crustacea Division of the Zoological Museum, Humboldt-University, Berlin. Dr. Gioacchino Bonaduce will select the lectotype as part of his revision of the Bay of Naples fauna.

The new material for this species is deposited as USNM 239104–239110 and in the collection of Gioacchino Bonaduce.

Type locality.—Bay of Naples.

Occurrence.—At Bonaduce 1, 15 live specimens (5M, 4F, 1MJ–1, 4J–1, 1J–2); at Bonaduce 7, 17 live plus 5 specimens (3M, 4F, 3J–1, 7J–2); at Bonaduce 8, 7 live plus 1 specimens (3F, 1J–1, 2J–3, 1J–4).

Distribution.—Pleistocene–Holocene; Bay of Naples and Mediterranean Sea; the live depth range in the material studied is 27 to 50 m. This species has been widely reported around the Mediterranean Sea, but most authors have not provided illustrations to confirm the identifications. Sissingh (1976) chose this species to name a biostratigraphic zone in the post-Calabrian Pleistocene of the Mediterranean region.

Dimensions.—Male 1904M, RVL 1.01 mm, RVH 0.40 mm, LVL 0.98 mm, LVH 0.42 mm. See also Graph 74. Müller (1894) reported the length of the female as 1.08 mm and of the male as 1.0 mm.

Diagnosis.—Carapace small, very elongate in lateral outline, greatest height located at or slightly anterior to midlength; dorsal margin broadly but unevenly arched; anterior margin narrowly and obliquely rounded, somewhat truncate; ventral margin sinuate, with fairly deep, broad ventral indentation, posteroventral margin upswung; posterodorsal margin nearly straight; posterior angle narrowly rounded, bluntly truncate, about 45°; patch pattern of three to four small opaque spots connected by elongate, less opaque central area; zone of concrescence very broad, irregular, enlarged in anterodorsal and posteroventral region; anterior vestibule may be somewhat constricted.

Male fifth limbs small, sinuously tapering, very asymmetrical, with slender distal hooks recurved at 63° in right limb and 142° in left limb. Female fifth limb slender with thick terminal claws. Dorsodistal claw of sixth limb about half as long as mediodistal claw. Recurved seta of moderate length, lined with fine hairs of decreasing size. Furcae rather thick, tapering to blunt ends, terminal portions well demarcated, no proximal setae visible. Hemipenis rounded-subtrapezoidal in outline, with anteroventral indentation, sinuate, obliquely truncate anterior margin, and acute anterodorsal angle; copulatory rod short, straight. Zenker's organ short, with large terminal bulb; vas deferens very thick, arranged in three to four irregular loops of varying sizes, the longest of which is as long as the Zenker's organ.

Comparisons.—*Mn. succinea* is about the same size as *Mn. propinqua* but more elongate, with a more sinuate, angulate, truncate posterior angle; and with a shorter, more tightly recurved distal hook on the male right fifth limb. The structure of the hemipenis is quite different from that of any other species studied. According to the published illustration, "*Macrocypris* sp. 2" of Sissingh (1972, p. 80, pl. 3, fig. 15; Upper Pliocene of Greece) is quite similar but considerably larger (L 1.42 mm, H 0.58 mm), somewhat more highly arched, especially posteriorly, and has a more narrowly rounded anterior margin.

Remarks.—*Mn. succinea* was thoroughly and accurately illustrated by Müller (1894). Triebel (1960) reassigned it to the genus *Macrocyprina* but did not actually cite the new combination.

MACROCYPRINA SWAINI new species

Graph 75; Figures 17.16, 21.8, 23.14, 24.48, 28.36,37, 35.3, 45.10, 47.25; Plates 56.5,6,12, 57.6,11,12, 96.11, 109.15

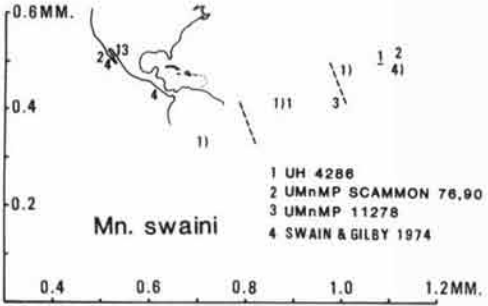
Macrocyprina pacifica (LeRoy) SWAIN, 1967, p. 42, fig. 35, 37, 38b–g; pl. 1, fig. 12; MCKENZIE and SWAIN, 1967, p. 286, fig. 4; pl. 30, fig. 3; SWAIN, 1969, p. 456 [*part.*]; SWAIN and GILBY, 1974, p. 283 [*part.*; not pl. 2, fig. 3–5].

Not *Paracypris pacificus* LEROY, 1943, p. 358, fig. 2z; pl. 60, fig. 38, pl. 61, fig. 15–18.

Derivation of name.—For Frederick M. Swain, who first collected this species.

Material.—Five type specimens, including 1 male, 2 females, 1 carapace, and 1 juvenile right valve; plus 6 additional empty carapaces and valves; for a total of 11 specimens.

Types.—Holotype specimen 2284W USNM 239111, paratypes USNM 239112–239113. Other paratypes in the University of Minnesota Museum of Paleontology, as follows: UMnMP 11278, labeled "Rec., Gulf of Calif. VS 143, GSA Mem. 101, Pl. 1, f. 12, *Macrocyprina pacifica* (LeRoy)," one juvenile right valve. From UMnMP Scammon Lagoon, station 76 of McKenzie and Swain (1967), a dissection mount labeled "*Macrocyprina pacifica* (LEROY)" and a vial of alcohol containing decalcified valves labeled "*Macrocypris* sp.," both apparently belonging to the same female specimen and both now bearing my specimen number 1994F. From UMnMP Scammon Lagoon, station 90 of



GRAPH 75

McKenzie and Swain (1967), labeled "*Macrocyprina pacifica* (LeRoy)," a male dissection slide labeled "specimen 2" and bearing my specimen number 1992M, a female dissection slide labeled "specimen 1" and bearing my specimen number 1993F, a paper slide containing one whole carapace and bearing my specimen number 1995A, and a vial of alcohol labeled "valves" but apparently empty (perhaps supposed to contain the valves of specimens 1992M and 1993F).

Type locality.—UH 4286, Gulf of California, east side of San Pedro Island, 17 nautical miles west of San Carlos, Guayamas area, Sonora, Mexico, depth 30 m.

Occurrence.—At UH 4286, 6 specimens; at UMnMP 11278, 1 specimen; at UMnMP Scammon Lagoon station 76, 1 live specimen (1F); at UMnMP Scammon Lagoon station 90, 2 live plus 1 specimens (1M, 1F).

Distribution.—Holocene; Gulf of California and Scammon Lagoon, Mexico, known live depth range 15 to 40 m.

Dimensions.—Holotype specimen 2284W, L 1.08 mm, H 0.51 mm. See also Graph 75.

Diagnosis.—Carapace small, subtriangular to subovate-oblong in lateral outline; dorsal margin very highly arched, obscurely angulate, greatest height located at or just behind midlength; anterior margin narrowly and evenly rounded; ventral margin with moderate ventral indentation, not upswung posteriorly; posterior angle very broadly and evenly rounded, slightly truncate, about 45°; patch pattern of three large, irregular spots; zone of concrescence very wide, irregular, anterior vestibule may be slightly constricted.

Male fifth limbs very asymmetrical, with sinuous outlines, elongate pegs, and gracefully tapering distal hooks recurved at 122° in right limb and 132° in left limb. Sixth limb with elongate podomeres but rather thick claws; dorsodistal claw about half as long as mediodistal claw. Recurved seta of seventh limb short, reaching only to middle of podomere II, lined with fine hairs decreasing in size distally. Hemipenis rounded-subtriangular, tapering to bluntly rounded anterior margin without accessory lamellae; copulatory rod long, nearly straight. Zenker's organ with long muscularized portion, lacking terminal bulb or damaged; vas deferens arranged in about three loose loops, about three-fourths as long as Zenker's organ.

Comparisons.—*Mn. swaini* is much larger, proportionally higher, and has more broadly rounded anterior and posterior angles than *Mn. vargata*. *Mn. barbara* is larger and much more elongate, with shallower ventral indentation, more gently tapering posterior angle, and more rectilinear, reduced male fifth limbs with more tightly recurved distal hooks. *Mn. parcens* is more elongate with more narrowly rounded anterior and posterior margins and a less distinct patch pattern. Furcae rather thick, arched, lined with regularly spaced, fine barbs; terminal portions well demarcated.

Remarks.—The holotype of *Paracypris pacifica* LeRoy, 1943, is a single whole carapace cataloged as no. 6769 of the Stanford University Paleontological and Conchological Collections (see Appendix II and Plates 114.9,11,12,17). It has good paracypridine shape and muscle scar pattern, left over right valve overlap, and branching radial pore canals. It is correctly classified in *Paracypris* (see also Maddocks, 1988b).

LeRoy described *Paracypris pacifica* from the Pleistocene Timms Point Formation of California, in which *Mn. parcens* and a second, unnamed species of Paracypridinae are also common. LeRoy's statement that *P. pacifica* is living today along the Pacific Coast cannot be confirmed, yet. Reexamination of specimens has shown that the reports of "*Macrocyprina pacifica*" by Swain (1967), McKenzie and Swain (1967), and in part by Swain and Gilby (1974) are based on *Mn. swaini*. Benson's (1959) illustrated specimen (USNM 113119) of *P. pacifica* appears to be a species of *Macrocyprina* but not *Mn. swaini*, although a species of Paracypridinae is also present in Todos Santos Bay. A third species living off the coast of southern California is described above as *Mn. barbara* n. sp.; it was reported as "*Macrocyprina pacifica*" by Swain and Gilby (1974), although the scar pattern they illustrated in their plate 2, figure 5, is that of *Paracypris*. See remarks under *Mn. barbara*, above, and under *Paracypris pacifica* in Appendix II, below.

MACROCYPRINA VARGATA

Allison and Holden, 1971

Graph 76; Figures 16.16, 17.17, 21.13, 23.15, 31.12, 35.4, 45.4, 47.27; Plates 56.1–4, 57.1–5, 77.4,5, 81.18

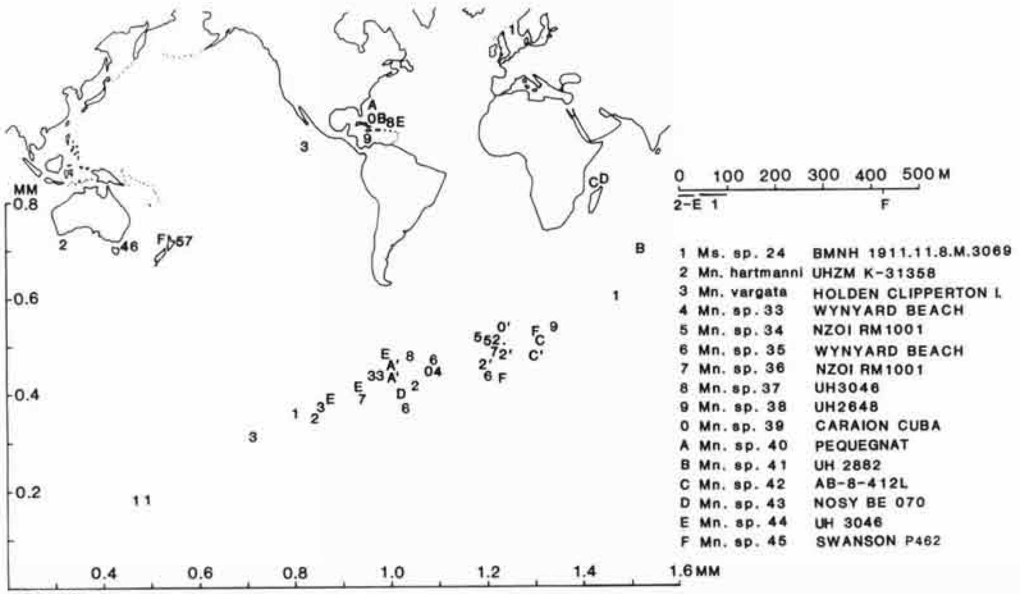
Macrocyprina vargata Allison and Holden, 1971, p. 181, fig. 10, 11.

Material.—Five carapaces, including 2 females with dry fragments of appendages.

Types.—Holotype USNM 128095, paratypes USNM 128098, additional paratypes in the San Diego Natural History Museum, SDNH 04201–04203 (not seen).

New material for this species is deposited as USNM 239114–239115.

Type locality.—Clipperton Island, station G-1 of Allison and Holden (1971), depth 10–15 m.



GRAPH 76

Occurrence.—At Holden Clipperton Island, 2 live plus 3 specimens (2F).

Distribution.—Holocene; Clipperton Island. Allison and Holden reported living specimens at depth of 10 to 12 m off the outer edge of the reef flat and empty carapaces on the steep slope on the north side of the atoll at depths of 40 to 45 m.

Dimensions.—Holotype USNM 128095, L 0.97 mm, H 0.44 mm. See also Graph 76. Allison and Holden (1971, fig. 10) provided a length:height plot showing dimensions of a large population, including adults and six instars. They reported the carapace length for adults as 0.90–0.94 mm, with no sexual dimorphism apparent in the carapace.

Diagnosis.—Carapace small, elongate-subtriangular in lateral outline, greatest height located at or slightly behind midlength; dorsal margin broadly arched with indistinct dorsal angle; anterior margin narrowly and obliquely rounded, slightly truncate; ventral margin broadly and deeply indented, not upswung posteriorly; posterior angle fairly broadly and evenly rounded, about 45°; patch pattern of three small opaque spots, the middle spot tending to divide; zone of concrescence broad, rather irregular, anterior vestibule may be slightly restricted. Female fifth limb robust with thick claws. Dorsodistal claw about two-thirds as long as mediodistal claw of sixth limb. Recurved seta of seventh limb reaching only to middle of podomere II, lined with very fine hairs that decrease in size distally.

Comparisons.—*Mn. vargata* is much smaller, more elongate, and more angulate in its contours than *Mn. swaini, Mn. barbara,* and *Mn. parcens. Mn. hortuli* and *Mn. bermudae* have somewhat similar, angulate outlines but are more elongate, more rounded, and less exaggerated. Furcae fairly large, with tiny proximal setae and well demarcated, slender tips.

MACROCYPRINA sp. 33

Graph 76; Figure 17.23; Plate 51.1

Material.—One left valve, USNM 239116.

Occurrence.—At Wynyard Beach, 1 specimen.

Distribution.—Holocene; Wynyard Beach, Tasmania.

Dimensions.—Specimen 1707F, LVL 1.09 mm, LVH 0.67 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 33 is smaller than *Mn. hartmanni* but similar in shape, with more steeply sloping anterodorsal and posterodorsal margins and more truncate anterior and posterior margins. *Mn.* sp. 34 is larger and proportionally higher, with more acutely pointed posterior angle. *Mn.* sp. 35, at the same locality, is a little longer and not nearly as high.

MACROCYPRINA sp. 34

Graph 76; Figures 16.24, 17.24; Plate 51.2

Material.—Five empty valves, USNM 239117–239120.

Occurrence.—At NZOI RM1001, 5 specimens.

Distribution.—Holocene; near East Cape, New Zealand.

Dimensions.—Specimen 1512, RVL 1.21 mm, RVH 0.51 mm. Specimen 1513, LVL 1.18 mm, LVH 0.52 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 34 resembles *Mn. hartmanni* in size and shape but has a somewhat more broadly rounded anterior margin and a slightly flared posterior angle. It is the same length as but much higher than *Mn.* sp. 36, which occurs at the same locality, and has a sharper posterior angle. It resembles *Macrocyprina* sp. of Swanson (1979a) from the Otago Shelf east of South Island, New Zealand, but is considerably larger, with a more broadly arched dorsal margin and more broadly rounded anterior and posterior margins.

MACROCYPRINA sp. 35

Graph 76; Figure 16.22; Plates 50.2, 51.3, 77.3, 81.19

Material.—Five empty valves, USNM 239121–239125.

Occurrence.—At Wynyard Beach, 5 specimens.

Distribution.—Holocene; Wynyard Beach, Tasmania.

Dimensions.—Specimen 1344, RVL 1.20 mm, RVH 0.45 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 35 is a little longer than *Mn.* sp. 33, which occurs at the same locality, and much more elongate in shape. It is the same length as *Mn.* sp. 34 but proportionally more elongate. *Mn. hartmanni* is very similar, especially in patch pattern, but proportionally a little higher.

MACROCYPRINA sp. 36

Graph 76; Figure 16.23; Plate 50.1

Material.—Two empty valves, USNM 239126–239127.

Occurrence.—At NZOI RM1001, 2 specimens.

Distribution.—Holocene; near East Cape, New Zealand.

Dimensions.—Specimen 1705, RVL 1.21 mm, RVH 0.48 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 36 is the same length as *Mn.* sp. 34, which occurs at the same locality, but not as high, with a more obliquely truncate anterior margin and more broadly rounded, slightly flared posterior angle. *Mn. hartmanni* has a broader ventral indentation and more narrowly rounded posterior angle.

MACROCYPRINA sp. 37

Graph 76; Plate 52.12

Material.—One valve, USNM 239128.

Occurrence.—At UH 3046, 1 specimen.

Distribution.—Holocene; St. Croix, U.S. Virgin Islands, depth 15 m.

Dimensions.—Specimen 2291RV, RVL 1.04 mm, RVH 0.48 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 37 is much smaller than *Mn. jamaicae* and less triangular in outline, with a broadly arched dorsal margin and nearly straight ventral margin. *Mn. propinqua* is about the same size and shape but is ventrally more indented and has larger opaque spots.

MACROCYPRINA sp. 38

Graph 76; Plate 54.5

Material.—One valve, USNM 239129.

Occurrence.—At UH 2648, 1 specimen.

Distribution.—Holocene; Jamaica, depth 1 m.

Dimensions.—Specimen 2004RV, RVL 1.34 mm, RVH 0.54 mm. See also Graph 76.

Comparisons.—In size and shape, *Mn.* sp. 38 is very like *Mn. hawkae*, which occurs in the same locality, but *Mn.* sp. 38 has more narrowly rounded anterior and posterior margins, a nearly straight ventral margin, and a divided anterior opaque spot. It is strikingly similar to *Mn.* sp. 39 in shape and patch pattern but significantly larger. It is smaller than *Mn. jamaicae*, less equilateral, and has larger opaque spots and a more narrowly rounded posterior angle. Because the geographic variability of Caribbean species of *Macrocyprina* is poorly understood, it is treated as a separate species for the time being.

MACROCYPRINA sp. 39

Graph 76; Plates 54.6, 55.6, 81.20

Material.—Two specimens, including one female carapace with fragmentary dry body and one empty juvenile carapace, USNM 239130.

Occurrence.—At Caraion Cuba Station II, 1 specimen (1F).

Distribution.—Holocene; Batabano, Cuba, depth 4 m.

Dimensions.—Female 1854F, RVL 1.23 mm, RVH 0.54 mm, LVL 1.20 mm, LVH 0.52 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 39 is similar in shape to *Mn. hawkae* but distinctly smaller, with more narrowly rounded, more produced anterior and posterior margins, smaller opaque spot, and a divided anterior opaque spot. It is virtually identical to *Mn.* sp. 38 in shape and patch pattern but significantly smaller. It is much smaller than *Mn. jamaicae*, less equilateral in shape, with larger opaque spots and a more narrowly produced posterior angle. It is here treated as a separate species until the geographic variability of *Macrocyprina* is better understood.

MACROCYPRINA sp. 40

Graph 76; Plates 55.4,5

Material.—Three specimens in alcohol, including 2 females and 1 juvenile male, USNM 239131–239133.

Occurrence.—At Pequegnat 0131-3(2B), 2 live specimens (2F); at Pequegnat 0146-2(2E), 1 live specimen (1MJ–1).

Distribution.—Holocene; Atlantic continental shelf off South Carolina, depth 16–36 m.

Dimensions.—Female specimen 1901F, RV not measurable, LVL 1.00 mm, LVH 0.45 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 40 is very similar in shape to *Mn. skinneri* but smaller, with more broadly rounded anterior and posterior margins and larger opaque spots. It also is very similar to *Mn. bermudae* but a little larger and more elongate than most specimens of that species, with a less arched dorsal margin. It is a little smaller than *Mn. hortuli*, with larger opaque spots and a less angular outline. It is here treated as a separate species until the geographic variation in these species is better known.

MACROCYPRINA sp. 41

Graph 76; Figure 17.31; Plate 45.5

Material.—Seven valves, USNM 239134–239135.

Occurrence.—At UH 2882, 7 specimens.

Distribution.—Holocene; Guantanamo Bay, Cuba, depth 3 m.

Dimensions.—Specimen 2421, LVL 1.54 mm, LVH 0.70 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 41 is very similar to *Mn. hawkae* but much larger, with a more obliquely rounded anterior margin and a slightly flared posterior angle. It is the largest known species of the genus as revised here.

MACROCYPRINA sp. 42

Graph 76; Figures 16.38, 17.37; Plates 52.11, 53.12

Material.—Three specimens in alcohol, including 1 female carapace with fragmentary body and 2 valves, USNM 239136–239137.

Occurrence.—At AB-8-412L, 1 live plus 2 specimens (1F).

Distribution.—Holocene; Banque de Cinq Mètres, near Nosy Be, Madagascar, depth 30 m.

Dimensions.—Female specimen 2422F, RVL 1.30 mm, RVH 0.48 mm, LVL 1.29 mm, LVH 0.52 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 42 is similar in shape to *Mn. madagascarensis* and occurs in the same area, but it is distinctly smaller, falling into the size-gap between the adult and the A–1 instar of that species. It also has a more narrowly rounded and truncate anterior margin and a more acute posterior angle. It is much larger and more elongate than *Mn. moza,* which also occurs nearby, and has a less flared, more extended posterior angle. It is similar in size and shape to *Mn. noharai* but has four small, discrete opaque spots, more truncate anterior and posterior margins, and a more acute posterior angle.

MACROCYPRINA sp. 43

Graph 76; Figures 16.36, 17.35; Plates 52.10, 53.11

Material.—One empty carapace, USNM 239138.

Occurrence.—Nosy Be 070, 1 specimen.

Distribution.—Holocene; Nosy Be, Madagascar, depth 3–5 m.

Dimensions.—Specimen 2409, RVL 1.02 mm, RVH 0.40 mm, LVL 1.00 mm, LVH 0.38 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 43 is smaller, more elongate, and more deeply indented ventrally than *Mn. moza, Mn.* sp. 42, and *Mn. madagascarensis,* all of which occur near Nosy Be, Madagascar. The single specimen has no patch pattern.

MACROCYPRINA sp. 44

Graph 76; Figures 16.20; Plate 44.5

Material.—Six valves, USNM 239139–239140.

Occurrence.—At UH 3046, 6 specimens.

Distribution.—Holocene; St. Croix, U.S. Virgin Islands, depth 15 m.

Dimensions.—Specimen 2420, RVL 0.99 mm, RVH 0.48 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 44 is very similar in size, patch pattern, marginal characters, and shape to *Mn. caiman* but has a more narrowly rounded, more truncate anterior margin and a more acute posterior angle.

MACROCYPRINA sp. 45

Graph 76; Figures 16.28, 17.22; Plates 56.7, 57.7

Material.—Two empty carapaces, USNM 239141–239142.

Occurrence.—At Swanson Northland P462, 2 specimens.

Distribution.—Holocene; west of New Zealand, depth 427 m.

Dimensions.—Specimen 2428, RVL 1.23 mm, RVH 0.43 mm. Specimen 2429, LVL 1.30 mm, LVH 0.53 mm. See also Graph 76.

Comparisons.—*Mn.* sp. 45 is fairly small and unusually elongate, with a sinuate ventral margin, sharply upswung, truncate posterior angle, and rather broad zone of concrescence.

MACROCYPRINA sp. 48

Plate 59.7

Macrocypris maculata (Brady) VAN DEN BOLD, 1966, pl. 1, fig. 3.

Material.—One juvenile A–1 or A–2 right valve, HVH 8267.

Occurrence.—In HVH 8267, one specimen.

Distribution.—Holocene; Colon Harbour, Panama.

Dimensions.—HVH 8267, RVL 1.00 mm, RVH 0.42 mm.

Comparisons.—This specimen has an exceptionally elongated anterior margin and very pointed posterior end, more so than the juveniles of any other Caribbean species described here. The boomeranglike shape is more extreme even than in *Mn. skinneri.* Juveniles of *Mn. hawkae* are somewhat similar but less exaggerated. The pointed posterior angle and deeply indented venter resemble those of juveniles of *Ms. texana,* but there is no dentiform corner. The juvenile valve labeled "*Macrocypris maculata + decora*" in the Brady Collection in the Hancock Museum has an even more narrowly produced anterior end and a less pointed posterior angle. Although the sizes and proportions of these two specimens are similar, it is not possible to establish their conspecificity. *Mn. maculata* is best abandoned (see discussion above), and it is not possible to identify this Panamanian species until adult material can be studied.

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APPENDIX I: SOME OTHER SPECIES REFERRABLE TO MACROCYPRIDIDAE

It has not been possible to examine material for every species that has at some time been referred to Macrocyprididae, particularly for the many fossil species. The following list, which is not complete, notes several additional species that may belong to Macrocyprididae (on the basis of published illustrations) but have not been studied for this paper. They are listed in alphabetical order according to the trival name without regard to generic assignment. Five of these names, for which types no longer exist, should be abandoned as *nomina dubia*.

Argilloecia anceps Rome, 1942, p. 10, pl. 1, fig. 3, 7, 11–14, pl. 2, fig. 4–6, 9, pl. 3, fig. 10; Holocene, Mediterranean Sea; a species of *Macromckenziea*. Rome's drawings show many features that he correctly recognized as anomalous for *Argilloecia*, notably the vestigial furca. Rome described this species from adult male and female specimens dredged living at 80 to 100 m depth off Monaco in the northern Mediterranean. The outline drawing of a left valve is dorsally arched and more pointed posteriorly than *Mk. ligustica* from the same region, giving a somewhat juvenile appearance. Likewise, the length given by Rome (0.86 mm) fits the A–1 instar but is too small to be the adult of *Mk. ligustica*. The drawings of the mandible show a molting specimen, in which the masticatory processes are being withdrawn from the old skeleton. Although Rome reported finding one male and three females, it seems likely that several of these illustrations were made from juveniles. To determine whether *Mk. anceps* is a separate species or a senior synonym of *Mk. ligustica* it will be necessary to restudy Rome's specimens and to collect males of *Mk. ligustica* for comparison.

Macrocypris acuticaudata Bate and Bayliss, 1969, p. 130, pl. 5, fig. 18; Cretaceous of Tanzania; may be a species of *Macrosarisa*.

Macrocypris calabra Seguenza, 1880, p. 191, 288; not illustrated, and Seguenza's types are said to be no longer in existence (Puri, Bonaduce, and Gervasio, 1969, p. 382); a *nomen dubium*.

Macrocypris compressa Seguenza, 1883–1886, p. 223, pl. 1, fig. 4, 4a, 4c; Quaternary of Rizzolo; also Ruggieri, 1984, p. 125, fig. 1–3; a *nomen dubium*. Ruggieri's (1984) attempt to resurrect this name, unused for more than a century, was ill-advised. Article 75a of the International Code of Zoological Nomenclature (1961, p. 81; 1985, p. 157) specifies that "a neotype is to be designated only in connection with revisory work, but only in exceptional circumstances when a neotype is necessary in the interests of stability of nomenclature; the designation of a specimen to be a neotype other than in accordance with these conditions is not valid." Ruggieri's schematic line drawings of what appear to be juvenile specimens and brief remarks, without any redescription of the species or comparisons with other species of the family, do not constitute revisory work, nor did any confusion exist before the neotype specimen was designated. Stability of nomenclature and precision of communication will be best served by continuing to consider *Macrocypris compressa* Seguenza a *nomen dubium* or *nomen oblitum*, while using younger names as needed for well-clarified species concepts. For a discussion of Ruggieri's proposed synonymization of *Mk. ligustica*, see the description of that species in the systematic section above.

Macrocypris elongata Seguenza, 1883–1886, p. 204, 76, pl. 1, fig. 5a,b; Strait of Messina; Seguenza's types are said to be no longer in existence (Puri, Bonaduce, and Gervasio, 1969, p. 382); a *nomen dubium*.

Macrocypris eocuneata Hornibrook, 1953, p. 304, pl. 1, fig. 6; Eocene and Oligocene of New Zealand; may be a species of *Macropyxis*.

Macrocypris gigantea Conti, 1953, p. 227, pl. 13, fig. 1, 2; Lower Jurassic of Italy.

Macrocypris gracilis (Brady) of Holden, 1967, p. 16, fig. 9a,b (not *Pontocypris gracilis* Brady, 1890); Quaternary, Hawaiian Islands; this is a species of *Macrocyprina*.

Paracypris hieroglyphica Brady, 1867–1871, p. 62, pl. 7, fig. 7, 8; listed as *Macrocypris hieroglyphica* in the plate explanations; northern Java; may have been a species of *Macrocyprina*. Brady (1880) listed it in the synonymy of "*Macrocypris decora*," another *nomen dubium* that has been applied to species of *Macrocyprina* worldwide. The color pattern described by Brady is common in fresh specimens of *Macrocyprina*. According to McKenzie (1967a and letter of 8 December 1977), no specimens of this species remain in the Brady collection in the Hancock Museum. It is best to consider this a *nomen dubium*.

Macrocypris insignis Lienenklaus, 1900, p. 505, pl. 19, fig. 1, text-fig. 1; middle Oligocene of Germany; probably a species of *Macropyxis*.

Argilloecia jeurrensis Keij, 1957, p. 49, pl. 1, fig. 12–14; Oligocene of the Paris Basin; the muscle scars and marginal features are those of *Macrocyprina*.

Paracypris lenticularis Hu, 1984, p. 73, pl. 8, fig. 13, 21, 22, text-fig. 4; Pleistocene of Taiwan; the lateral outline, hinge, opaque spots, and slightly misinterpreted muscle scars are all those of *Macrocyprina*.

Macrocypris limburgensis van Veen, 1936, p. 171, pl. 1, fig. 1–9; new name for *Macrocypris siliqua* van Veen, 1934; Upper Cretaceous, The Netherlands.

Macrocypris luganensis Conti, 1953, p. 226, pl. 12, fig. 18, 19, Jurassic of Italy; Conti's illustration resembles *Macrocyprina* and certain Cretaceous species of *Macrosarisa*.

Macrocypris mucronata Conti, 1953, p. 227, pl. 13, fig. 5; Jurassic, Italy.

Macrocypris siliqua van Veen, 1934, p. 88, pl. 1, fig. 1–9; Upper Cretaceous, The Netherlands; renamed *Macrocypris limburgensis* van Veen, 1936.

Macrocypris trigona Seguenza, 1883–1886, p. 77, pl. 1, fig. 7a,b; Port of Messina, Quaternary of Italy; Seguenza's types no longer exist (Puri, Bonaduce, and Gervasio, 1969, p. 353); a *nomen dubium*.

Macrocypris uniformis Conti, 1953, p. 226, pl. 13, fig. 3, 4; Lower Jurassic of Italy.

Macrocypris sp. of Bonaduce, Masoli, and Pugliese, 1976, p. 376, pl. 1, fig. 8, 9; Holocene, Gulf of Aqaba; this is a species of *Macrocyprina*. The illustrated specimen is a juvenile. The size is close to that of the A–1 instar of *Mn. madagascarensis*, from which it differs by more bluntly angulate anteroventral and posteroventral margins. It is smaller, more elongate, and less deeply indented ventrally than *Mn. bonaducei*.

Macrocypris sp. 1 of Bonaduce and Sprovieri, 1985, pl. 2, fig. 5; Pliocene of Sicily.

Macrocypris sp. of Donze et al., 1982, pl. 2, fig. 6; Late Cretaceous or early Tertiary, North Africa.

Macrocypris sp. of Hazel and Holden, 1971, p. D16, pl. 2, fig. 15, 19, pl. 4, fig. 10; Eocene of Tonga; this is a species of *Macrocyprina*.

Macrocypris sp. of Sissingh, 1972, p. 80, pl. 3, fig. 15; late Cenozoic of Greece; this is a species of *Macrocyprina.*

Macrocypris sp. 1 of van den Bold, 1988, p. 21, pl. 1, fig. 11, 12; Pliocene of the Dominican Republic; this is a species of *Macrocyprissa* closely related to *Mc. vandenboldi* but slightly more elongate, with a less angular outline. Figure 12 may be a different species, belonging to *Macropyxis.*

Macrocypris sp. 2 of van den Bold, 1988, p. 22, pl. 1, fig. 13; Upper Miocene and Pliocene of the Dominican Republic; this is a species of *Macrosarisa* closely related to *Ms. texana,* differing primarily by the more attenuate posterior angle.

Macrocyprina sp. of van den Bold, 1988, p. 22, pl. 1, fig. 14; Holocene, Colon Harbor, Panama; this is a species of *Macrocyprina.* The outline resembles *Mn. jamaicae* except for the unusually acute posterior angle. No similar species has been seen in the material from the Gulf of Mexico examined for this paper.

Macrocyprina sp. of Swanson, 1979a, p. 11, fig. 10; Holocene, Otago Shelf, South Island, New Zealand; this is a species of *Macrocyprina.* Also cited by Swanson, 1979b, p. 155, fig. 2g, near Stewart Island, New Zealand; the figured specimen is an instar.

Macrocypris sp. of Dias-Brito et al., 1988, pl. 2, fig. 42; Holocene, Sepetiba Bay, Rio de Janeiro, Brazil; this is a species of *Macrocyprina.*

Macrocypris sp. of van den Bold, 1965, p. 386, pl. 2, fig. 8; Lares Formation, lower Miocene, Puerto Rico; may be a species of *Macromckenziea.*

APPENDIX II: SOME SPECIES EXCLUDED FROM MACROCYPRIDIDAE

"*Macrocypris*" has become something of a dumping ground for smooth, elongate, cypridiform species, especially for poorly preserved fossils. Many of these species probably belong to the Pontocyprididae, which includes several genera with elongate shapes and right valve overlap. Others may be Paracypridinae, which have left valve overlap, a variety of elongate shapes, and even more chaotic taxonomy. Those that have come to my attention are listed below, alphabetically by species name. Only the original binomen is given in most cases, without subsequent reports or full synonymy. The list is not complete even for named species, and most citations in open nomenclature are not included. For those marked with an asterisk (*), I have studied specimens of the species. For all others, the exclusion from Macrocyprididae is based on published descriptions and illustrations that fail to show the diagnostic characters of the family. In some cases, especially for the Cretaceous species, it may be that examination of well-preserved material would confirm the original assignment to Macrocyprididae, but this is not supported by the information available at present.

Macrocypris acuminata (Alth, 1850) of Brady, 1868 (1867–1871), p. 313. Brady identified "*Macrocypris orientalis*" (see below) with the Cretaceous species reported by Reuss (1851, p. 49, pl. 6, fig. 7a,b) under the name "*Cytherina acuminata* Alth, 1850," writing (translated from French): "Since the time when the description of this species was done (p. 61 of the present volume, 1867), we have had the occasion to examine once again the specimens from the Java Sea and to compare them to the figures of *Cythere acuminata* given by Reuss in his '*Foram. und entomos. des Kreidemergels von Lemberg.*' We believe that the species described belongs to this latter, and we would propose, in this case, to name *Macrocypris acuminata,* [the] *M. orientalis.*" It would appear that Brady recognized that Reuss had misidentified Alth's species, which has since been reclassified in *Monoceratina* (Howe and Laurencich, 1958), and that he believed Reuss's species to be *M. orientalis.* He expressed surprise that a Cretaceous species should be found living. In fact, however, there is no basis for this identification, nor for Brady's combination "*Macrocypris acuminata.*"

Macrocypris acuminata Cooper, 1941, p. 34, pl. 4, fig. 30–41; Lower Carboniferous of Illinois.

Macrocypris? acutula Stewart, 1936, p. 758, pl. 101, fig. 25, 26; Devonian of Ohio.

Macrocypris aequabilis Oertli, 1959, p. 24, pl. 3, fig. 74–82; Jurassic of Switzerland; possibly belongs in Pontocyprididae.

Macrocypris albertensis Loranger, 1954, p. 193; Devonian of Alberta.

Macrocypris? alta Jones, 1887, p. 181, pl. 5, fig. 10a,b; Silurian of England.

Macrocypris anomala Boucek, 1937, p. 4, fig. 2; Silurian of Czechoslovakia.

Macrocypris aspera Přibyl, 1962, p. 40, pl. 10, fig. 1–3; Upper Carboniferous of Czechoslovakia.

Macrocypris? baghensis Jain, 1961, p. 341; Cretaceous of India; see also Bhatia, Guha, and McKenzie, 1972, p. 37; assigned by Jain (1975) to *Acuticytheretta* (Cytheracea).

Macrocypris barrandei Boucek, 1936, p. 80, pl. 5, fig. 9, Silurian of Czechoslovakia.

Macrocypris? bartensteini Kummerow, 1949, p. 57, pl. 1, fig. 10, pl. 2, fig. 12; Upper Carboniferous of Germany.

Macrocypris biconcava Croneis and Gutke, 1939, p. 60, pl. 1, fig. 16–17; Lower Carboniferous of Illinois. The shape and larger right valve are appropriate for Macrocyprididae, but information is needed about the dorsal overlap, hinge, and muscle scars.

Macrocypris bicurvata Cooper, 1946, p. 61, pl. 6, fig. 25–27; Upper Carboniferous of Illinois.

Macrocypris bradiana Jones, 1884, p. 766, pl. 34, fig. 34; Lower Cretaceous of England.

Macrocypris carbonica Jones and Kirkby of Bassler and Kellett, 1934, p. 404; Carboniferous of Scotland.

Macrocypris chapmani Croneis and Bristol, 1939, p. 99, pl. 3, fig. 19; Lower Carboniferous of Illinois.

Macrocypris concinna Jones and Hinde, 1890, p. 11, pl. 2, fig. 66, 67; Upper Cretaceous of England.

Macrocypris? crassula Jones, 1887, p. 181, pl. 7, fig. 10a,b; Silurian of England.

Macrocypris delicatula Bradfield, 1935, p. 104, pl. 8, fig. 12; Upper Carboniferous of Oklahoma. The shape is appropriate for Macrocyprididae, but more information is needed about overlap, hinge, and muscle scars.

**Macrocypris? dimorpha* Hazel and Holden, 1971, p. D6, pl. 5, fig. 8, 11, 13, 17, 19; holotype USNM 651442, paratype 651441, Eocene of Tonga; see also Hartmann (1984, p. 141); =*Propontocypris (Propontocypris) dimorpha.* The valve asymmetry is less pronounced and the line of right valve overlap much less sinuous than is the case in Macrocyprididae. Under high magnification there are numerous tiny, close-spaced normal pore canals visible, another characteristic of *Propontocypris,* and the paratype specimen shows a large, central opaque patch. The paratype differs in outline from the holotype and probably belongs to another species of *Propontocypris.* See Plates 113.9–14.

**Macrocypris?* sp. aff. *M. dimorpha* Hazel and Holden, of Holden, 1976, p. F18, pl. 10, fig. 12–14, 19, 20; USNM 184363–184367; Miocene–Pleistocene? of Midway Island; =*Propontocypris (Propontocypris)* sp. indet. All five specimens have the characteristic right valve overlap and triangular shape of *Propontocypris.* Holden's (1976) drawings are accurate. USNM 184364 is somewhat more elongate posteriorly and may be the male of the species. USNM 184365 has a good pontocyprid muscle scar pattern. See Plates 113.7,15–25.

Macrocypris dreikanter Coryell and Fields, 1937, p. 3, fig. 4a,b; Miocene of Panama. The illustrations show characters of *Pontocypris.* Van den Bold (1946, 1958) reported the species in *Pontocypris* from the Miocene of Cuba and Trinidad.

Macrocypris dubia Bonnema, 1940, pl. 2, fig. 28–30; Upper Cretaceous of The Netherlands. *Macrocypris elegans* Jones, 1887, p. 180, pl. 5, fig. 8a–c; Silurian of England.

Novocypris eocaenana Ducasse, 1967; Eocene of France. Ducasse correctly assigned it to the Cyprididae. The lateral outline, left-valve overlap, and paracypridine muscle scar pattern all place this unusual genus and species with the Cyprididae, rather than the Macrocyprididae, where it was classified by McKenzie et al. (1979). The hinge is taxodont, consisting of a uniform series of alternating small, round teeth and sockets, not differentiated into anterior, median, and posterior elements. In the left valve, the teeth are larger and more prominent in the anterior region, diminishing slightly in diameter toward the posterior as the intervening sockets increase in size; in the right valve there is a corresponding, gradual gradient from slight dominance of sockets in the anterior portion to slight dominance by teeth in the posterior part. It is a unique hinge, without known homologue elsewhere in the Cypridacea. See Plates 114.3–8,10,16.

Macrocypris flexuosa Chapman, 1904, p. 309, pl. 13, fig. 6a,b; Devonian of Australia.

**Macrocyprina gibsonensis* (Howe and Chambers, 1935) of Hazel, Mumma, and Huff, 1980, pl. 1, fig. 4; Oligocene of Mississippi and Alabama. Originally named in "*Bythocypris?*", the species was transferred to *Triangulocypris* by Teeter (1975, p. 423). *Triangulocypris,* formerly classified by Teeter in the Subfamily Bythocypridinae, belongs to the Paracypridinae and may be a senior subjective synonym of McKenzie's (1979) genus *Tasmanocypris* (see also Maddocks, 1988b). *T. gibsonensis* has a good paracypridine muscle-scar pattern.

Macrocypris garrisonensis Upson, 1933, p. 25, pl. 2, fig. 14a,b; Lower Permian of Nebraska; transferred to *Bairdia* by Willey, 1970.

Macrocypris gracilis Chapman, 1915, p. 37, pl. 2, fig. 2a–c; Holocene, east of Tasmania. Junior primary homonym of *Macrocypris gracilis* Seguenza, 1883–1886. Reclassified by Neale (1967) in *Xiphichilus* (Cytheracea).

Pontocypris gracilis Brady, 1890, p. 491, pl. 1, fig. 5, 6; "between tide-marks, Levuka and Rambé Island, South Pacific"; a species of Paracypridinae. McKenzie (1967b) referred the material (from Fiji) of this species in the Hancock Museum to *Paracypris.* The species illustrated by Holden (1967, p. 16, fig. 9; Quaternary, Hawaiian Islands) as "*Macrocypris*" *gracilis* (Brady, 1890) (a junior secondary homonym of *Macrocypris gracilis* Seguenza) is an unnamed species of *Macrocyprina.* The species illustrated by Holden (1976, p. F19, pl. 10, fig. 6, 7; upper Cenozoic of Midway Island; see also Hartmann, 1984, p. 141) as *Macrocyprina gracilis* has left valve overlap and is probably a species of *Paracypris.*

Macrocypris gracillima (Richter, 1867) of Bassler and Kellett, 1934, p. 404; Permian of Germany.

Macrocypris horatiana Jones and Sherborn, 1887, p. 252, pl. 5, fig. 2a–c; Middle Jurassic of England. The species was placed in synonymy with *Paracypris terraefullonica* (Jones and Sherborn) by Bate (1967).

Macrocypris? illinoiensis Scott and Borger, 1941, p. 358, pl. 50, fig. 1, 2; Upper Carboniferous of Illinois.

Macrocypris jonesiana (Kirkby, 1858) of Jones and Kirkby, 1897, p. 194; Carboniferous of Ireland.

Macrocypris kayi Spivey, 1939, p. 173, pl. 21, fig. 11–13; Upper Ordovician of Iowa.

Macrocypris? kellettae Príbyl and Snajdr, 1950, p. 121, pl. 1, fig. 14; Middle Devonian of Czechoslovakia.

Macrocypris kirkbyana (Jones, 1885) of Bassler and Kellett, 1934, p. 405; Carboniferous of England.

Macrocypris kovacsiensis Mehes, 1936, p. 11, pl. 1, fig. 6–8; Eocene of Hungary.

Macrocypris lenticularis Cooper, 1946, p. 62, pl. 6, fig. 38–40; Upper Carboniferous of Illinois.

Macrocypris leptura (Richter, 1867) of Bassler and Kellett, 1934, p. 405; Permian of Germany.

Macrocypris? marginata (Richter, 1867) of Bassler and Kellett, 1934, p. 405; Permian of Germany.

Macrocypris menardensis Harlton, 1929, p. 161, pl. 4, fig. 7a,b; Upper Carboniferous of Texas. The shape and larger right valve are appropriate for Macrocyprididae, but information is needed about the overlap, hinge, and muscle scars.

Macrocypris cf. *meridionalis* (Lyubimova and Mohan, 1960) of Krstic, 1979, p. 676; Miocene of Iran.

**Macrocypris minutus* Swain and Peterson, 1952, p. 9, pl. 1, fig. 13–16; holotype USNM 117965, paratypes 117966, 116639, 116640; Jurassic, Redwater Shale, 112–117 feet above base, Red Gulch, sec. 22, T58N, R89W, Sheridan Co., Wyoming; =*Propontocypris (Propontocypris) minutus.* The right valve is slightly larger than and overlaps the left valve on all specimens, but the asymmetry is less pronounced and the line of overlap less sinuous than in Macrocyprididae. Although Swain and Peterson reported "a slightly dorsomedian group of four spots of which the dorsal two are the largest," no muscle scars are visible on these specimens. The minute size (0.39 mm long) is not unusual for *Propontocypris.* See Plates 113.2–5.

Macrocypris modesta (Reuss, 1851) of Howe and Laurencich, 1958, p. 392; Cretaceous of Poland.

Macrocypris? novaki Boucek and Príbyl, 1955, p. 601, pl. 5, fig. 14–17; Silurian of Czechoslovakia.

Macrocypris orientalis Brady, 1867–1871, p. 61, pl. 7, fig. 1–3; Holocene near Java; a species of Paracypridinae. Brady's illustration shows widely spaced, conspicuous normal pore canals and branching or irregular radial pore canals, together with a somewhat misunderstood paracypridine muscle scar pattern. McKenzie (1967b) assigned Brady's type specimens to *Phlyctenophora,* a paracypridine genus that is homeomorphic with *Macrocyprissa.* It was reported by Brady (1880), Egger (1902), A. Scott (1905), Müller (1912), and Hanai et al., (1980) from recent sediments near Booby Island, Papua-New Guinea, Australia, and Ceylon, but it is unlikely that these later records apply either to Brady's species or to a species of Macrocyprididae. The *Challenger* specimens belong to *Ghardaglaia* or a related genus of Paracypridinae. It was reclassified without comment in *Macrocyprina* by Bhatia et al., 1972, p. 37.

Macrocypris ovata Cooper, 1941, p. 34, pl. 4, fig. 25, 26; Upper Carboniferous of Illinois.

**Paracypris pacifica* LeRoy, 1943, p. 358, text-fig. 2z, pl. 60, fig. 38, pl. 61, fig. 15–18; Plio-Pleistocene of California. The type specimen is a species of *Paracypris* (Cyprididae, Paracypridinae) and has a good paracypridine muscle scar (see Maddocks, 1988a), although *Mn. parcens* occurs in the same formation. The species reported by Swain (1967) and by McKenzie and Swain (1967) as *Macrocyprina pacifica* (LeRoy) is *Mn. swaini* (see above). Swain (1969) and Swain and Gilby (1974) apparently included at least two species of *Macrocyprina, Mn. swaini* and *Mn. barbara,* plus a species of *Paracypris* under the label "*Macrocyprina pacifica.*" See Plates 114.9,11,12,17.

Macrocypris pacifica Hu, 1979, p. 76, text-fig. A, B, E, F, pl. 2, fig. 13, 16; Pleistocene or Holocene of Taiwan. There are two species represented in the illustrations. The more elongate, posteriorly acuminate one may belong to *Paracypris,* in which case it would be a secondary homonym of *Paracypris pacifica* LeRoy. The more elongate, subtrapezoidal form might be a species of *Macrocyprina,* or it might belong to a homeomorphic cypridid such as *Tasmanocypris.* The muscle scars as sketched are approximately macrocypridid but too large for the specimen in which they are drawn, and the overlap and hingement cannot be determined from the illustrations. The illustrations of Hu (1982, 1986) may belong to a separate species of *Macrocyprina.*

Macrocypris? panxianensis Wang, 1978. See also Wei et al., 1983, p. 74, pl. 22, fig. 5; Permian or Triassic of southwestern China.

**Macrocypris parva* Kaye, 1965, p. 75, pl. 5, fig. 1, 2; Kaye and Barker, 1965, p. 375, pl. 5, fig. 1, 2; holotype HU.10.C.7.1, paratypes HU.20.C.8.1–13. The additional paratypes in the Senckenberg Museum (Xe 4637) were not seen. Lower Cretaceous, Barremian–Aptian, of England; =*Propontocypris (Propontocypris) parva.* The type specimens show distinct right valve overlap, but not as extreme and as sinuous as in Macrocyprididae, deep open anterior and posterior vestibules, and a simple lophodont hinge consisting in the right valve of a narrow groove. One paratype shows a very distinct pontocypridid scar consisting of five oblong scars arranged in a curved anterior column of three scars and a posterior column of two posterior scars. Michaelsen (1975) assigned this species to *Pseudomacrocypris,* which is related to if not synonymous with *Propontocypris.* See Plates 113.1,6,8.

Macrocypris parvula Boucek, 1936, p. 80, pl. 5, fig. 10; Silurian of Czechoslovakia.

Macrocypris? piscis (Richter, 1867) of Bassler and Kellett, 1934, p. 405; Permian of Germany.

Macrocypris posterobtusa Wang, 1978. See also Wei et al., 1983, p. 74, pl. 22, fig. 6; Permian or Triassic of southwest China.

Macrocypris prima Mehes, 1936, p. 10, pl. 1, fig. 1–5, 27, 28; Eocene of Hungary.

Macrocypris? pusilla Jones, 1889, p. 268, pl. 15, fig. 10a,b; Silurian of Sweden.

Macrocypris? pusilla Kozur, 1968, p. 501, pl. 2, fig. 4, 20–27; Triassic of Germany. Junior primary homonym of *Macrocypris? pusilla* Jones, 1889. The shape and larger right valve are compatible with Macrocyprididae, but the tiny size (0.30 to 0.43 mm), straight-line overlap, adont hinge, narrow calcified inner lamella, lack of information about muscle scars, and occurrence in brackish facies cast doubt on that assignment.

Macrocypris reginni Coryell and Johnson, 1939, p. 222, pl. 26, fig. 14; Lower Carboniferous of Illinois.

Macrocypris? regularis (Richter, 1867) of Bassler and Kellett, 1934, p. 405; Permian of Germany.

Macrocypris remesiana Kegel, 1928, p. 654, pl. 33, fig. 4; Devonian of Czechoslovakia.

**Macrocypris setigera* Brady, 1880, p. 43, pl. 1, fig. 1a–d; Puri and Hulings, 1976, p. 260, pl. 1, fig. 1–5; lectotype BMNH 80.38.2, Port Jackson, Australia, 2–10 fathoms (4–19 m); =*Tasmanocypris setigera.* The species was reclassified in ?*Aglaiella* by McKenzie (1965, 1974) and in *Tasmanocypris* by McKenzie (1979). The left valve overlap, marginal features, muscle scars, and coastal habitat all support assignment to the Paracypridinae. The "seven adductor scars" mentioned by Puri and Hulings result from the fact that the cap scar above the adductor scars is consistently divided, as is frequently the case in the Paracypridinae. Seguenza's (1883–1886) and Egger's (1902) records also probably apply to various species of Paracypridinae, while Chapman's (1941) illustration (pl. 7, fig. 5, from Bass Strait) appears to show a species of the homeomorphic genus *Macromckenziea.* See Plates 114.1,2,13,14.

Macrocypris? silesiaca Kummerow, 1953, p. 20, pl. 1, fig. 15; Upper Carboniferous of Poland.

Macrocypris siliquoides Jones, 1887, p. 181, pl. 5, fig. 9a–c; Silurian of England.

Pseudomacrocypris subaequabilis Michaelsen, 1975, p. 131, pl. 2, fig. 21, pl. 4, fig. 9; Lower Jurassic of Denmark; a species of Pontocyprididae, closely related to *Propontocypris.*

Macrocypris? subcylindrica Jones, 1890, p. 549, pl. 21, fig. 5; Ordovician of Quebec.

Macrocypris subelongata (Geinitz, 1861) of Bassler and Kellett, 1934, p. 406; Permian of Germany.

Macrocypris subinflata Neviani, 1928, p. 26, pl. 1, fig. 1–3; "Pliocene, lower Calabrian" of Italy.

Pseudomacrocypris subtriangularis Michaelsen, 1975, p. 132, pl. 2, fig. 22–28, pl. 4, fig. 40, 41, 44, 45; Lower Jurassic of Denmark; a species of Pontocyprididae, closely related to *Propontocypris.*

Pseudomacrocypris aff. *subtriangularis* Michaelsen, 1975, p. 134, pl. 4, fig. 42, 43; Lower Jurassic of Denmark; a species of Pontocyprididae, closely related to *Propontocypris.*

Macrocypris symmetrica Jones, 1887, p. 181, pl. 7, fig. 8a,b; Silurian of England.

Macrocypris? tenuis Kozur, 1968, p. 501, pl. 2, fig. 17–19; Triassic of Germany. The shape and larger right valve would be compatible with juveniles of Macrocyprididae, but information is needed about the dorsal overlap, hinge, adult inner lamella, and muscle scars. The occurrence in brackish facies also makes this identification unlikely.

Macrocypris teretis Cooper, 1946, p. 62, pl. 6, fig. 28–30; Upper Carboniferous of Illinois.

Macrocypris terraefullonica Jones and Sherborn, 1887, p. 252, pl. 5, fig. 3a–c; Jurassic of England. Referred to *Paracypris* by Bate (1967), probably belongs to another genus of Paracypridinae.

**Macrocypris tumida* Brady, 1880, p. 43, pl. 6, fig. 2a–d; Puri and Hulings, 1976, p. 261, pl. 2, fig. 13–15; lectotype BMNH 80.38.161, *Challenger* st. 149, 49°08'0"S, 70°12'0"E, depth 28 fathoms (53 m), Royal Sound, Kerguelen Island; =*Argilloecia tumida.* The species was transferred to *Argilloecia* by Maddocks (1969a) on the basis of overlap, hinge, marginal features, and the distinctive muscle scars. It has also been listed by Müller (1912), Puri and Hulings (1976), and Benson (1964). The species reported by this name by Chapman (1914) is *Maddocksella tumefacta* (Chapman, 1914), according to McKenzie (1981). Other records of this species—Wellington Harbour, New Zealand, by Brady (1880); Kerguelen Island and Adelie Sound by Lofthouse (1967), and the Miocene–Pliocene of Australia by Chapman (1914, 1916), Chapman and Crespin (1928), and Crespin (1943)—may have included various species of the homeomorphic genus *Macromckenziea,* while the record in the Gulf of Mexico by Tressler (1954) is likely to have been a species of *Macropyxis.*

Macrocypris vinei Jones, 1887, p. 179, pl. 4, fig. 1–3; Silurian of England.

Macrocypris cf. *vinei* Jones, 1887 of Chapman, 1904; Lower Devonian of Australia; =*Bairdia flexuosa* (Chapman, 1904) according to Willey (1970).

Macrocypris? sp. 855 of Christensen, 1968, pl. 23, fig. 4, Jurassic of Denmark; identified with *Pseudomacrocypris subtriangularis* by Michaelsen (1975); a species of Pontocyprididae, closely related to *Propontocypris.*

Macrocypris sp. of Oertli, 1961, p. 22, pl. 2, fig. 16; Miocene of Italy.

Macrocypris sp. of Kingma, 1948, p. 67, pl. 6, fig. 17; Miocene of Sumatra; also Hanai et al., 1980, p. 121.

Macrocypris sp. of Hu and Yang, 1975, p. 112, pl. 2, fig. 13; Pliocene or Pleistocene of Taiwan; Hanai et al., 1980, p. 121.

APPENDIX III: LIST OF COLLECTIONS STUDIED

These samples, stations, and catalogued museum specimens are listed in alphabetical order according to the alphanumeric identifying code, followed by the location, depth, stratigraphic age if fossil, and label data (copied exactly) if previously identified by other workers. Following the equals (=) sign, the true species identification(s) and number of specimens are given. Specimens containing the soft body are counted as "live." All other counts apply to empty carapaces or valves.

U.S. RESEARCH VESSEL *ANTON BRUUN*
(Richard H. Benson)

AB-7-361B, 26°34'S, 35°59'E, depth 1829 m; = 4 *Mk.* sp. 4.
AB-7-363D, 23°45'S, 43°11'E, 1605 m, near Tulear, Madagascar; = 2 live *M. proclivis,* 1 live plus 2 *Mx.* sp. 8, 1 live *Ms.* sp. 47.
AB-7-363K, 23°43'S, 43°25'E, 1190 m, near Tulear, Madagascar; = 1 *Mk.* sp. 1.
AB-7-365D, 23°20'S, 43°32'E, 695–475m; = 10 *M. opinabilis,* 4 *Mx.* sp. 13.
AB-7-371C, 24°54'S, 35°20'E, 165 m; = 1 *Ms. hiulca.*
AB-7-371G, 24°49'S, 35°13'E, 73 m, 18 August 1964, rock dredge; = 8 *Ms. hiulca.*
AB-7-381C, 33°13'S, 43°53'E, 40 m, Walterson Shoal; = 2 live plus 1 *Ms. hiulca.*
AB-8-403F, 19°09'S, 36°55'E, 8 m; = 9 live *Ms. capacis.*
AB-8-409J, 16°02'S, 44°14'E, 25 m, 19 October 1964, Oeckelman dredge; = 1 *Mn. madagascarensis.*
AB-8-412C, 12°47'S, 47°42'E, 23 m, near Nosy Be, Madagascar; = 1 *Mn. madagascarensis,* 4 live plus 2 *Mn. captiosa.*
AB-8-412L, Banque de Cinq Mètres, near Nosy Be, Madagascar, 30 m, by R. H. Benson; = 1 live plus 2 *Mn.* sp. 42.
AB-11-36, 5°43'S, 82°00.5'W, 5047 m; = 4 live *Mx. antonbruunae,* 5 live *Mx. kalbi.*
AB-11-59, 6°45.5'S, 82°10.5'W, 4526–4609 m; = 1 live *Mx. kalbi.*
AB-11-95, 8°30.5'S, 81°40'W, 4332–4423 m; = 2 live *Mx. antonbruunae.*
AB-11-109, 8°22'S, 80°43'W, 5123–2571 m; = 1 live *Mx. kalbi.*
AB-11-113, 8°44'S, 80°45'W, 5986–6134 m; = 1 live *Mx. antonbruunae,* 2 live *Mx. kaesleri,* 1 live *Mx. kalbi.*
AB-11-157, 12°02.6'S, 78°44.5'W, 3994–4364 m; = 1 live *Mx. kalbi.*
AB-11-169, 8°46.2'S, 80°44'W, 3909–3970 m; = 3 live *Mx. kalbi.*
AB-11-179, 8°54'S, 80°41'W, 4823–4925 m; = 3 live *Mx. antonbruunae,* 1 live *Mx. kalbi.*
AB-11-196, 9°00.5'S, 80°40'W, 4516–4383 m; = 1 live *Mx. kalbi.*
AB-18B-714C, 25°07'S, 70°43'W, 1025 m, off the coast of Chile; = 2 live *Mh. sinuata.*

U.S. RESEARCH VESSEL *ATLANTIS II*
USNM ACC. NO. 307408, SANDERS COLLECTION
(Richard H. Benson, Louis S. Kornicker)

AII-12-65, 38°46.8'N, 70°6.8'W, depth 2891 m; = 1 *Mx. bathyalensis.*
AII-24-118H, 32°19.4'–19.0'N, 64°34.9'–34.8'W, depth 1135–1153 m; = 12 live plus 10 *Mx. bathyalensis.*
AII-31-142, 10°30'N, 17°51.5'W, 1624–1796 m; = 8 live *M. miranda.*
AII-31-145, 10°36'N, 17°49'W, 2185 m; = 1 live *M. maioris,* 8 live *M. miranda,* 10 live *Mk. siliquosa.*
AII-31-155, 00°03.0'S, 27°48.0'W, 3730–3783 m; = 1 live *Ms.* sp. 23.
AII-31-156, 00°46.0'–00°46.5'S, 29°28.0'–29°24.0'W, 3459 m; = 1 live *M. maioris,* 1 live *Mx.* sp. 18.
AII-31-159, 7°58'S, 34°22'W, 834–939 m; = 1 live *Mx.* sp. 11, 9 live *Ms. bensoni,* 1 live *Mh.* sp. 30.
AII-31-167, 07°58.0'–50.0'S, 34°17.0'W, depth 943–1007 m; = 1 live plus 11 *Mx. kornickeri,* 14 *Mx. similis,* 15 live *Ms. bensoni,* 12 live plus 1 *Mh.* sp. 30.
AII-31-169A, 8°2'–3'S, 34°23'–25'W, depth 587 m; = 1 live *Mx. kornickeri,* 8 live plus 5 *Mx. similis,* 65 live plus 2 *Ms. bensoni,* 14 live plus 1 *Mh.* sp. 30.
AII-40-172, 40°12.3'–40°10.8'N, 70°44.7'–70°43.6'W, 119 m; = 118 live *Mx. labutisi,* 8 live plus 4 *Mx. sapeloensis.*
AII-40-173, 40°10.8'–40°10.6'N, 70°43.6'–70°44.0'W, 122.6 m; = 53 live *Mx. labutisi,* 25 live *Mx. sapeloensis.*
AII-42-191, 23°05'S, 12°31.5'E, 1546–1559 m; = 2 live *M. miranda.*
AII-42-194, 22°54'S, 11°55'E, 2864 m; = 172 live *M. metuenda,* 114 plus 1 live *Mk. siliquosa.*
AII-42-195, 14°49'–14°40'S, 9°56'–9°54'E, 3797 m; = 4 live *M. metuenda,* 3 live *Mx. audens.*
AII-42-196, 10°29'S, 9°03'–9°04'E, 4612–4630 m; = 2 live *M. maioris.*
AII-42-197, 10°29'S, 9°04'E, 4597–4595 m; = 14 live plus 1 *M. maioris,* 2 live *Mx. adrecta.*
AII-42-198, 10°24'S, 9°09'E, 4559–4566 m; = 10 live *M. maioris,* 3 live plus 1 *Mx. adrecta,* 1 live *Mx. adunca.*
AII-42-199, 9°47'–9°49'S, 10°29'–10°33'E, 3764–3779 m; = 12 live *M. miranda,* 10 live *Mx. audens.*
AII-42-200, 9°41'–9°43.5'S, 10°55'–10°57'E, 2644–2754 m; = 13 live *M. miranda,* 11 live plus 2 *Mk. siliquosa,* 13 live plus 2 *Mx. amanda.*
AII-42-201, 9°29'–9°25'S, 11°34'–11°35'E, 1964–2031 m; = 16 live *M. miranda,* 9 live *Mx. arta,* 5 live *Mx. audens.*

U.S. FISH COMMISSION STEAMER *ALBATROSS*
(Richard H. Benson)

Albatross 3375, 2°34'N, 82°29'W, 2197 m; = 1 live *Mx.* sp. 17.

AMERICAN MUSEUM OF NATURAL HISTORY
(Julia Golden, Harold S. Feinberg)

AMNH 12733, holotype, *Macrocypris bathyalensis* Hulings, *Vema* station V-17-118, 55°50'N, 56°06'W, depth 3369 m; = 1 live *Mx. bathyalensis.*

ARTHUR HARBOUR, ANTARCTICA
(Richard H. Benson)

Arthur Harbour St. III, USNM Acc. No. 380141, Podocopa, Stat. III, Arthur Harbour, Antarctica, 64°45'46"S, 64°06'17"W, 39 m, 20 February 1967; = 3 live *Mh. turbida.*

U.S. BUREAU OF LAND MANAGEMENT
MIDDLE ATLANTIC OUTER CONTINENTAL SHELF ENVIRONMENTAL STUDY
VIRGINIA INSITUTE OF MARINE SCIENCE
(Marcia Bowen)

[These stations were occupied 8 times or 4 times each. All stations were sampled in February and August of 1976 and 1977. The stations of transects A through F were also sampled in November 1975 and 1976 and in June 1976 and 1977. These seasonal samples and the six replicates within each sample have been combined in the data given below. The latitude-longitude coordinates given are those for the first sampling period in Fall 1975; later sampling coordinates may vary slightly. See also Tables 2 and 3. Additional sedimentological, physical, chemical, and biological data for these stations are on file at Virginia Institute of Marine Science.]

BLM-A1, 39°14.7'N, 72°47.3'W, 90–91 m, outer shelf, medium fine sand, moderate sorting, 6–9% silt and clay; = 64 live *Mh. atlantica*, 173 live *Mx. labutisi*, 183 live *Mx. sapeloensis*.

BLM-A2, 39°21.6'N, 72°31.0'W, 127–132 m, shelf break, silty medium to fine sand, poor sorting, 22–25% silt and clay; = 51 live *Mh. atlantica*, 153 live *Mx. labutisi*, 17 live *Mx. sapeloensis*.

BLM-A3, 39°16.5'N, 72°29.7'W, 136–139 m, hummock, medium sand, poor sorting, 17–21% silt and clay; = 1 live *Mh. atlantica*, 23 live *Mx. labutisi*, 3 live *Mx. sapeloensis*.

BLM-A4, 39°14.3'N, 72°26.7'W, 196–198 m, shelf break, medium-fine sand, poor sorting, 14–16% silt and clay; = 7 live *Mx. labutisi*, 1 live *Mx. sapeloensis*.

BLM-D4, 39°02.9'N, 73°47.1'W, 48-51 m, swale, fine sand, moderately well sorted, 4–6% silt and clay; = 1 live *Mx. labutisi*.

BLM-E2, 38°44.2'N, 73°25.8'W, 64–73 m, flank, medium-fine sand, moderately well sorted, 3–7% silt and clay; = 1 live *Mh. atlantica*, 1 live *Mx. sapeloensis*.

BLM-E4, 38°42.8'N, 73°24.3'W, 75–80 m, swale, shelly-medium-coarse sand, moderately well sorted, 3–6% silt and clay; = 28 live *Mh. atlantica*, 1 live *Mx. sapeloensis*.

BLM-F1, 38°44.0'N, 73°14.7'W, 84–85 m, outer shelf, medium-fine sand, well sorted, 1–2% silt and clay; = 28 live *Mh. atlantica*.

BLM-F2, 38°44.3'N, 73°09.2'W, 110–113 m, shelf break, fine sand, well sorted, 4–7% silt and clay; = 142 live *Mh. atlantica*, 21 live *Mx. labutisi*, 32 live *Mx. sapeloensis*.

BLM-F3, 38°43.8'N, 73°04.4'W, 150–153 m, shelf break, medium-fine sand, moderately sorted, 6–9% silt and clay; = 1 live *Mh. atlantica*, 7 live *Mx. labutisi*.

BLM-F4, 38°44.3'N, 73°02.9'W, 183–184 m, shelf break, medium-fine sand, moderately sorted, 7–10% silt and clay; = 1 live *Mh. atlantica*, 11 live *Mx. labutisi*, 16 live *Mx. sapeloensis*.

BLM-G5, 39°48.9'N, 72°12.3'W, 90–92 m, medium sand, moderately sorted, 9–11% silt and clay; = 3 live *Mh. atlantica*, 58 live *Mx. labutisi*, 11 live *Mx. sapeloensis*.

BLM-G6, 39°40.6'N, 72°00.8'W, 167 m, medium-fine sand, poor sorting, 18–22% silt and clay; = 31 live *Mx. labutisi*, 2 live *Mx. sapeloensis*.

BLM-G7, 39°39.2'N, 71°57.4'W, 310–350 m, fine sand, poor sorting, 21–29% silt and clay; = 5 live *Mh. atlantica*, 13 live *Mx. labutisi*.

BLM-H1, 39°12.1'N, 72°23.6'W, 350–400 m, silty-medium-fine sand, poor sorting, 28–33% silt and clay; = 8 live *Mh. atlantica*, 1 live *Mx. sapeloensis*.

BLM-I1, 39°06.6'N, 72°59.0'W, 77–78 m, medium-coarse sand, moderate sorting, 2–4% silt and clay; = 10 live *Mh. atlantica*.

BLM-I2, 39°07.5'N, 72°49.1'W, 93–94 m, medium-coarse sand, poor sorting, 4–5% silt and clay; = 26 live *Mh. atlantica*, 1 live *Mx. labutisi*, 1 live *Mx. sapeloensis*.

BLM-I3, 39°08.8'N, 72°42.0'W, 176–181 m, medium-fine sand, moderate sorting, 9–16% silt and clay; = 4 live *Mx. labutisi*, 7 live *Mx. sapeloensis*.

BLM-I4, 39°06.1'N, 72°40.5'W, 460 m, sand-silt-clay, poor sorting, 46—51% silt and clay; = 2 live *Mh. atlantica*.

BLM-J1, 38°45.0'N, 73°00.8'W, 342–410 m, silty-fine sand, poor sorting, 28–31% silt and clay; = 5 live *Mx. labutisi*.

BLM-K4, 38°04.5'N, 74°01.7'W, 102–105 m, fine sand, moderately well sorted, 10% silt and clay; = 40 live *Mh. atlantica*, 25 live *Mx. labutisi*, 42 live *Mx. sapeloensis*.

BLM-K5, 38°01.6'N, 73°53.8'W, 143–152 m, medium-fine sand, poor sorting, 7–9% silt and clay; = 1 live *Mx. labutisi*.

BLM-K6, 38°00.8'N, 73°51.8'W, 339–370 m, fine sand, poor sorting, 22–24% silt and clay; = 6 live *Mx. labutisi*, 4 live *Mx. sapeloensis*.

BLM-L4, 37°08.1'N, 74°37.0'W, 90–94 m, medium-coarse sand, moderate sorting, 1% silt and clay; = 3 live *Mh. atlantica*.

BLM-L5, 37°06.1'N, 74°33.4'W, 180–201 m, mixed sand, poor sorting, 8% silt and clay; = 4 live *Mh. atlantica*, 4 live *Mx. labutisi*, 1 live *Mx. sapeloensis*.

BLM-L6, 37°04.6'N, 74°33.1'W, 332-350 m, sand-silt-clay, poor sorting, 36–53% silt and clay; = 3 live *Mx. labutisi*, 1 live *Mx. sapeloensis*.

BRITISH MUSEUM (NATURAL HISTORY)
CRUSTACEA SECTION, THE W. BAIRD COLLECTION

(Joan Ellis, Ann Gurney)

BMNH 1945.9.26.105, *Cythere minna* Baird, 114, Zetland, R. McAndrew, 50.60, TYPE, Norway, R. McAndrew; = 1 *M. minna*.

THE G. S. BRADY HMS *CHALLENGER* COLLECTION

BMNH 80.38.14, "*Macrocypris similis* Brady, lectoholotype H. S. Puri 7/67, Challenger no. 120, Depth 675"; Challenger station 120, off Pernambuco, 8°37'0"S, 34°28'0"W, depth 675 fathoms (1235 m), red mud; = 1 *Mx. similis*.

BMNH 80.38.14, slide 153, "*Macrocypris similis* Brady, paralectotype Puri 6/67, Challenger No. 120, Depth 675"; Challenger station 120, 8°37'S, 34°28'W, depth 675 fathoms (1235 m), off Pernambuco, Brazil, September 9, 1873; = 4 *Mx. similis*.

BMNH 80.38.15, "*Macrocypris tenuicauda* Brady, lectoparatype; Challenger station 122, 9°5'S, 34°49'W, depth 350 fathoms (640 m), off North Brazil, 10/9/1973, G. S. Brady, washings of dredge"; = 5 *Ms. bensoni*.

BMNH 80.38.15, slide 157, "*Macrocypris tenuicauda* Brady, lectoparatype H. S. Puri 7/67, Challenger no. 122, D 350"; Challenger station 122, 9°5'S, 34°49'W, depth 350 fathoms (640 m), off north Brazil, 10/9/1873, G. S. Brady, washings; = 4 *Ms. bensoni*.

BMNH 80.38.16, "*Macrocypris tenuicauda* Brady, lectoholotype H. S. Puri 7/67, no. 24, D. 390, N of St. Thomas"; Challenger station 24, off St. Thomas Island, West Indies, 18°38'30"N, 65°05'30"W, depth 390 fathoms (713 m), pteropod ooze, March 25, 1873; = 1 *Mx. tenuicauda*.

BMNH 80.38.16, slide 154, "*Macrocypris tenuicauda* Brady, lectoparatype H. S. Puri 7/67, Challenger No. 24, D. 390, N. of St. Thomas"; Challenger station 24, off St. Thomas Island, West Indies, 18°38'30"N, 65°05'30"W, depth 390 fathoms (713 m), pteropod ooze, March 25, 1873; = 1 *Mx. tenuicauda*.

BMNH 81.5.6, slide 148, "*Macrocypris canariensis* Brady, Challenger D. 600, Canary Is., Lectoholotype H. S. Puri 7/67"; Challenger station 8, a dredging off Gomera, the Canary Islands, 28°03'15"N, 17°27'0"W, depth 620 fathoms (1134 m), on a bottom of sandy mud and shells; = 1 *Ma. canariensis*.

BMNH 1961.12.4.65, "*Macrocypris tenuicauda* Brady, Challenger No. 122, Depth 350 fath., washings of dredge"; Challenger station 122, 9°5'S, 34°49'W, depth 350 fathoms (640 m), off

North Brazil, 10/9/1973, G. S. Brady, washings of dredge; = 7 *Ms. bensoni*.

THE A. M. NORMAN COLLECTION

BMNH 1900.3.6.166, *Macrocypris minna* Baird, No. 5, Oster Fjord, Norway, 375 fath. (686 m), 1878, 114; = 2 *M. minna*.

BMNH 1900.3.6.167, *Macrocypris minna* Baird, *Porcupine* 1869, stat. 36, 45°50'N, 11°9'W, 725 fath. (1326 m); = 1 *M. minna*.

BMNH 1911.11.8.M.3066, *Macrocypris minna* Baird, *Porcupine* 1869, stat. 25, 160 fath. (293 m), near Rockal, 56°41'N, 13°30'W; = 4 *M. minna*.

BMNH 1911.11.8.M.3067, *Macrocypris minna* Baird, *Porcupine* 1869, stat. 3, 722 fath. (1320 m), off S. W. Ireland, Lat. 51°38'N, Long. 12°5'W; = 4 *M. minna*.

BMNH 1911.11.8.M.3069, *Macrocypris minna*, Oster Fjord & Bukken, Norway, 114, 50–20 faths. (91–37 m), 1878; *Macrocypris minna* Baird, Oster Fjord, Norway, 1878, No. 6, 19 + 20, off Sartoro, Bukken, Norway, 1878, No. 19, 15–40 f.; = 4 *M. minna*, 4 *Ms.* sp. 24.

BMNH 1911.11.8.M.3070A, *Macrocypris minna*, Dröback, Norway, stat. 44, 30–100 fath. (54–183 m); = 5 *M. minna*.

BMNH 1911.11.8.M.3070B, *Macrocypris minna* (Baird), Dröback, Norway, Stat. 44, 30–100 fath. (54–183 m), 1879, Plesiotypes (described by P. C. Sylvester-Bradley, 1948); = 3 *M. minna*.

BMNH 1911.11.8.M.3071, *Macrocypris minna* Sars [*sic*], Lervig, Norway, St. 30, 33 fath. (61 m), 1879; Lervig, Norway, 1879, St. 30. 33; = 2 *M. minna*, 1 *Ms.* sp. 24.

BMNH 1911.11.8.M.3072, *Macrocypris minna*, Shetland, 1861; = 1 *M. minna*.

BMNH 1911.11.8.33669-683, *Macrocypris minna*, off Uidto Lighthouse, Hardanger Fjord, 150–180 fms (247–329 m); = 3 live *M. minna*. BMNH 1911.11.8.33691-694, *Macrocypris minna*, off Fair Isle, coll. T. Scott; = 2 live *M. minna*.

BRITISH MUSEUM (NATURAL HISTORY) DEPARTMENT OF PALAEONTOLOGY

(Raymond H. Bate)

BMNH In.51617, *Bairdia siliqua* Jones, Lectotype, Detritus, Charing, Kent, Jones 1870; = 1 *Ms. siliqua*.

BMNH In.51618, *Macrocypris muensteriana* J. & H. 1890, Detritus, Charing, Kent, Jones 1870; = 1 *Mh. muensteriana*.

BMNH In.51619, *Bairdia siliqua* Jones, Paralectotype, Chalk, Gravesend, Jones 1870; = 1 *Ms. siliqua*.

BMNH In.51620, *Bairdia siliqua* Jones, Paralectotype, Chalk, Gravesend, Jones 1870; = 1 *Ms. siliqua*.

BMNH In.51622, *Macrocypris muensteriana* J. &. H. 1890, Lectotype, Detritus, Charing, Kent, Jones 1870; = 1 *Mh. muensteriana*.

BMNH Io.1270, *Macrocypris exquisita* Kaye, 1963, Holotype, U. Gault, Burwell, Cambs., L. Cretaceous (Albian), England; = 1 *Ms. exquisita*.

BMNH Io.1271, *Macrocypris exquisita* Kaye, 1963, Paratype, U. Gault, Burwell, Cambs., L. Cretaceous (Albian), England; = 1 *Ms. exquisita*.

BMNH Io.1272, *Macrocypris exquisita* Kaye, 1963, Paratype, U. Gault, Burwell, Cambs., Kaye 1963; = 1 *Ms. exquisita*.

BMNH Io.1273, *Macrocypris exquisita* Kaye, 1963, Paratype, U. Gault, Burwell, Cambs.; = 1 *Ms. exquisita*.

BMNH Io.1274, *Macrocypris exquisita* Kaye, 1963, Paratype, U. Gault, Burwell, Cambs.; = 1 *Ms. exquisita*.

BMNH Io.1275, *Macrocypris simplex* Chapman 1898, Red Chalk, South Cave, E. Yorks., Kaye 1963; = 1 *Ms. simplex*.

BMNH Io.1276, *Macrocypris siliqua* (Jones) 1869, U. Chalk, Sonning, Berks., Kaye 1963; = 2 *Ms. siliqua*.

BMNH Io.1595, *Macrocypris wrightii* Jones & Hinde 1890, lectotype; = 1 *Ms. wrightii*.

BMNH Io.2473, *Macrocypris wrightii* Jones & Hinde 1890, paralectotype; = 1 *Ms. wrightii*.

GIOACCHINO BONADUCE ZOOLOGICAL STATION OF NAPLES

(Gioacchino Bonaduce, Kenneth G. McKenzie)

Bonaduce 1, Bay of Naples, northern side of Ischia, on Forio Bank, on calcareous algae, depth 50 m, collected by Gioacchino Bonaduce, 1975; = 15 live *Mn. succinea*.

Bonaduce 2, Bay of Naples, Pozzuoli, depth 95 m, collected by Gioacchino Bonaduce; = 5 *Mk. ligustica*.

Bonaduce 3, Bay of Naples, B.C. 22, depth 145 m; = 2 live plus 1 *Mk. ligustica*.

Bonaduce 4, Bay of Naples, B.C. 21, depth 308–340 m, collected by Gioacchino Bonaduce; = 19 *Mk. ligustica*.

Bonaduce 5, Gulf of Aqaba, *Sansone II* station 1, collected by Pasquale Sansone on the southeast coast of Sinai between Sharm-el-sheikh and Na'ama, at Fiasko Reef, depth 50 m; = 5 *Mn. bonaducei*.

Bonaduce 6, Gulf of Aqaba, *Sansone III* station 10, southeast coast of Sinai between Na'ama and Ros Nasrani at For Gardens Reef, depth 15 m; = 14 *Mn. bonaducei*.

Bonaduce 7, Gulf of Naples, BC-32, 27–40 m; = 22 live *Mn. succinea*.

Bonaduce 8, Campione M, Socca di Forio, Bay of Naples, 50 m, coralligens; = 8 live *Mn. succinea*.

Bonaduce 9, Mare Tirrens, St. 83, depth 86 m; = 1 *Mk. ligustica*.

Bonaduce 10, B.C.M. 333, St. 80, depth 77 m, Mare Tirrens, paratype; = 1 *Mk. ligustica*.

U.S. RESEARCH VESSEL *CHAIN* USNM ACC. NO. 307408, SANDERS COLLECTION

(Richard H. Benson, Louis S. Kornicker)

C # 1, 40°20.5'N, 70°47'W, depth 97 m, 25 May 1961; = 2 live *Mx. labutisi*, 5 live *Mx. sapeloensis*.

C-50-85, 37°59.2'N, 69°26.2'W, depth 3834 m; = 2 live *Mx. bathyalensis*.

C-106-313, 51°32.2'N, 12°35.9'W, 1500–1491 m, 17 August 1972, epibenthic sled; = 10 *M. nimia*, approximately 900 live *Mc. arcuata*.

FRANCESCA CARAION, INSTITUTE OF BIOLOGY TRAIAN SAVULESCU, BUCHAREST

Caraion Cuba stat. II, Gulf of Batabano, 4 m, 1 March 1969, coll. Dr. Trajan Marian Gomoiu; = 2 *Mn.* sp. 39.

U.S. NAVY SHIP *ELTANIN*

(Richard H. Benson, Roger L. Kaesler)

E-3-25, 04°53'-04°51'N, 80°28'W, depth 2489 m, 2 June 1962, Menzies trawl; = 3 live *Mx. kaesleri*.

E-3-40, 13°10'–13°07'S, 77°56.5'–77°57'W, depth 1910–1860 fathoms (3494–3402 m), 11 June 1962, Peru–Chile Trench, Menzies trawl; = 2 live *Mx. kalbi*, 3 live *Ma. semesa*.

E-3-43, 13°15'–13°13.5'S, 78°06'–78°06.5'W, depth 2910–2840 fathoms (5323–5119 m), 12 June 1962, Menzies trawl; = 1 live *Ma. semesa*, 1 live *M.* sp. 1.

E-3-48, 14°11'–14°08'S, 77°08'–77°09'W, depth 3883–4004 m, 13 June 1962, Menzies trawl; = 5 live *Mx. kalbi*, 1 live *Ma. semesa*.

E-3-50, 16°12'–16°10'S, 74°41'–74°41'W, depth 2599–2858 m, 15 June 1962, Menzies trawl; = 1 live *Mx. kalbi*, 12 live *Mh. sinuata*.

E-3-65, 25°53'–25°42'S, 71°07'W, depth 3149–3257 m, 21 June 1962, Menzies trawl; = 5 live *Mx. eltaninae*.

E-4-127, 61°45'S, 61°14'W, 4758 m, 1 August 1962; = 2 live *Mx. eltaninae*.

E-5-322, 56°04'–56°05'S, 071°03'–071°09'W, depth 1806–2013 m, 7 November 1962, Menzies trawl; = 1 live *Mk.* sp. 19, 1 live *Mh. tensa*.

E-6-344, 54°04'S, 58°46'–58°45'W, depth 119 m, Burdwood Bank, 4 December 1962, Menzies trawl; = 36 live *Mh. opaca*.

E-6-350, 55°03–55°00'S, 58°57'–58°51'W, depth 2452 m, south side of Burdwood Bank, 4 December 1962, Menzies trawl; = 5 live *Mh. inaequata*.

E-6-412, 62°06'S, 56°00'-55°59'W, depth 1180 m, Bransfield Strait, 1 January 1963, Menzies trawl; = 2 live *Mk. glacierae*.

E-6-418, 62°39'–62°40'S, 56°8'–56°10'W, depth 426–311 m, 2 January 1963, 5-foot Blake trawl; = 2 live *Mh. inaequalis*, 3 live *Mh. turbida*.

E-9-740, 56°06'–56°07'S, 66°19'–66°30'W, depth 384–494 m, south of Cape Horn, 18 September 1963; = 3 live *Mh. inaequata*, 1 live *Mh. opaca*, 4 live *Mh. turbida*, 1 live *Mh.* sp. 25.

E-12-993, 61°25'–61°25'S, 56°30'–56°32'W, depth 300 m, South Shetland Islands, 13 March 1964, 10-foot Blake Trawl; = 1 live *Mh. turbida*.

E-22-1535, 53°51'–53°52'S, 37°38'–37°36'W, depth 97–101 m, northwest of South Georgia Island, 7 February 1986, 5-foot Blake trawl; = 1 live *Mk. glacierae*, 3 live *Mh. opaca*, 1 live *Mh. turbida*.

E-25-364, 56°17'–56°19'S, 156°13'–156°18'W, depth 3694 m, 11 November 1966; = 1 live *Mh. inaequata*.

E-27-1885, 74°30'–74°32'S, 170°10'–170°12'E, depth 328–311 m, 16 January 1967, 10-foot Blake trawl, USNM Acc. no. 292568; = 1 live *Mh. turbida*.

E-27-1974, 54°30'–54°34'S, 158°59'–158°59'E, depth 112–124 m, 15 February 1967, 5-foot Blake trawl; = 2 live *Mh. turbida*.

E-32-1996, 72°05'S, 172°08'–172°09'E, depth 348–352 m, 10 January 1968, 5-foot Blake trawl; = 1 live *Mh. turbida*.

E-32-2025, 75°24'–75°23'S, 174°10'–174°22'W, 1225–1240 m, 16 January 1968, 5-foot Blake Trawl; = 1 live *Mh. inaequata*.

E-32-2085, 77°32'–77°31'S, 172°32'–172°23'W, 468–482 m, 1 February 1968, 10-foot Blake trawl; = 1 live *Mh. turbida*.

E-39-32, *Eltanin* cruise 39 station 32, 47°26.4'S, 148°17.2'E, 960 m; = 355 *Mk. gregalis*, 31 *Mh. jiangi*, 3 *Mh.* sp. 27, 1 *Mh.* sp. 28, 1 *Mh.* sp. 29.

PATRICIA FITHIAN, SCHOOL OF GEOSCIENCES LOUISIANA STATE UNIVERSITY

Fithian st. 1040, Gulf of Paria, 9°30'30"N, 60°05'45"W, 76 m; = 1 *Mn. hawkae*.

Fithian st. 1041, Gulf of Paria, 63 m; = 1 *Mn. hawkae*.

Fithian st. 1047, Gulf of Paria, 8°54'30"N, 59°11'W, 93 m; = 1 *Mn. hawkae*.

Fithian st. 1055, Gulf of Paria, 8°55'N, 59°04'W, 88 m; = 1 *Mn. hawkae*.

Fithian st. 1076, Gulf of Paria, 40 m; = 2 *Mn. hawkae*.

Fithian st. 1108, Gulf of Paria, 10°15'N, 60°47'W, 44 m; = 1 *Mn. hawkae*.

Fithian st. 1109, Gulf of Paria, 10°10'N, 60°52'W, 44 m; = 1 *Mn. hawkae*.

Fithian st. 1185, Gulf of Paria, 10°36'N, 60°49'W, 44 m; = 4 *Mn. hawkae*.

Fithian st. 1189, Gulf of Paria, 11°04'06"N, 60°36'12"W, 77 m; = 2 *Mn. hawkae*.

Fithian st. 1200, Gulf of Paria, 11°19'36"N, 60°54'48"W, 126 m; = 2 *Mn. hawkae*.

Fithian st. 1202, Gulf of Paria, 11°29'N, 61°20'48"W, 187 m; = 5 *Mn. hawkae*.

Fithian st. 1203, Gulf of Paria, 11°21'N, 61°20'30", 156 m; = 1 *Mn. hawkae*.

Fithian st. NT, Gulf of Paria, 11°30'N, 61°30'W, 183 m; = 3 *Mn. hawkae*.

SOUTH AFRICAN ECOLOGICAL SURVEY

(Richard H. Benson, J. H. Day)

GIL 127, continental shelf off South Africa, South African Ecological Survey, collected by J. H. Day; = 10 *Mn. africana*. GIL 616, False Bay, South Africa, collected by J. H. Day; = 1 *Mn. dispar*.

GIL 623, False Bay, South Africa, collected by J. H. Day; = 3 *Mn. dispar*.

U.S. COAST GUARD SHIP *GLACIER*

International Weddell Sea Oceanographic Expedition, program NSFGA-1125, coll. J. S. Rankin, K. Clark, and C. Biernbaum (Richard H. Benson)

GL-1-0001, 74°06'S, 39°38'W, depth 400 fathoms (732 m), 6 February 1968, anchor dredge, WAGB-4; = 17 live plus 3 *Mk. glacierae*, 1 live *Mh. inaequata*, 17 live *Mh. tensa*.

GL-2-0001, 74°28.1'S, 30°31.7'W, depth 513 m, 24 February 1969, anchor dredge; = 1 live *Mh. tensa*, 2 live *Mh. inaequata*.

GL-2-002, 75°31'S, 30°08'W, depth 412 m, 25 February 1969, anchor dredge; = 1 live *Mk.* sp. 5, 1 live *Mh. inaequata*, 1 live *Mh. turbida*.

GL-2-004, 77°54.2'S, 45°13.3'W, depth 252 m, 3 March 1969, anchor dredge; = 5 live plus 1 *Mk. glacierae*, 1 live *Mh. turbida*.

GL-2-0022, 73°28.4'S, 30°26.9'W, 3111 m, 13 March 1969, anchor dredge; = 1 live *Mk. glacierae*.

U.S. RESEARCH VESSEL *HERO*

(Roger L. Kaesler, Richard H. Benson)

H-69-5-49, 53°41'40"S, 72°0'45"W, depth 16.3–46.3 m, 20 October 1969, epibenthic dredge, outer edge of Fortescue Bay; = 1 *Mx. amoena*.

H-69-5-53, 52°51'–52°50'S, 73°53'–73°55'W, 526.7 m, 21 October 1969, epibenthic dredge, at location of *Challenger* station 311; = 130 *Mx. amoena*, 125 *Mh. heroica*.

H-69-5-57, 51°0'50"S, 74°14'10"W, depth 214 m, 23 October 1969, epibenthic dredge, sample in channel off Puerto Buena (Canal Sarmiento); = 2 live plus 24 *Mx. amoena*, 6 *Mh. heroica*.

H-69-5-201, 50°9'55"S, 74°43'25"–74°44'W, depth 386.3–456.34 m, 25 October 1969, epibenthic dredge, about same position as *Challenger* station 308, Concepcion Canal, Passo Caffin; = 1 *Mx. amoena*, 31 *Mh. heroica*.

H-69-5-210, 50°21'17"S, 75°17'25"W, depth 74.3 m, 28 October 1969, Petersen grab, in Bahia Corbeta Papudo; = 6 *Mx. amoena*, 6 *Mh. heroica*.

H-69-5-212, 50°59'5"S, 74°13'50"W, depth 9.3 m, 20 October 1969, Petersen grab, outer part of Porto Bueno; = 1 *Mx. amoena*, 2 *Mh. heroica*.

H-69-5-213, 51°27.5'S, 74°03'W, depth 696.3–916.3 m, 30 October 1969, epibenthic dredge, off Punta Don Pedro, southern tip of Vancouver Island; = 3 live plus 13 *Mx. amoena*, 1 *Mh. heroica*.

H-69-5-214, 51°12.5'S, 74°09'W, depth 230–280 fathoms (421–512 m), 29 October 1969, try net; = 2 live *Mh. heroica*.

H-69-5-219, 53°11.8'S, 71°42.2'W, 65 fathoms (119 m), 2 November 1969, Petersen Grab; = 2 *Mx. heroica*.

H-69-5-220, 53°11.4'S, 71°37.9'W, 70 fathoms (128 m), 2 November 1969, Petersen grab; = 3 *Mx. amoena*, 2 *Mh. heroica*.

H-69-5-222, 53°07.7'S, 71°29.1'W, depth 35 fathoms (64 m), 2 November 1969, Petersen Grab; = 5 *Mx. amoena*.

H-69-5-225, 53°05.3'S, 71°21.8'W, depth 9 fathoms (16 m); = 1 *Mh. turbida*.

H-69-5-259, 52°53.7'S, 71°27.4'W, 30 fathoms (55 m), 3 November 1969, Petersen grab; = 1 *Mx. amoena*, 1 *Mh. heroica*.

H-69-5-268, 52°57.5'S, 71°39.1'W, 36 fathoms (66 m), 4 November 1969, Petersen grab; = 1 *Mx. amoena*.

H-69-5-282, 53°18'40"S, 70°42'20"W, depth 384–421 m, off Punta Arenas; = 1 *Mx. amoena*.

H-71-5-15, 54°34'S, 64°20'W, depth 92 m; = 1 *Mh. turbida*.

H-71-5-20, 54°29'S, 64°00'W, depth 104 m; = 3 *Mh. turbida*.

H-71-5-22, 54°39'S, 64°00'W, depth 73 m; = 1 *Mh. turbida*.

H-71-5-24, 54°29'S, 63°50'W, depth 110 m; = 4 *Mh. turbida*.

H-71-5-25, 54°35'S, 64°0.6'W, depth 82 m; = 1 *Mh. turbida*.

H-71-5-874, 54°39'–54°39.2'S, 62°50'–62°50.2'W, depth 135–137 m, 26 October 1971, trawl; = 5 live *Mh. turbida*.

H-71-5-893, 54°55.6'–54°54.8'S, 64°21.8'–64°19.0'W, depth 303–358 m, 2 November 1971, trawl; = 1 live *Mh. turbida*.

HANCOCK MUSEUM, NEWCASTLE-UPON-TYNE
G. S. BRADY OSTRACOD COLLECTION
(A. M. Tynan)

HM "*Cytherideis maculata* & *decora* Brady, Australia, West Indies"; = 1 juvenile LV of an unknown species of *Macrocyprina*, not suitable as a lectotype for either species.

HM 1.45.28 *Macrocypris siliquosa* Brady, Lectotype, "Talisman, 932 m, Lat. 23°N, Long. 19°50'W, 11/7/83"; *Talisman* station 85, 23°00'N, 17'30"W, depth 932 m, greenish muddy sand, temperature 7°C, 11/7/83; = 1 *Mk. siliquosa* Brady, my specimen 1949.

HM 1.45.29, *Macrocypris siliquosa* Brady, paralectotypes, "Talisman, 932 m, Lat. 23°N, Long. 19°50'W, 11/7/83"; *Talisman* station 85, 23°00'N, 17°30'W, depth 932 m, greenish muddy sand, temperature 7°C, 12 July 1883; = 6 *Mk. siliquosa*.

HM 1.45.30, *Macrocypris siliquosa* Brady, "Syntypes B122, Arguin Bank, Africa, 20°N, 15 July 1883, 2333 m"; *Talisman* station 99, 15 July 1883, 19°19'N, 18°02'W, depth 2333 m, bottom temperature 3.1°C, greenish-gray mud; = 2 *Mk. siliquosa*, including my specimen 1950.

HM 1.45.31, *Macrocypris siliquosa* Brady, "West Coast of Morocco, 630 mètres. (Travailleur) 630 m, 30/7/82"; = 1 *Mk. siliquosa*.

HM *Challenger* station 120, off Pernambuco, 8°37.0'S, 34°28.0'W, depth 675 fath. (1235 m), red mud; "*Cytherella lata*, n. s., *Macrocypris similis* n. sp., *Bythocypris reniformis* n. sp., Challenger no. 120, depth 675 fath., washing of dredge, G. S. Brady 9/9/73"; = 5 *Mx. similis*.

HM *Challenger* st. 122, 7°5'S, 34°49'W, depth 350 fath. (640 m), off North Brazil; "*Macrocypris tenuicauda* Brady, Challenger no. 122, depth 350 fath., washings of dredge, G. S. Brady, 10/9/73"; = 29 *Ms. bensoni*.

HM *Challenger* station 305, near 47°48'S, 74°48'W, depth 160 fath. (304 m); "*Bairdia amygdaloides* B., *Macrocypris similis* sp. nov., G. S. Brady, 13/1/76"; = 2 specimens of an unidentified species of *Macropyxis*, not *Mx. similis*.

HM *Talisman* station 35, 17 June 1883, 32°29'N, 9°47'W, depth 834 m, bottom temperature 11.0°C, mud; "*Macrocypris siliquosa* Brady, *Bythocypris bosquetiana* Brady, West Coast of Morocco, 836 mètres (Talisman) 17/6/83"; = 4 *Mk. siliquosa*.

JOHN HOLDEN

Holden Clipperton Island, 10°18'N, 109°13'W, *Macrocyprina vargata* Allison and Holden (1971); = 2 live plus 3 *Mn. vargata*.

HULL UNIVERSITY PALAEONTOLOGY COLLECTIONS
(John W. Neale)

HU.13.CA.3.N.582-10, MYRNY STATION, Section 1, sample 3b, Depth 55 m, Ground rock, coll. Pushkin, 16.XII.67, *Macrocypris dispar* Müller, 1908; = 2 live *Mh. turbida*.

HU.13.R.12.1-100, *Macrocypris* sp. aff. *similis*, Neale 1967, Halley Bay, Antarctica; = 6 *Mh.* sp. 26.

HU.20.C.7.1, *Macrocypris parva* Kaye, 1965, holotype, Cretaceous, depth 61.25 metres ls. Her base hole, Senck. leth. 1965 46(1) pl. 5, fig. 1; = 1 *Propontocypris parva*.

HU.20.C.8.1-13, *Macrocypris parva* Kaye 1963, paratypes, Cretaceous, Barremian, mounted & figured specimens, Senck. leth. 1965, 46(1) pl. 5, fig. 2; = 11 *Propontocypris parva*.

HU.65.C.6.60, *Macrocypris australiana* Neale, 1975, One Tree Hill, Gingin, W. Australia, Santonian; = 1 *Mk. australiana*.

H. V. HOWE OSTRACOD COLLECTION
SCHOOL OF GEOSCIENCES
LOUISIANA STATE UNIVERSITY
(Alvin Phillips, W. A. van den Bold)

HVH 8267, *Macrocypris maculata* (Brady) of van den Bold (1966), Colon Harbour, pl. 1, fig. 3; = *Mn.* sp. 48.

HVH 9437, *Macrocyprina skinneri* Kontrovitz, holotype, Rec., La. cont. shelf sta. 97, pl. 1, fig. 2; Kontrovitz, 1976, station 97, 28°29.4'N, 92°08.4'W, depth 156 feet (48 m); = 1 *Mn. skinneri*.

HVH 9438, *Macrocyprina skinneri* Kontrovitz, paratype, pl. 1, fig. 3, Louisiana continental shelf station 97, 28°29.4'N, 92°8.4'W, depth 156 feet (48 m); = 1 *Mn. skinneri*.

HVH 9439, *Macrocyprina skinneri* Kontrovitz, paratype, Louisiana continental shelf station 97, 28°29.4'N, 92°8.4'W, depth 156 feet (48 m); = 1 *Mn. skinneri*.

HVH 9440, *Macrocyprina skinneri* Kontrovitz, paratype, Vaca Key, Florida, 24°47'N, 81°07'W; = 1 *Mn. schmitti*.

HVH 9441, *Macrocyprina skinneri* Kontrovitz, paratype, Vaca Key, Florida, 24°47'N, 81°07'W; = 1 live *Mn. schmitti*.

HVH 9738, *Macrocyprissa* sp. of Howe and van den Bold, 1975, Pleistocene, Mississippi River mudlumps; = 1 *Mx. improcera*.

HVH 9739, *Macrocyprina* ? sp. of Howe and van den Bold, 1975, Pleistocene, Mississippi River mudlumps; = 1 *Mn. skinneri*.

INGOLF EXPEDITION, 1895–1896 UNIVERSITY OF COPENHAGEN ZOOLOGICA MUSEUM

(Torben Wolff)

Ingolf 18, 61°44'N, 30°29'W, depth 2137 m, 3.0°C bottom temperature, 17 June 1895; = 7 *Mx. bathyalensis.*

Ingolf 38, 59°12'N, 51°05'W, depth 3521 m, 1.3°C bottom temperature, 30 July 1895; = 1 live plus 1 *Mx. bathyalensis.*

Ingolf 85, 63°21'N, 25°21'W, depth 320 m, 17 June 1896; = 1 live plus 4 *M. minna,* 1 live *Ma. sarsi.*

JACK RUDLOE, SMITHSONIAN OCEANOGRAPHIC SORTING CENTER, INTERNATIONAL INDIAN OCEAN EXPEDITION

(Richard H. Benson)

JR-29 (= JR-7), SOSC-IIOE, 13°23'S, 48°13'E, depth 1.5 m, Ambatoloaka Beach, Nosy Be, Madagascar, collected by J. J. Rudloe; = 3 live *Mn. madagascarensis.*

U.S. RESEARCH VESSEL *KNORR*

(Richard H. Benson)

KN-25-287, 30°24.4'S, 39°00'W, depth 4818 m, 21 November 1972; = 1 live *Mx. adunca.*

KN-25-303, 24°0.2'S, 8°28.5'E, depth 4637 m, 17 February 1973; = 5 live *Mx. adunca.*

KN-25-306, 15°59.9'S, 1°58.5'E, depth 5550 m, 21 February 1973; = 8 live *Mx. adunca,* 1 *Mx.* sp. 20.

KN-25-307, 12°0.5'S, 1°58.5'E, depth 5631 m, 22 February 1973; = 2 live *Mx. adrecta.*

VIDMANTAS R. LABUTIS GREAT BARRIER REEF, AUSTRALIA

Labutis GBR 1305, 23°17'S, 151°38'E, depth 20 m, 5 km northwest of North West Reef, Great Barrier Reef, Australia; = 20 *Mn. quadrimaculata.*

Labutis GBR 1306, 23°18'S, 151°37'E, depth 40 m, 7 km west of North West Reef, Great Barrier Reef, Australia; = 3 *Mn. quadrimaculata.*

Labutis GBR 1369, 23°37'S, 151°32'E, depth 30 m, Great Barrier Reef, Australia; = 1 *Mn. quadrimaculata.*

Labutis GBR 1374, 23°36'S, 151°34'E, depth 30 m, Great Barrier Reef, Australia; = 1 *Mn. quadrimaculata.*

NATUR-MUSEUM UND FORSCHUNGS-INSTITUT SENCKENBERG, FRANKFURT-AM-MAIN

(Gerhard Becker, Heinz Malz)

NMFIS Xe 3359, *Macrocyprissa cylindracea* (Bornemann), plesiotypes of Triebel, 1960, Oligocene, Septarienton bei Berlin; = 4 *Mc. cylindracea.*

NMFIS Xe 3362–3370, *Macrocyprina propinqua* Triebel, paratype, Punt Vierkant, Bonaire, 1–2 m; = 1 live *Mn. propinqua.*

TOMOHIDE NOHARA UNIVERSITY OF THE RYUKYU'S, OKINAWA

Nohara, Sesoko Island, Okinawa, near biological station of Ryukyu University, 6 samples of sand from fringing reef, depth less than 5 m; = 1 live plus 17 *Mn. noharai.*

Nohara station 3, Okinawa Continental Shelf, 26°46'5"N, 125°19'7"E, depth 265 m, gray medium sand; = 1 *Mn. okinawae.*

Nohara station 4, Okinawa Continental Shelf, 27°16'5"N, 124°50'5"E, depth 106 m, fine to medium sand, dark brown to gray; = 6 *Mn. okinawae.*

Nohara station 6, Okinawa Continental Shelf, 26°51'3"N, 124°22'2"E, depth 130 m, fine dark gray sand; = 2 *Mn. okinawae.*

Nohara station 14, Okinawa Continental Shelf, 27°08'0"N, 124°22'8"E, depth 108 m, fine to medium sand, dark brown to gray; = 8 *Mn. okinawae.*

Nohara station 15, Okinawa Continental Shelf, 26°58'0"N, 124°28'5"E, depth 135 m, fine dark gray sand; = 5 *Mn. okinawae.*

Nohara station 18, Okinawa Continental Shelf, 26°32'0"N, 124°20'6"E, depth 146 m, very fine dark gray sand; = 2 *Mn. okinawae.*

Nohara station 19, Okinawa Continental Shelf, 26°03'5"N, 124°24'7"E, depth 250 m, fine dark gray sand; = 1 *Mn. okinawae.*

Nohara station 20, Okinawa Continental Shelf, 25°45'9"N, 123°45'8"E, depth 135 m, medium brown to gray sand; = 5 *Mn. moza,* 1 *Mn. noharai.*

NOSY BE, MADAGASCAR, COLLECTIONS BY ROSALIE F. MADDOCKS (1966), JUNE–AUGUST 1964, INTERNATIONAL INDIAN OCEAN EXPEDITION

Nosy Be 019, sediment sample west of Pointe Lokobe; = 4 *Mn. madagascarensis.*

Nosy Be 020, sediment sample south of Pointe Lokobe; = 8 *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 023, sediment sample in shallow water near sand beach on Nosy Komba; = 1 *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 068, Nosy N'Tangam, washings of small dead coral fragments and some shells, encrusted with nondescript brown algae and other organisms, loose on sand about 0.5 m below low tide level; = 1 live *Mn. madagascarensis.*

Nosy Be 070, Nosy N'Tangam, surficial sand, mostly bare but some grass, 3 m below low tide level, bolapipe sample; = 6 *Mn. madagascarensis,* 1 *Mn.* sp. 43.

Nosy Be 079, near beach at Ankify, washings of red tunicate; = 1 live *Mn. madagascarensis.*

Nosy Be 089; washings of algae at Pte. Mahatsinjo; = 1 live *Mn. madagascarensis.*

Nosy Be 094, Pte. Mahatsinjo, coarse sand and gravel between reef patches in about 1.5 m at low tide; = 2 *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 095, washings of *Tridacna squamosa,* collected 15 June 1964 by Arthur G. Humes; = 1 live *Mn. madagascarensis.*

Nosy Be 117, sediment sample in east side of Baie d'Ampasindava, north of Sambirano River; = 2 *Mn. madagascarensis.*

Nosy Be 127, west side of Ambariobe, fine sand with *Thallassia*; = 1 *Mn. madagascarensis.*

Nosy Be 155, Nosy Tanikely, washings of coral; = 1 live *Mn. madagascarensis.*

Nosy Be 158, Nosy Tanikely, washings of coral; = 1 live *Mn. madagascarensis.*

Nosy Be 159, Nosy Tanikely, washings of coral; = 2 live *Mn. madagascarensis.*

Nosy Be 212, Nosy Tanikely, washings of red alga; = 9 live *Mn. madagascarensis.*

Nosy Be 219, Nosy Tanikely, washings of dead coral fragments with encrusting red sponges, lacy brown alcyonarians (?), and algae; = 1 live *Mn. madagascarensis.*

Nosy Be 220, Nosy Tanikely, washings of dead coral encrusted with algae, sponges, and tunicates; = 11 live *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 229, Pte. Lokobe, washings of live and dead coral; = 1 live *Mn. madagascarensis.*

Nosy Be 230, Pte. Lokobe, surface sand from patches of *Cymodocea,* in about 1 m of water at low tide; = 2 live *Mn. madagascarensis,* 1 *Mn. captiosa;* 10 *Mn. moza.*

Nosy Be 248, south of Nosy Komba, dredge sample from R. V. *Ambariaka,* 13°30'S, 48°22'E, depth 16 m; = 8 *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 249, south of Nosy Komba, dredge sample from R. V. *Ambariaka,* 13°30'S, 48°20.5'E, depth 24–20 m; = 1 *Mn. madagascarensis.*

Nosy Be 270, near Ambatoloaka, washings of dead coral; = 9 live *Mn. madagascarensis,* 1 live plus 2 *Mn. moza.*

Nosy Be 271, near Ambatoloaka, washings of red alga; = 1 live *Mn. madagascarensis.*

Nosy Be 275, near Ambatoloaka, washings of green alga; = 1 live *Mn. madagascarensis.*

Nosy Be 276, near Ambatoloaka, washings of green calcareous alga and dead coral; = 2 live *Mn. madagascarensis.*

Nosy Be 277, near Ambatoloaka, washings of green calcareous alga; = 2 live *Mn. madagascarensis.*

Nosy Be 327, near Antsakoabe, surface sandy mud among mangrove pneumatophores; = 4 live *Mn. madagascarensis.*

Nosy Be 329B, near Antsakoabe, sand at low tide level; = 1 *Mn. madagascarensis.*

Nosy Be 344, sediment grab sample east of Pte. Tafondro; = 3 *Mn. madagascarensis.* Nosy Be 353, sediment grab sample west of Pte. d'Andemby; = 1 live *Mn. madagascarensis.*

Nosy Be 359, in Lac du Cratère, washings of dead coral encrusted with algae, sponges, corals, and tunicates; = 10 live *Mn. madagascarensis.*

Nosy Be 361, in Lac du Cratère, fecal castings of a black holothurian, *Halodeima atra* (Jaeger); = 7 *Mn. madagascarensis.*

Nosy Be 362, in Lac du Cratère, washings of green calcareous alga; = 1 live *Mn. madagascarensis.*

Nosy Be 363, in Lac du Cratère, washings of a sponge; = 1 live *Mn. madagascarensis.*

Nosy Be 366, in Lac du Cratère, surface sand from among coral patches in about 1 m of water; = 27 *Mn. madagascarensis,* 2 *Mn. captiosa.*

Nosy Be 381, Pte. Lokobe, surface sand between coral masses in about 3 m water; = 5 *Mn. madagascarensis,* 2 *Mn. captiosa.*

Nosy Be 382, at Nosy N'Tangam, surface coarse sand in bare patch among *Cymodocea* and dead coral; = 4 *Mn. madagascarensis.*

Nosy Be 394, south of Nosy Komba, dredge sample from R. V. *Ambariaka,* 13°28.5'S, 48°22'E, depth 14 m; = 5 *Mn. madagascarensis.*

Nosy Be 395, south of Nosy Komba, dredge sample from R. V. *Ambariaka,* 13°28.5'S, 48°24'E, 11 m; = 1 *Mn. madagascarensis.*

Nosy Be 400, about halfway between the Centre d'Océanographie et des Pêches and Nosy Tanikely, sediment grab sample; = 26 *Mn. madagascarensis.*

Nosy Be 401, north of Nosy Tanikely, sediment grab sample; = 23 *Mn. madagascarensis.*

Nosy Be 403, in Lac du Cratère, sediment grab sample in center of crater; = 1 *Mn. madagascarensis.*

Nosy Be 404, south of Lac du Cratère, grab sample, shallow sand among corals of fringing reef; = 6 *Mn. madagascarensis.*

Nosy Be 405, south of Lac du Cratère, grab sample of sediment in deep water beyond the reef; = 1 *Mn. madagascarensis.*

Nosy Be 419, north of Pte. d'Ampahana, sediment grab sample, sand, depth about 40 m; = 2 *Mn. madagascarensis.*

Nosy Be 427, near Mahatsinjo, washings of brown and white calcareous algae among *Cymodocea;* = 2 live *Mn. madagascarensis.*

Nosy Be 465, in Lac du Cratère, sediment grab sample in interior; = 6 *Mn. madagascarensis,* 2 *Mn. moza.*

Nosy Be 466, in Lac du Cratère, bolapipe sediment sample in interior; = 1 *Mn. madagascarensis.*

Nosy Be 472, south of Port du Cratère, opposite the mouth of the Djabala River, sediment grab sample, depth about 20 m; = 16 *Mn. madagascarensis.*

Nosy Be 473, south of Mahatsinjo, sediment grab sample, sand just beyond edge of coral reef; = 1 *Mn. madagascarensis.*

Nosy Be 474, near Pte. Lokobe, sediment grab sample, sand just beyond edge of reef; = 1 *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 474A, near Pte. Lokobe, sediment grab sample, sand just beyond edge of reef; = 1 *Mn. madagascarensis,* 1 *Mn. moza.*

Nosy Be 477, south of Ambariobe, sediment grab sample; = 1 *Mn. madagascarensis.*

Nosy Be 478, south of Ambariobe, east of Antamotano, sediment grab sample; = 4 *Mn. madagascarensis,* 3 *Mn. moza.*

Nosy Be 480, off the southeast coast of Nosy Komba, sediment grab sample; = 4 *Mn. madagascarensis.*

Nosy Be 484, off the northwest coast of Nosy Komba, opposite Passe de Nosy Vorona, sediment grab sample; = 1 *Mn. madagascarensis.*

Nosy Be 487, east side of the Baie d'Ampasindava, north of the mouth of the Sambirano River, sediment grab sample, muddy sand, depth 2 m; = 1 *Mn. madagascarensis.*

Nosy Be 491, east side of the Baie d'Ampasindava, just beyond the delta of the Sambirano River, sediment grab sample, soft black mud with oysters; = 160 *Mn. madagascarensis.*

Nosy Be 496, about halfway between Centre d'Océanographie et des Pêches and Nosy Tanikely, sediment grab sample, sand, depth about 27 m; = 51 *Mn. madagascarensis.*

Nosy Be 497, south of Hellville, sediment grab sample; = 20 *Mn. madagascarensis.*

Nosy Be 498, halfway between Pte. Lokobe and Nosy Komba, sediment grab sample; = 7 *Mn. madagascarensis.*

Nosy Be 504, at Ambariobe, surface loose sand among coral, just below low tide; = 3 *Mn. madagascarensis.*

Nosy Be 508, at Nosy Tanikely, on large orange sponge, 20 m depth, collected by Arthur G. Humes; = 1 *Mn. madagascarensis.*

Nosy Be 521, at Ambatoloaka, rotting *Cymodocea* floating in tide pool at upper low tide level; = 1 live *Mn. madagascarensis.*

Nosy Be 528, at Navetsy, sand with sparse sea grass at low tide level; = 2 *Mn. madagascarensis.*

NEW ZEALAND OCEANOGRAPHIC INSTITUTION

(Richard H. Benson)

NZOI B-303, New Zealand Oceanographic Institution, 45°7.8'S, 177°55'E, 2888 m; = 1 live *Mx.* sp. 16.

NZOI RM1001, near East Cape, New Zealand; = 5 *Mn.* sp. 34; 2 *Mn.* sp. 36.

LINDA PEQUEGNAT
TERECO CORPORATION, COLLEGE STATION, TEXAS

Pequegnat 0131-3(2B), 32°54'N, 79°12'W, depth 16 m; = 2 live *Mn.* sp. 40.

Pequegnat 0146-2(2E), 32°40'N, 78°47'W, depth 36 m; = 1 live *Mn.* sp. 40.

SANTA BARBARA MUSEUM OF NATURAL HISTORY
(Paul H. Scott)

SBMNH Chevron/Pt. Arguello Field Project station 1, 34°28'29"N, 120°38'25"W, depth 360 feet (114 m), 1 September 1982; = 11 live *Mn. barbara.*

SBMNH Chevron/Pt. Arguello Field Project station 14, 34°29'58"N, 120°40'12"W, depth 300 feet (95 m), 30 August 1982; = 3 live *Mn. barbara.*

SBMNH Chevron/Pt. Arguello Field Project station 28, 34°31'32"N, 120°43'25"W, depth 408 feet (129 m), 31 August 1982; = 3 live *Mn. barbara.*

SBMNH Chevron/Pt. Arguello Field Project station 29, 34°31'27"N, 120°46'01"W, depth 732 feet (232 m), 31 August 1982; = 1 live *Mn. barbara.*

PAUL LEWIS STEINECK
DIVISION OF NATURAL SCIENCES
S.U.N.Y. COLLEGE AT PURCHASE

These specimens are from samples in the Montpelier Group, exposed in road cuts along the Montego Bay–Adelphi Road in northwest Jamaica (See Steineck, 1981, fig. 2, 3, table II).

Steineck sample M15, Lower Miocene, Sign Formation; = 5 *Mc. vandenboldi.*

Steineck sample M17, Lower Miocene, Sign Formation; = 3 *Mx. steinecki.*

Steineck sample M23, Lower Miocene, Sign Formation; = 2 *Mx. steinecki.*

Steineck sample M25, Lower Miocene, Sign Formation; = 3 *Mx. steinecki, 2 Mc. vandenboldi.*

Steineck sample M27, Lower Miocene, Spring Garden Formation; = 1 *Mx. steinecki,* 1 *Mc. vandenboldi.*

Steineck sample M27A, Lower Miocene, Spring Garden Formation; = 9 *Mx. steinecki,* 5 *Mc. vandenboldi.*

Steineck sample M28, Lower Miocene, Spring Garden Formation; = 4 *Mx. steinecki,* 3 *Mc. vandenboldi.*

Steineck sample M29, Lower Miocene, Spring Garden Formation; = 6 *Mx. steinecki,* 5 *Mc. vandenboldi.*

Steineck sample M32, Middle Miocene, Spring Garden Formation; = 6 *Mc. vandenboldi.*

STANFORD UNIVERSITY, PALEONTOLOGICAL AND CONCHOLOGICAL COLLECTIONS
(Myra Keen)

SU 6769, *Paracypris pacificus* LeRoy, 1943, holotype; = 1 *Paracypris pacifica* (not Macrocyprididae).

KERRY SWANSON, DEPARTMENT OF GEOLOGY
UNVERSITY OF CANTERBURY
CHRISTCHURCH, NEW ZEALAND

Swanson Northland P461, 34°20.4'S, 171°48.2'E, depth 440 m; = 7 *Mk. swansoni,* 9 *Mh. jiangi.*

Swanson Northland-Three Kings P462, 34°17.6'S, 171°45.3'E, depth 427 m; = 2 *Mk. swansoni,* 1 *Mh. jiangi,* 2 *Mn.* sp. 45.

Swanson Northland P464, 34°24.1'S, 171°42.0'E, depth 655 m; = 11 *Mk. swansoni,* 1 *Mh. jiangi.*

Swanson Northland-Three Kings P476, 34°01.8'S, 172°12.0'E, depth 508 m; = 1 *Mk. swansoni,* 2 *Mh. jiangi,* 3 *Mh.* sp. 29.

Swanson Northland-Three Kings P484, 34°04.5'S, 172°18.4'E, depth 350 m; = 7 *Mh. jiangi,* 1 *Mh.* sp. 31.

Swanson Northland P566, 33°56.1'S, 171°27.2'E, depth 514 m; = 4 *Mh.* sp. 32.

Swanson Northland P573, 34°05.0'S, 172°00.2'E, depth 850 m; = 3 *Mh. jiangi.*

Swanson Tasman Sea P653, 41°43.2'S, 170°01.6'E, depth 873 m; = 1 *Mx.* sp. 14.

Swanson Tasman Sea P654, 42°02.1'S, 170°12.7'E, depth 769 m; = 4 *Mx.* sp. 15.

Swanson Tasman Sea P662, 41°27.2'S, 170°55.7'E, 196 m; = 3 *Mk. swansoni.*

Swanson Tasman Sea P665, 42°47.2'–42°52.8'S, 169°51.7'–169°48.0'E, depth 768–531 m, washings from box corer and letter box dredge; = 1 live *Mk.* sp. 6.

Swanson Tasman Sea P667, 42°24.3'S, 169°25.0'E, depth 1047 m; = 2 *Mx.* sp. 14.

JAMES TEETER
GEOLOGY DEPARTMENT, UNIVERSITY OF AKRON

Teeter "British Honduras"; = 1 live *Mn. belizensis.*

TEXAS A&M UNIVERSITY
OUTER BANKS STUDY, TEXAS CONTINENTAL SHELF
(Richard Titgen)

TA&MU OBS 28F1, near 28 Fathom Bank, 1 September 1976, approximately 27°55'N, 93°27'W, depth 101 m; = 1 live *Mn. skinneri.*

TA&MU OBS 28F3, 28 Fathom Bank, 4 September 1976, approximately 27°55'N, 93°27'W, depth 77 m; = 27 live *Mn. skinneri.*

TA&MU OBS STB-4C, Stetson Bank, 6 August 1976, approximately 28°8'N, 94°17'W, depth 50 m; = 1 live *Mn. skinneri.*

TA&MU OBS UNB-2B, Unnamed Bank, 2 August 1976, approximately 27°53'N, 93°28'W, 75 m; = 1 live *Mn. skinneri.*

TEXAS MEMORIAL MUSEUM
THE UNIVERSITY OF TEXAS AT AUSTIN
(Elisabeth M. Brouwers, Joseph E. Hazel)

TMM 11518, in the C. I. Alexander collection, labeled "*Macrocypris graysonensis,* n. sp., Holotype, Grayson, Cret., 11518, B 2907, 34, pl. 2, figs. 13-14, no. 91"; = 1 *Ms. graysonensis.*

UNIVERSITÉ DE BORDEAUX
INSTITUT DE GEOLOGIE DU BASSIN D'AQUITAINE
(Odette Ducasse)

UB IGBA, slide no. 196 in the reference collection of the Institut de Géologie du Bassin d'Aquitaine, Université de Bordeaux, labeled "*Macrocypris* gr. *wrightii* Jones & Hinde, forage Sandrigues H.1, 331 m, Miocène, C.O. 196"; = 1 *Mx.* sp. 10.

UB IGBA, slide no. 693 in the reference collection of the Institut de Géologie du Bassin d'Aquitaine, Université de Bordeaux, labeled "*Macrocypris minna* (Baird 1850), CREO 6502-37, 2100 m, Atlantique, C.O. 693"; = 1 *Mx.* sp. 9.

UB IGBA, slide no. 1086 in the reference collection of the Institut de Géologie du Bassin d'Aquitaine, Université de Bordeaux, labeled "*Macrocypris wrightii* Jones et Hinde 1890, X868, BD1086"; = 1 *Mc.* sp. 22.

UNIVERSITY OF HOUSTON
DEPARTMENT OF GEOSCIENCES
MICROPALEONTOLOGY COLLECTIONS

UH 166, East Flower Garden, northwest Gulf of Mexico, approximately 27°54'N, 93°36'W, depth not recorded, probably less than 50 m, dry coralline sand; = 4 *Mn. hortuli.*

UH 182, Heald Bank, northwest Gulf of Mexico, 2 miles 220° from green light on Heald Bank, approximately 29°5'N, 94°15'W, depth 18 m; = 11 *Mn. skinneri.*

UH 270, Stetson Bank, northwest Gulf of Mexico, approximately 28°8'N, 94°17'W, depth 48 m; = 18 *Mn. skinneri.*

UH 679, northwest Gulf of Mexico, 28°40'N, 94°33'W, depth 27 m, station X of Gene Ross Kellough (1956); = 5 *Mn. skinneri.*

UH 1220, Flower Gardens, northwest Gulf of Mexico, dry coralline sand, collected by Edward A. McQuade III, November 1977; = 19 *Mn. hortuli.*

UH 1263, Stetson Bank, northwest Gulf of Mexico, approximately 28°8'N, 94°17'W, depth not recorded, probably about 50 m; = 20 *Mn. skinneri.*

UH 1264, East Flower Garden, northwest Gulf of Mexico, approximately 28°00'N, 93°32'W, depth 90 feet (27 m), collected 10 August 1961, donated by Gene Ross Kellough, dry coralline sand; = 1 live plus 4 *Mn. hortuli.*

UH 1295, Florida Bay, near Pigeon Key; = 20 *Mn. schmitti.*

UH 1297, Florida Keys, off Tavernier; = 18 *Mn. schmitti.*

UH 1494, West Flower Garden, northwest Gulf of Mexico, depth 23 m, 25 May 1972, bare sand flat among corals, collected by Jabe Wills; = 1 *Mn. hortuli.*

UH 1495, West Flower Garden, northwest Gulf of Mexico, depth 23 m, 25 May 1972, bare sand flat among corals, collected by Jabe Wills; = 16 *Mn. hortuli.*

UH 1497, Bermuda, sand from between patch reefs near North Rock, within North Lagoon, collected by R. F. Maddocks, 30 July 1963, depth 1–2 m; = 18 live plus 25 *Mn. bermudae.*

UH 1499, Bermuda, 32°23'N, 64°41'W, depth 16 m, van Veen grab from R. V. *Panulirus* in North Lagoon, by R. F. Maddocks, 5 August 1963; = 17 *Mn. bermudae.*

UH 1504, Bermuda, 32°25.5'N, 64°43.5'W, depth 18 m, in North Lagoon, van Veen grab from R. V. *Panulirus,* collected by R. F. Maddocks, 5 August 1963; = 1 *Mn. bermudae.*

UH 1510, Bermuda, South Shore, south of Castle Roads, grab sample from R. V. *Panulirus,* depth less than 15 m, collected by R. F. Maddocks, 12 August 1963; = 2 *Mn. bermudae,* 3 *Mn. hortuli.*

UH 1511, Bermuda, South Shore, south of Castle Roads, depth less than 15 m, nearer shore than UH 1510, grab sample from R. V. *Panulirus,* collected by R. F. Maddocks, 12 August 1963; = 1 *Mn. hortuli.*

UH 1549, Bermuda, south of Somerset Island, sand between patch reefs, collected by R. F. Maddocks, 30 August 1963; = 8 *Mn. bermudae.*

UH 1556, Bermuda, CH-13, 32°20.6'N, 64°40.3'W, depth 4 m, in Castle Harbor, collected by John T. Barnhart, 1962; = 3 *Mn. bermudae.*

UH 1558, Bermuda, CH-20, 32°20.3'N, 64°39.9'W, depth 4 m, in Castle Roads, collected by John T. Barnhart, 1962; = 3 *Mn. bermudae.*

UH 1559, Bermuda, FP-1, 32°21.6'N, 64°42.5'W, depth 5 m, near Ferry Point, collected by John T. Barnhart, 1962; = 5 *Mn. bermudae,* 1 *Mn. hortuli.*

UH 1564, Bermuda, NR-5, 32°24.9'N, 64°44.9'W, depth 6 m, in North Lagoon, collected by John T. Barnhart, 1962; = 1 *Mn. bermudae.*

UH 1565, Bermuda, NR-6, 32°26.6'N, 64°45.0'W, depth 9 m, in North Lagoon near North Rock, collected by John T. Barnhart, 1962; = 2 *Mn. bermudae.*

UH 1571, Bermuda, SS-19, 32°18.4'N, 64°39.1'W, depth 475 m, on South Slope, collected by John T. Barnhart, 1962; = 3 *Mn. bermudae,* 5 *Mn. hortuli.*

UH 1613, East Flower Garden, northwest Gulf of Mexico, depth 21 m, 3 December 1972, near UT-MBI-FGORC survey station, surface sand collected by diver; = 1 live plus 14 *Mn. hortuli.*

UH 1617, West Flower Garden, northwest Gulf of Mexico, UT-MBI-FGORC WFG721024, depth 96 m, muddy sand, collected by diver; = 56 *Mh. gyreae,* 3 *Mn. hortuli,* 7 *Mx. improcera;* 57 *Mn. skinneri,* 20 *Ms. texana.*

UH 1618, West Flower Garden, northwest Gulf of Mexico, UT-MBI-FGORC WFG721024, depth 86 m, muddy sand; = 13 *Mh. gyreae,* 3 *Mn. skinneri,* 2 *Ms. texana.*

UH 1672, Lower Cretaceous (Cenomanian), Grayson-Del Rio Formation, Austin, Texas; = 4 *Ms. graysonensis.*

UH 1985, West Flower Garden, northwest Gulf of Mexico; = 7 *Mn. hortuli.*

UH 1986, Stetson Bank, northwest Gulf of Mexico, collected by Edward A. McQuade III, 24 June 1973; = 7 *Mn. skinneri.*

UH 2018, West Flower Garden, northwest Gulf of Mexico, depth 29 m, 30 September 1973, collected by Edward A. McQuade III; = 18 *Mn. hortuli.*

UH 2019, Stetson Bank, northwest Gulf of Mexico, depth 27 m, collected by Edward A. McQuade III, 1 October 1973; = 28 *Mn. skinneri.*

UH 2369, northwest Gulf of Mexico, off Texas coast at High Island, 6800 feet from south line, 6100 feet from east line of Block A-274, depth 51 m, collected by Joseph Millo, 15 March 1974; = 40 *Mn. skinneri.*

UH 2371, Bahamas, Great Abaco Island, east side of Man o' War Cay, ocean side, 50 yards offshore, 5 yards east of coral reef, weeds on bottom, water depth 1.5 m, collected by Dwight Hayworth, July 1974; = 13 live plus 51 *Mn. hawkae.*

UH 2376, Bahamas, Great Abaco Island, off Harbour Lodge Beach, Hope Town, Bahamas, east side, water depth 10 m, 100 yards offshore, within living coral reef, sandy bottom, collected by Dwight Hayworth, July 1974; = 5 *Mn. hawkae.*

UH 2433, West Flower Garden, northwest Gulf of Mexico, depth 21–24 m, sand flat among coral masses; = 2 live *Mn. hortuli.*

UH 2638, Jamaica, Mo Bay, back reef, depth 6 m, collected by M. M. Osborne, August 1975; = 5 *Mn. hawkae,* 7 *Mn. jamaicae.*

UH 2645, Jamaica, west shore, at *Calypso* anchorage, depth 6 m, collected by M. M. Osborne, August 1975; = 15 *Mn. jamaicae.*

UH 2648, Jamaica, fore-reef at Negril, depth 0.6 m, collected by M. M. Osborne, August 1975; = 3 *Mn. hawkae,* 23 *Mn. jamaicae,* 1 *Mn.* sp. 38.

UH 2738 Florida, Dove Key, subtidal, depth 1 m, collected by Gary Kocurek; = 116 *Mn. schmitti.*

UH 2739 Florida, Dove Key, depth 1 m, washings of sponge, collected by Gary Kocurek; = 2 live plus 101 *Mn. schmitti.*

UH 2740 Florida, Carysfort reef, depth 5 m, collected by Gary Kocurek; = 1 live plus 11 *Mn. schmitti*, 89 *Mn. hawkae*.

UH 2741, Lower Pleistocene, San Pedro Sands, Timms Point, California; = 25 *Mn. parcens*.

UH 2742, Belize, near Caye Chappel, windward side of island, inside of barrier reef, 300-400 feet from shore, depth 7 m, collected by Edward A. McQuade, Jr., 31 October 1975; = 78 *Mn. belizensis*, 17 *Mn. hawkae*.

UH 2744, Belize, near Caye Chappel, approximately 7 m depth, inside cave, collected by Edward A. McQuade, Jr.; = 5 *Mn. hawkae*.

UH 2860, Grand Cayman Island, south end, depth 18 m, flat area between coral heads; = 17 *Mn. caiman*.

UH 2882, Guantanamo Bay, Cuba, depth 3 m, collected by Harold M. Maddocks; = 7 *Mn.* sp. 41.

UH 2961, Honduras, Roatan, Bay Islands, Big and Little French Keys, in shallow reef tract, depth 0.5 m, collected by Warren W. Brooks; = 1 *Mn. belizensis*.

UH 2963, Honduras, Roatan, Bay Islands, Half Moon Bay area, sandy bottom in open bay, depth 6 m, collected by Warren W. Brooks; = 1 *Mn. hawkae*.

UH 2972, Honduras, Roatan, Bay Islands, St. Anthony's Key, in the lagoon, depth 1 m, collected by Warren W. Brooks; = 1 *Mn. belizensis*.

UH 2973, Honduras, Roatan, Bay Islands, St. Anthony's Key, in lagoon, depth 1 m; = 2 *Mn. hawkae*.

UH 3046, Christiansted, St. Croix, U.S. Virgin Islands, marine sand in channel, at Salt River drop-off, depth 14 m; = 1 *Mn.* sp. 37, 6 *Mn.* sp. 44.

UH 3049, Lower Pleistocene, Timms Point Silt Member, San Pedro Formation, railroad cut adjacent to Harbor Drive, San Pedro, California; = 2 *Mn. parcens*.

UH 3086, Texas A&M University R. V. *Gyre* cruise 76-G-3, station 15, off San Juan, Puerto Rico; = 9 *Ms. texana*.

UH 4123, Texas A&M University R. V. *Gyre* cruise 77-G-14, station 5, 28°25.7'N, 94°01.7'W, depth 40 m; = 25 *Mn. skinneri*.

UH 4125, Texas A&M University R. V. *Gyre* cruise 77-G-14, station 7, 27°53.8'N, 93°37.8'W, depth 91.5 m; = 10 *Ms. texana*, 8 *Mh. gyreae*, 4 *Mn. skinneri*, 17 *Mx. improcera*.

UH 4127, Texas A&M University R. V. *Gyre* cruise 77-G-14, station 9, 27°19.4'N, 93°36.2'W, depth 841 m; = 2 *Mx.* sp. 12.

UH 4130, Texas A&M University R. V. *Gyre* cruise 77-G-14, station 11, 27°5.5'N, 94°08.7'W, depth 1116 m; = 3 *Mx. simulans*.

UH 4132, Texas A&M University R. V. *Gyre* cruise 77-G-14, station 13, 27°20.9'N, 95°9.0'W, depth 1079 m; = 1 *Mx.* sp. 12, 2 *Ms. bensoni*, 12 *Mx. simulans*.

UH 4286, Gulf of California, east side of San Pedro Island, 17 nautical miles west of San Carlos, Guayamas area, Sonora, Mexico, depth 30 m, collected by David J. Webb; = 6 *Mn. swaini*.

UNIVERSITY OF HAMBURG ZOOLOGICAL MUSEUM
(Gerd Hartmann)

UHZM K-31358, Goode Beach, Frenchmans Bay, near Albany, southwest Australia, September–October 1975 (see Hartmann, 1979, p. 267); = 5 live plus 1 *Mn. hartmanni*.

UHZM K-27321a(FZ), *Macrocyprina marchilensis* Hartmann, holotype, Mar Chile I Expedition station 96, 39°59.9'S, 74°01.5'W, depth 260 m, near Punta Galera, south of Valdivia, southern Chile; = 1 live *Mh. marchilensis*.

UHZM K-27321b(FZ), *Macrocyprina marchilensis* Hartmann, paratype, Mar Chile I Expedition Station 95, 39°59'S, 73°54'W, depth 162 m; = 1 live *Mh. marchilensis*.

UHZM K-27321(GL), *Macrocyprina marchilensis* Hartmann, paratype, Mar Chile Expedition station 96, 39°59.9'S, 74°01.5'W, depth 260 m; = 3 live *Mh. marchilensis*.

UNIVERSITY OF MICHIGAN MUSEUM OF PALEONTOLOGY
(Robert V. Kesling)

UMMP 48679, *Pontocypris* sp. of Donald D. Hall, 1965, Pleistocene, Sapelo Island, Georgia, pl. 1, figs. 1–6; = 1 *Mn. skinneri*.

UMMP 48780, *Macrocypris sapeloensis* Darby, 1965, holotype, near Sapelo Island, Georgia, taken from 625 feet (191 m) of water, salinity approximately 35‰, water temperature 23°C, 75 miles offshore near edge of Gulf Stream; = 1 live *Mx. sapeloensis*.

UNIVERSITY OF MINNESOTA MUSEUM OF PALEONTOLOGY
(Frederick M. Swain)

UMnMP 11278, *Macrocyprina pacifica* (LeRoy) of Swain (1967), Recent, Gulf of California, VS 143, G. S. A. Memoir 101, Pl. 2, fig. 12; = 1 *Mn. swaini*.

UMnMP *Macrocyprina pacifica* (LeRoy) of McKenzie and Swain (1967), Scammon Lagoon, station 76; = 1 live *Mn. swaini*.

UMnMP *Macrocyprina pacifica* (LeRoy) of McKenzie and Swain (1967), Scammon Lagoon, station 90; = 2 live plus 1 *Mn. swaini*.

UNIVERSITY OF OSLO, ZOOLOGICAL MUSEUM
(Marit Christensen)

UOZM F1484, *Macrocypria angusta* Sars, collected by G. O. Sars, locality not recorded; = 37 live *Ma. sarsi*.

UOZM F1485, *Macrocypris minna* (Baird), Sunde, Norway, collected by G. O. Sars, depth not recorded; = 32 live *M. minna*.

U.S. NATIONAL MUSEUM OF NATURAL HISTORY DEPARTMENT OF INVERTEBRATE ZOOLOGY
(Louis S. Kornicker)

USNM 88847, *Macrocypris schmitti*, Holotype, Loggerhead Key, Tortugas, collected by W. L. Schmitt, June 26, 1931, Acc. No. 115488, Willis Tressler; = 1 live *Mn. schmitti*.

USNM 88852, *Macrocypris schmitti*, paratypes, Loggerhead Key, Tortugas, collected by W. L. Schmitt, June 26, 1931, USNM 115488, Willis Tressler; = 6 live *Mn. schmitti*.

USNM 88859, *Macrocypris africana* Müller of Tressler (1949, 1954), haul of 30-foot otter trawl in 10–11 fathoms (18–19 m) in channel east and south of Loggerhead Key, 8 August 1930, station 47-30, Dry Tortugas; = unidentifiable specimens.

USNM 168088, *Macrocypris schmitti* Tressler, paratype, Loggerhead Key, Tortugas, collected by W. S. Schmitt, June 26, 1931, formerly part of USNM 88852, Acc. No. 115488, my specimen number 1538M; = 1 live *Mn. schmitti*.

U.S. NATIONAL MUSEUM OF NATURAL HISTORY DEPARTMENT OF PALEOBIOLOGY
(Frederick J. Collier)

USNM 117965, *Macrocypris minutus* Swain and Peterson, 1952, holotype, Jurassic, Redwater Shale, 112–117 feet above base, Red Gulch, sec. 22, T58N, R89W, Sheridan Co., Wyoming, coll. Imlay and Loeblich 9/48, USGS PP 243-A, p. 9, pl. 1, fig. 13; = 1 *Propontocypris (Propontocypris) minutus* (not Macrocyprididae).

USNM 117966, 116639, 116640 (all in same slide, with one unnumbered specimen), *Macrocypris minutus* Swain and Peterson, 1952, Jurassic, Redwater Shale, 112–117 feet above base, Red Gulch, sec. 22, T58N, R89W, Sheridan Co., Wyoming, coll. Imlay and Loeblich 9/48, USGS PP 243-A, p. 9, pl. 1, fig. 14, 15, 16; = 4 *Propontocypris (Propontocypris) minutus* (not Macrocyprididae).

USNM 153744, "*Macrocypris minna* (Baird)" of Tressler 1941 (p. 98, pl. 19, fig. 26), North Atlantic Piggot Deep-Sea Core #13, 1936, 49°38'00"N, 13°28'00"W, depth 1955 m, sample H137; = 1 *Mx. bathyalensis.*

USNM 184363, *Macrocypris ?* aff. *M. dimorpha* Hazel and Holden of Holden (1976), hypotype, Lower Miocene, Pacific Ocean, Midway Island reef borehole, R320.95 m, USNM Acc. No. 324713, USGS Prof. Paper 680-F, p. F18, pl. 10, fig. 12; = *Propontocypris* sp. indet. (not Macrocyprididae).

USNM 184364, *Macrocypris ?* aff. *M. dimorpha* Hazel and Holden of Holden (1976), hypotype, Lower Miocene, Pacific Ocean, Midway Island, reef bore hole R-343.05 m, USGS Prof. Paper 680-F, p. F19, pl. 10, fig. 13; = 1 *Propontocypris (Propontocypris)* sp. indet. (not Macrocyprididae).

USNM 184365, *Macrocypris ?* aff. *M. dimorpha* Hazel and Holden of Holden (1976), hypotype, Quaternary-Pleistocene?, USNM acc. no. 324713, Pacific Ocean, Midway Island, sand island bore hole S-44.20 m, USGS Prof. Paper 680-F, p. F18, pl. 10, fig. 19; = 1 *Propontocypris (Propontocypris)* sp. indet. (not Macrocyprididae).

USNM 184366, *Macrocypris ?* aff. *M. dimorpha* Hazel and Holden of Holden (1976), hypotype, USNM Acc. no. 324713, Upper Miocene, Pacific Ocean, Midway Island, reef bore hole R-162.76 m, USGS Prof. Paper 680F, p. F18, pl. 10, fig. 20; = 1 *Propontocypris (Propontocypris)* sp. indet. (not Macrocyprididae).

USNM 184367, *Macrocypris ?* aff. *M. dimorpha* Hazel and Holden of Holden (1976), hypotype, USNM Acc. No. 324713, Lower Miocene, Pacific Ocean, Midway Island, reef bore hole, R-320.95 m, USGS Prof. Paper 680-F, p. F18, pl. 10, fig. 14, short form; = 1 *Propontocypris (Propontocypris)* sp. indet. (not Macrocyprididae).

USNM 563493, *Macrocypris longana* van den Bold, 1960, holotype, Upper Eocene, lower part of the San Fernando Formation, Lower Mount Moriah Silt, *Globorotalia cerroazulensis* zone, Harmony Hall well no. 2, depth 686–698 feet, San Fernando area, Trinidad; = 1 *Mx. longana.*

USNM 563494, *Macrocypris longana* van den Bold, 1960, paratype, BP 342, 10,234.5 feet, Eocene, Trinidad; = 1 *Mx. longana.*

USNM 563495, *Macrocypris longana* van den Bold, 1960, paratypes, B 7564 Trinidad; = 2 *Mx. longana.*

USNM 563496, *Macrocypris rhodana* van den Bold, 1960, holotype, Upper Eocene, lower part of the San Fernando Formation, Lower Mount Moriah Silt, *Globorotalia cerroazulensis* zone, Harmony Hall well no. 2, depth 609–613 feet, San Fernando area, Trinidad; = 1 *Mx. rhodana.*

USNM 563497, *Macrocypris rhodana* van den Bold, 1960, paratype, Eocene, San Fernando Formation, Calyx well no. 59, 430–440 feet, San Fernando area, Trinidad; = 1 *Mx. rhodana.*

USNM 563498, *Macrocypris rhodana* van den Bold, 1960, paratype, Eocene, Moruga, 1:5, 8–38 feet, Trinidad; = 1 *Mx. rhodana.*

USNM 563499, *Macrocypris rhodana* van den Bold, 1960, paratypes, Eocene–Oligocene, San Fernando Formation, Calyx well 59, 290–310 feet, San Fernando area, Trinidad; = 1 *Mx. rhodana.*

USNM 651441, *Macrocypris ? dimorpha* Hazel and Holden, 1971, paratype, Eocene, USGS Cenozoic loc. #24686, Vaingava, 0.25 mile N. Eua, Tonga, Kondo, Y. Aug. 1967, USNM Acc. No. 297176, USGS Prof. Paper 640-D, p. D6, pl. 5, fig. 8, 13; = 1 *Propontocypris (Propontocypris) dimorpha?* (not Macrocyprididae).

USNM 651442, *Macrocypris ? dimorpha* Hazel and Holden, 1971, holotype, Eocene, USGS Cenozoic loc. #24686, Vaingava, 0.25 mile N. of Eua, Tonga, Kondo, Y. Aug. 1967. USNM Acc. No. 197176, USGS Prof. Paper 640-D, p. D6, pl. 5, fig. 11, 17, 19; = 1 *Propontocypris (Propontocypris) dimorpha.*

U.S. RESEARCH VESSEL *VEMA*
USNM ACC. NO. 307408
(Richard H. Benson, Louis S. Kornicker)

V-12-4, 25°33'S, 12°27'E, depth 2970 m, 3 May 1957, upper continental rise off Walvis Bay, South Africa; = 5 live plus 1 *M. metuenda,* 1 live *Mk. siliquosa.*

V-12-10, 5°53.5'S, 9°51.5'E, depth 2997 m, 21 May 1957, northern wall of Congo Submarine Canyon, upper continental rise; = 1 live *M. miranda.*

V-14-2, 41°49'S, 64°20'W, depth 129 m, 31 January 1953, South Atlantic, Gulf of San Matios, Argentina; = 4 live *Mh. opaca.*

V-14-21, 54°18'S, 39°23'W, depth 237 m, 5 March 1958, west of South Georgia Island; = 5 live *Mk. glacierae,* 3 live *Mh. opaca.*

V-14-33, 34°26'S, 17°32'E, depth 706 m; 6 April 1958; = 16 live *M. metuenda,* 9 live *M. miranda,* 1 live *Mk. siliquosa.*

V-15-37, 7°25'N, 79°23'W, depth 1749 m, Gulf of Panama, 14 November 1958; = 1 live *Mx. kaesleri.*

V-15-40, 4°25'N, 78°25'W, 3696–3755 m, 16 November 1958; = 2 live *Mx. kalbi.*

V-15-42, 7°55'N, 86°00'W, 3085–3078 m; = 4 live *Mx. kaesleri.*

V-15-55, 12°45'N, 88°38'W, depth 3950–3777 m, 24 November 1958, Menzies trawl; = 7 live *Mx. kalbi.*

V-15-59, 7°05'N, 85°55'W, 2851 m; = 1 live *Mx. kaesleri.*

V-15-67, 9°43'S, 80°04'W, 2813–2851 m; = 1 live *Mx. kaesleri.*

V-15-70, 10°02'S, 80°21'W, depth 5490–5666 m, 10 December 1958, Peru–Chile Trench, Menzies Trawl; = 1 live *Mx. eltaninae.*

V-15-84, 27°35'S, 71°51'W, 5627 m; = 1 live *Mx. antonbruunae.*

V-15-124, 49°35'S, 48°04.6'W, depth 2738 m, 26 March 1959, Argentine Basin; = 1 *Mh. opaca.*

V-15-131, 40°14.6'S, 55°24'42"W, depth 1475 m, 3 April 1959, Argentine continental slope; = 2 live *Mh. opaca.*

V-16-15, 45°80'S, 45°46'W, depth 1622 m, 8 January 1960; = 1 live *Mx.* sp. 21.

V-16-39, 50°53'S, 62°35'W, depth 157 m, 19 May 1960, Falkland Rise; = 2 live *Mh. opaca.*

V-16-65, 46°45'N, 56°22'W, 42–42 m; = 8 live *Mx. labutisi.*

V-17-5, 38°15'S, 76°00'W, 3824–3739 m, 16 March 1961; = 2 live *Mx.* sp. 46.

V-17-74, 41°27'S, 59°33'W, 71 m, 23 May 1961, Argentine continental shelf; = 1 live *Mh. opaca.*

V-17-93, 44°35'S, 63°07'W, 95–95 m, 12 June 1961, Argentine continental shelf; = 1 live *Mh. opaca.*

V-17-101, 38°13'S, 55°19'W, 454–450 m, 19 June 1961; = 1 *Mh. opaca.*

V-18-9, 36°17'S, 53°21'W, depth 676–547 m, 4 February 1962, Argentine continental slope; = 1 *Mk.* sp. 2, 7 live plus 1 *Mh. opaca.*

VRIJE UNIVERSITEIT AMSTERDAM
PALEONTOLOGICAL DEPARTMENT
INSTITUUT VOOR AARDWETENSCHAPPEN
(J. R. van de Fliert)

VUA EB-NS-223A, Vrije Universiteit Amsterdam, paratypes of *Macrocypris adriatica* Breman, Core 353, interval 250–585 cm., Late Pleistocene including Allerød and younger Dryas, collected 1962 by R. V. *Horizon* from deep basin in southeastern Adriatic Sea, about 75 km southeast of Dubrovnik, Yugoslavia; = 15 *Mx. adriatica.*

WILKES STATION, ANTARCTICA
(Richard H. Benson)

Wilkes St. AH, 66°15'56"–66°15'57"S, 110°31'09"–110°31'47"E, depth 55–91 m, 11 December 1961, dredge, USNM Acc. No. 292568; = 1 live *Mh. turbida.*

WYNYARD BEACH, TASMANIA
(Richard H. Benson)

Wynyard Beach, Tasmania, 1148, Recent sand, collected by N. G. Lane; = 1 *Mn.* sp. 33, 5 *Mn.* sp. 35.

A. G. S. *YELCHO*
USNM Acc. No. 307408
(Richard H. Benson)

Y-2-6, 64°23'S, 63°53'W, 326 m; = 7 live *Mk. glacierae,* 3 live *Mh. opaca.*

Y-2-9, 64°08'S, 64°05'W, 527 m; = 1 *Mh. opaca.*

Y-2-11, 63°40'S, 64°08'W, 240 m; = 1 live *Mk.* sp. 3, 9 live *Mh. opaca.*

ZOOLOGICAL MUSEUM,
HUMBOLDT UNVERSITY, BERLIN
(H. E. Gruner)

ZMHUB 13129, *Macrocypris inaequalis* G. W. Müller, syntypes, Gauss-Stat., 385 m, D. Süpol.-Exp., 181, 2.12.2; Gauss-Station, Antarctica, 65°S, 90°E, depth 385 m, German South-Polar Expedition 1902–1903 (lectotype = my specimen number 1940M, paralectotypes = my specimen numbers 1939F and 1941M); = 3 live *Mh. inaequalis.*

ZMHUB 13130, *Macrocypris dispar* G. W. Müller, syntypes, 1741, Gauss-Exp., 217, 1-4.7.03; Simonstown, South Africa, German South-Polar Expedition (lectotype = my specimen number 1933M, paralectotypes = my specimen numbers 1931F and 1932F); = 4 live *Mn. dispar.*

ZMHUB 13131, *Macrocypris tensa* G. W. Müller, syntypes, Gauss-Stat., D. Südpolar.-Exp., 178f, 1.03; Gauss-Station, Antarctica, 65°S, 90°E, depth 385 m, German South-Polar Expedition (lectotype = my specimen 1935F); = 1 live *Mh. tensa,* 1 live *Mh. turbida* (= my specimen 1934M).

ZMHUB 13132, *Macrocypris africana* G. W. Müller, syntypes, Simonstown, D. Südpolar.-Exp., 222, 1-4.7.03; Simonstown, South Africa, German South-Polar Expedition (lectotype = my specimen number 1937M, paralectotypes = my specimen numbers 1936F, 1938F); = 3 live *Mn. africana.*

ZMHUB 13133, *Macrocypris turbida* G. W. Müller, syntypes, Gauss-Exp., 178; Gauss-Station, Antarctica, 65°S, 90°E, depth 385 m, German South-Polar Expedition 1902-1903 (lectotype = "2-4.12.2, 1364," my specimen 1943M; 6 paralectotype slides = my specimen numbers 1942RV, 1944M, 1945RV,LV, 1946M, 1947F, 1948M); = 25 live plus 2 *Mh. turbida.*

APPENDIX IV: LIST OF NUMBERED SPECIMENS

The specimen number identifies individual specimens that have been dissected, illustrated, or otherwise distinguished, including museum syntypes that do not have unique museum numbers. For most species many additional specimens were identified and measured (see "Material" under individual species). Full details concerning the collecting localities are given in Appendix III, the list of collecting localities. Specimens borrowed from museums have been returned to that museum. Abbreviations for the museum repositories for other material are as follows: HVH = Henry V. Howe Ostracod Collection at Louisiana State University, UCZM = University of Copenhagen Zoological Museum, UHZM = University of Hamburg Zoological Museum, USNM 240 = U.S. National Museum of Natural History.

Specimen Number	Name	Collecting Locality	Repository	Notes
19M	*Mn. madagascarensis*	Nosy Be 270	USNM 240934	
20F	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
83F	*Mn. madagascarensis*	Nosy Be 277	USNM 240936	
84M	*Mn. madagascarensis*	Nosy Be 277	USNM 240937	
126F	*Mx.* sp. 8	AB-7-363D	USNM 240578	
127F	*Ms.* sp. 47	AB-7-363D	USNM 240648	Fifth limb missing
128F	*M. proclivis*	AB-7-363D	USNM 240327	
130M	*Mn. bermudae*	UH 1497	USNM 240811	
131F	*Mn. bermudae*	UH 1497	USNM 240812	
183M	*Mx. antonbruunae*	AB-11-179	USNM 240458	
184FJ–1	*Mx. kalbi*	AB-11-179	USNM 240523	
189F	*Mh. turbida*	E-6-418	USNM 240759	
190F	*Mh. inaequalis*	E-6-418	USNM 240683	
197M	*Mh. turbida*	E-9-740	USNM 240762	
198M	*Mh.* sp. 25	E-9-740	USNM 240782	Vas deferens missing
327F	*Mx.* sp. 16	NZOI-B303	USNM 240590	
328M	*Mh. sinuata*	AB-18B-714C	USNM 240745	
329M	*Mh. sinuata*	AB-18B-714C	USNM 240746	
331M	*Mx. kalbi*	AB-11-157	USNM 240524	
332M	*Mx. antonbruunae*	AB-11-179	USNM 240456	Holotype
333F	*Mx. antonbruunae*	AB-11-179	USNM 240457	
334F	*Mx. kalbi*	AB-11-169	USNM 240526	
335M	*Mx. kalbi*	AB-11-169	USNM 240527	
340FJ–2	*Mx. kalbi*	AB-11-196	USNM 240525	
341M	*Mx. antonbruunae*	AB-11-95	USNM 240463	Just molted
342FJ–1	*Mx. antonbruunae*	AB-11-95	USNM 240464	
343FJ–2	*Mx. kalbi*	AB-11-109	USNM 240521	
344F	*Mx. kaesleri*	AB-11-113	USNM 240513	
345FJ–2	*Mx kalbi*	AB-11-113	USNM 240522	
346F	*Mx. kaesleri*	AB-11-113	USNM 240514	
347FJ–1	*Mx. antonbruunae*	AB-11-113	USNM 240465	
348FJ–3	*Mx. kalbi*	AB-11-59	USNM 240520	
349MJ–2	*Mx. kalbi*	AB-11-169	USNM 240528	
350M	*Mx. antonbruunae*	AB-11-36	USNM 240459	
351M	*Mx. kalbi*	AB-11-36	USNM 240515	Holotype
352F	*Mx. kalbi*	AB-11-36	USNM 240516	
353FJ–1	*Mx. kalbi*	AB-11-36	USNM 240517	
354F	*Mx. antonbruunae*	AB-11-36	USNM 240460	
355FJ–2	*Mx. kalbi*	AB-11-36	USNM 240519	
356FJ–1	*Mx. antonbruunae*	AB-11-36	USNM 240461	
357FJ–3	*Mx. kalbi*	AB-11-36	USNM 240518	
358M	*Mx. antonbruunae*	AB-11-36	USNM 240462	
361F	*M. proclivis*	AB-7-363D	USNM 240326	Holotype
373M	*Mh. turbida*	E-6-418	USNM 240760	
375M	*Mh. turbida*	E-12-993	USNM 240766	
638F	*Mx. kaesleri*	E-3-25	USNM 240511	

Specimen Number	Name	Collecting Locality	Repository	Notes
639J	*Mx. kaesleri*	E-3-25	USNM 240512	
653MJ–1	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
654FJ–1	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
655FJ–1	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
656MJ–1	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
657J	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
658J	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
659J	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
660J	*Mn. madagascarensis*	Nosy Be 270	USNM 240935	
661F	*Mn. madagascarensis*	Nosy Be 220	USNM 240929	
662MJ–1	*Mn. madagascarensis*	Nosy Be 220	USNM 240930	
663MJ–1	*Mn. madagascarensis*	Nosy Be 220	USNM 240930	
664J	*Mn. madagascarensis*	Nosy Be 220	USNM 240930	Molting
665J	*Mn. madagascarensis*	Nosy Be 220	USNM 240931	
666J	*Mn. madagascarensis*	Nosy Be 220	USNM 240931	
667J	*Mn. madagascarensis*	Nosy Be 220	USNM 240931	
668M	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
669J	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
670J	*Mn. madagascarensis*	Nosy Be 212	USNM 240927	Molting
671J	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
672J	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
673J	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
674J	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
675J	*Mn. madagascarensis*	Nosy Be 212	USNM 240928	
676J	*Mn. madagascarensis*	Nosy Be 068	USNM 240921	
677J	*Mn. madagascarensis*	Nosy Be 095	USNM 240923	
713M	*Mh. inaequata*	E-6-350	USNM 240689	
714M	*Mh. inaequata*	E-6-350	USNM 240685	Holotype
715F	*Mh. inaequata*	E-6-350	USNM 240686	
716M	*Mh. inaequata*	E-6-350	USNM 240687	
717J–1	*Mh. inaequata*	E-6-350	USNM 240688	
718F	*Mk. glacierae*	GL-1-0001	USNM 240350	
719F	*Mk. glacierae*	GL-1-0001	USNM 240351	
720M	*Mk. glacierae*	GL-1-0001	USNM 240352	
721F	*Mk. glacierae*	GL-1-0001	USNM 240353	
722M	*Mk. glacierae*	GL-1-0001	USNM 240354	
723J–3	*Mk. glacierae*	GL-1-0001	USNM 240361	
724J–3	*Mk. glacierae*	GL-1-0001	USNM 240355	
725M	*Mk. glacierae*	GL-1-0001	USNM 240356	
818M	*Mk. glacierae*	E-22-1535	USNM 240367	
819MJ	*Mh. opaca*	E-22-1535	USNM 240718	Molting, valves mounted
820FJ	*Mh. opaca*	E-22-1535	USNM 240718	
821M	*Mh. turbida*	E-22-1535	USNM 240767	
822J	*Mh. opaca*	E-22-1535	USNM 240718	Valves mounted
823F	*Mh. turbida*	E-6-418	USNM 240761	
824J–1	*Mh. inaequalis*	E-6-418	USNM 240684	
825F	*Mh. inaequata*	E-9-740	USNM 240691	
826F	*Mh. inaequata*	E-9-740	USNM 240692	
827M	*Mh. turbida*	E-9-740	USNM 240763	
828F	*Mh. turbida*	E-9-740	USNM 240764	
829J–2	*Mh. opaca*	E-9-740	USNM 240717	Valves mounted
831M	*Mx. eltaninae*	E-3-65	USNM 240490	Holotype, valves lost
832F	*Mx. eltaninae*	E-3-65	USNM 240491	Valves mounted
833F	*Mx. eltaninae*	E-3-65	USNM 240492	
834FJ	*Mx. eltaninae*	E-3-65	USNM 240493	

Specimen Number	Name	Collecting Locality	Repository	Notes
835FJ	*Mx. eltaninae*	E-3-65	USNM 240494	
836W	*Mk.* sp. 7	AB-7-363K	USNM 240398	
837F	*Mx. eltaninae*	E-4-127	USNM 240495	
838J	*Mx. eltaninae*	E-4-127	USNM 240496	
839M	*Mx. kalbi*	E-3-48	USNM 240530	
840MJ–2	*Mx. kalbi*	E-3-48	USNM 240531	Molting
841MJ–1	*Mx. kalbi*	E-3-48	USNM 240531	
842MJ–1	*Mx. kalbi*	E-3-48	USNM 240531	
843M	*Ma. semesa*	E-3-48	USNM 240596	Holotype
844FJ–2	*Mx. kalbi*	E-3-50	USNM 240533	
845M	*Mh. sinuata*	E-3-50	USNM 240733	Holotype
846M	*Mh. sinuata*	E-3-50	USNM 240734	
847F	*Mh. sinuata*	E-3-50	USNM 240735	
848MF?	*Mh. sinuata*	E-3-50	USNM 240736	Indeterminate sex
849J–1	*Mh. sinuata*	E-3-50	USNM 240743	
850F	*Mh. sinuata*	E-3-50	USNM 240737	
851F	*Mh. sinuata*	E-3-50	USNM 240738	
852F	*Mh. sinuata*	E-3-50	USNM 240739	
853FJ–1	*Mh. sinuata*	E-3-50	USNM 240740	
854FJ–1	*Mh. sinuata*	E-3-50	USNM 240742	
855MJ–1	*Mh. sinuata*	E-3-50	USNM 240741	
856MJ–1	*Mh. sinuata*	E-3-50	USNM 240744	
857F	*Ma. semesa*	E-3-43	USNM 240597	
858F	*M.* sp. 1	E-3-43	USNM 240329	
859F	*Mh. tensa*	GL-1-0001	USNM 240747	
860F	*Mh. tensa*	GL-1-0001	USNM 240748	
861M	*Mh. tensa*	GL-1-0001	USNM 240749	
862F	*Mh. tensa*	GL-1-0001	USNM 240750	Attached ciliates?
863FJ	*Mh. tensa*	GL-1-0001	USNM 240756	
864MJ	*Mh. tensa*	GL-1-0001	USNM 240756	
865M	*Mh. inaequata*	GL-1-0001	USNM 240694	
866F	*Mh. tensa*	GL-1-0001	USNM 240751	
867F	*Mh. tensa*	GL-1-0001	USNM 240752	
868MJ	*Mh. tensa*	GL-1-0001	USNM 240756	
869F	*Mh. tensa*	GL-1-0001	USNM 240756	
870J	*Mh. tensa*	GL-1-0001	USNM 240753	
871MJ	*Mh. tensa*	GL-1-0001	USNM 240754	
872MJ	*Mh. tensa*	GL-1-0001	USNM 240756	
873MJ	*Mh. tensa*	GL-1-0001	USNM 240756	
874J	*Mh. tensa*	GL-1-0001	USNM 240755	
875J	*Mh. tensa*	GL-1-0001	USNM 240756	
876J	*Mh. tensa*	GL-1-0001	USNM 240756	
877F	*Mk. glacierae*	GL-1-0001	USNM 240357	
878M	*Mk. glacierae*	GL-1-0001	USNM 240358	
879FJ–1	*Mk. glacierae*	GL-1-0001	USNM 240359	
880M	*Mk. glacierae*	GL-1-0001	USNM 240349	Holotype
881MJ–2	*Mk. glacierae*	GL-1-0001	USNM 240360	
980J	*Mn. hortuli*	UH 1494	USNM 240884	
993M	*Mn. hortuli*	UH 1264	USNM 240882	
1039J	*Mn. madagascarensis*	Nosy Be 158	USNM 240926	
1149F	*Mn. madagascarensis*	Nosy Be 155	USNM 240925	
1150F	*Mx.* sp. 17	Albatross 3375	USNM 240591	
1193M	*Mn. captiosa*	AB-8-412C	USNM 240840	Dry soft parts destroyed
1284LVJ	*Mh. gyreae*	UH 1617		Lost
1339F	*M. minna*	Ingolf 85	UCZM	

Specimen Number	Name	Collecting Locality	Repository	Notes
1340F	*Ma. sarsi*	Ingolf 85	UCZM	
1341F	*Mx. bathyalensis*	Ingolf 38	UCZM	
1342RV	*Mn.* sp. 35	Wynyard Beach	USNM 239121	
1343LV	*Mn.* sp. 35	Wynyard Beach	USNM 239122	
1344RV	*Mn.* sp. 35	Wynyard Beach	USNM 239123	
1345LV	*Mn.* sp. 35	Wynyard Beach	USNM 239124	
1346RV	*M. minna*	Ingolf 85	UCZM	
1347RV	*M. minna*	Ingolf 85	UCZM	Crystal overgrowth
1348LV	*M. minna*	Ingolf 85	UCZM	
1349LV	*M. minna*	Ingolf 85	UCZM	Crystal overgrowth
1350M	*Mx. labutisi*	AII-40-173	USNM 240543	
1351M	*Mx. labutisi*	AII-40-173	USNM 240542	Holotype
1352F	*Mx. labutisi*	AII-40-173	USNM 240544	
1353F	*Mx. labutisi*	AII-40-173	USNM 240545	
1354M	*Mx. sapeloensis*	AII-40-173	USNM 240403	
1355M	*Mx. sapeloensis*	AII-40-173	USNM 240404	
1356MF?	*Mx. sapeloensis*	AII-40-173	USNM 240411	Indeterminate sex
1357F	*Mx. sapeloensis*	AII-40-173	USNM 240405	
1358MF?	*Mx. sapeloensis*	AII-40-173	USNM 240406	Pathological
1359F	*Mx. sapeloensis*	AII-40-173	USNM 240407	
1360FJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1361FJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240408	
1362FJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1363M	*Mx. labutisi*	AII-40-173	USNM 240546	
1364M	*Mx. labutisi*	AII-40-173	USNM 240547	
1365MJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1366MJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1367M	*Mx. labutisi*	AII-40-173	USNM 240548	
1368MJ–1	*Mx. labutisi*	AII-40-173	USNM 240558	
1369MJ–1	*Mx. labutisi*	AII-40-173	USNM 240549	
1370MJ–2	*Mx. labutisi*	AII-40-173	USNM 240558	
1371FJ–2	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1372MJ–1	*Mx. labutisi*	AII-40-173	USNM 240558	
1373FJ–2	*Mx. labutisi*	AII-40-173	USNM 240550	
1374FJ–2	*Mx. sapeloensis*	AII-40-173	USNM 240409	
1375FJ–3	*Mx. labutisi*	AII-40-173	USNM 240558	
1376FJ–3	*Mx. labutisi*	AII-40-173	USNM 240551	
1377FJ–3	*Mx. labutisi*	AII-40-173	USNM 240552	
1378FJ–4	*Mx. labutisi*	AII-40-173	USNM 240557	
1379FJ–2	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1380FJ–1	*Mx. labutisi*	AII-40-173	USNM 240553	
1381FJ–1	*Mx. labutisi*	AII-40-173	USNM 240554	
1382F	*Mx. labutisi*	AII-40-173	USNM 240558	
1383MJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240410	
1384M	*Mx. labutisi*	AII-40-173	USNM 240558	
1385FJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1386F	*Mx. labutisi*	AII-40-173	USNM 240558	
1387FJ–1	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1388F	*Mx. labutisi*	AII-40-173	USNM 240555	
1389FJ–1	*Mx. labutisi*	AII-40-173	USNM 240556	
1390FJ–1	*Mx. labutisi*	AII-40-173	USNM 240558	
1391M	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1392MJ–1	*Mx. labutisi*	AII-40-173	USNM 240558	
1393F	*Mx. sapeloensis*	AII-40-173	USNM 240411	
1394F	*Mx. sapeloensis*	AII-40-173	USNM 240411	

Specimen Number	Name	Collecting Locality	Repository	Notes
1395FJ–1	*Mx. sapeloensis*	AII-40-172	USNM 240400	
1396FJ–2	*Mx. labutisi*	AII-40-172	USNM 240560	
1397FJ–2	*Mx. labutisi*	AII-40-172	USNM 240558	
1398MJ–2	*Mx. labutisi*	AII-40-172	USNM 240561	
1399MJ–1	*Mx. labutisi*	AII-40-172	USNM 240561	
1400MJ–1	*Mx. sapeloensis*	AII-40-172	USNM 240401	
1401F	*M. metuenda*	AII-42-194	USNM 240275	
1402F	*M. metuenda*	AII-42-194	USNM 240276	
1403F	*M. metuenda*	AII-42-194	USNM 240284	
1404M	*M. metuenda*	AII-42-194	USNM 240277	
1405M	*M. metuenda*	AII-42-194	USNM 240274	Holotype
1406M	*Mx. amanda*	AII-42-200	USNM 240439	Holotype
1407M	*Mx. amanda*	AII-42-200	USNM 240440	
1408F	*Mx. amanda*	AII-42-200	USNM 240441	
1409W	*Mx. amanda*	AII-42-200	USNM 240446	
1410M	*Mk. siliquosa*	AII-42-200	USNM 240330	
1411F	*Mk. siliquosa*	AII-42-200	USNM 240331	
1412F	*Mk. siliquosa*	AII-42-200	USNM 240332	
1413FJ	*Mk. siliquosa*	AII-42-200	USNM 240334	
1414M	*Mk. siliquosa*	AII-42-200	USNM 240333	
1415M	*Ms.* sp. 23	AII-31-155	USNM 240647	
1416F	*Mx.* sp. 11	AII-31-159	USNM 240580	
1417F	*Ms. bensoni*	AII-31-159	USNM 240615	
1418FJ–1	*Mh.* sp. 30	AII-31-159	USNM 240787	
1419M	*M. miranda*	AII-42-201	USNM 240294	Holotype
1420F	*M. miranda*	AII-42-201	USNM 240295	
1421FJ–1	*M. miranda*	AII-42-201	USNM 240296	
1422J–2	*M. miranda*	AII-42-201	USNM 240297	
1423J–3	*M. miranda*	AII-42-201	USNM 240298	
1424J–4	*M. miranda*	AII-42-201	USNM 240299	
1425F	*Mx. amanda*	AII-42-201	USNM 240442	
1426F	*M. miranda*	AII-42-199	USNM 240309	
1427MJ	*M. miranda*	AII-42-199	USNM 240309	
1428J–2	*M. miranda*	AII-42-199	USNM 240309	
1429J–3	*M. miranda*	AII-42-199	USNM 240309	
1430J	*M. miranda*	AII-42-199	USNM 240309	
1431M	*M. maioris*	AII-42-198	USNM 240259	
1432F	*M. maioris*	AII-42-198	USNM 240260	
1433M	*M. maioris*	AII-42-197	USNM 240267	
1434M	*M. maioris*	AII-42-197	USNM 240268	
1435F	*M. maioris*	AII-42-197	USNM 240269	
1436MJ	*M. maioris*	AII-42-197	USNM 240270	
1437J	*M. maioris*	AII-42-197	USNM 240270	
1438F	*M. metuenda*	AII-42-195	USNM 240286	
1439M	*M. metuenda*	AII-42-195	USNM 240287	
1440F	*M. miranda*	AII-42-200	USNM 240311	
1441M	*M. miranda*	AII-31-145	USNM 240303	
1442F	*M. miranda*	AII-31-142	USNM 240301	
1443F	*Mx.* sp. 18	AII-31-156	USNM 240592	
1444F	*Mx. audens*	AII-42-199	USNM 240473	
1445M	*Mx. audens*	AII-42-199	USNM 240474	
1446M	*Mx. audens*	AII-42-199	USNM 240472	Holotype
1447FJ	*Mx. audens*	AII-42-199	USNM 240475	
1448M	*Mx. adrecta*	AII-42-198	USNM 240421	Holotype
1449F	*Mx. adunca*	AII-42-198	USNM 240438	

Specimen Number	Name	Collecting Locality	Repository	Notes
1450J	*Mx. adrecta*	AII-42-198	USNM 240422	
1451M	*Mx. arta*	AII-42-201	USNM 240468	
1452J	*Mx. arta*	AII-42-201	USNM 240469	
1453J	*Mx. arta*	AII-42-201	USNM 240470	
1454F	*Mx. arta*	AII-42-201	USNM 240471	
1455MJ	*Mx. audens*	AII-42-201	USNM 240280	
1456M	*Mx. arta*	AII-42-201	USNM 240467	Holotype
1457F	*Mx. amanda*	AII-42-200	USNM 240443	
1458F	*Mh. turbida*	GL-2-002	USNM 240773	
1459F	*Mh. inaequata*	GL-2-002	USNM 240697	
1460F	*Mk.* sp. 5	GL-2-002	USNM 240396	
1461F	*Mh. heroica*	H-69-5-214	USNM 240673	
1462M	*Mh. heroica*	H-69-5-214	USNM 240672	Holotype
1463M	*Mx. amoena*	H-69-5-214	USNM 240448	Holotype
1464J	*Mx. amoena*	H-69-5-214	USNM 240449	
1465M	*Mx. amoena*	H-69-5-57	USNM 240455	
1466MJ	*Mx. amoena*	H-69-5-57	USNM 240455	
1467F	*Mh. turbida*	GL-2-004	USNM 240774	
1468F	*Mk. glacierae*	GL-2-004	USNM 240364	
1469FJ–2	*Mk. glacierae*	GL-2-004	USNM 240363	
1470FJ–2	*Mk. glacierae*	GL-2-004	USNM 240364	
1471FJ–3	*Mk. glacierae*	GL-2-004	USNM 240364	
1472FJ–3	*Mk. glacierae*	GL-2-004	USNM 240364	
1473W	*Mk. glacierae*	GL-2-004	USNM 240364	
1474MJ–1	*Mh. turbida*	H-71-5-893	USNM 240779	
1475M	*Mh. turbida*	E-27-1974	USNM 240769	
1476FJ–1	*Mh. turbida*	E-27-1974	USNM 240770	
1477M	*Mh. opaca*	E-6-344	USNM 240709	
1478M	*Mh. opaca*	E-6-344	USNM 240710	
1479M	*Mh. opaca*	E-6-344	USNM 240708	Holotype
1480F	*Mh. opaca*	E-6-344	USNM 240711	
1481F	*Mh. opaca*	E-6-344	USNM 240712	
1482J	*Mx. kalbi*	E-3-40	USNM 240529	
1483J	*Mx. kalbi*	E-3-40	USNM 240529	
1484J	*Ma. semesa*	E-3-40	USNM 240598	
1485J	*Ma. semesa*	E-3-40	USNM 240599	
1486J	*Ma. semesa*	E-3-40	USNM 240600	
1487M	*Mh. turbida*	H-71-5-874	USNM 240775	
1488F	*Mh. turbida*	H-71-5-874	USNM 240776	
1489F	*Mh. inaequata*	E-32-2025	USNM 240698	
1490M	*Mh. turbida*	E-32-2085	USNM 240772	
1491MF?	*Mh. inaequata*	E-3-25	USNM 240690	Indeterminate sex
1492F	*Mk. glacierae*	E-6-412	USNM 240366	
1493F	*Mk. glacierae*	E-6-412	USNM 240366	
1494F	*Mh. tensa*	E-5-322	USNM 240758	
1495M	*Mk.* sp. 19	E-5-322	USNM 240399	
1496F	*Mx. kaesleri*	E-3-25	USNM 240510	
1500M	*Mk. siliquosa*	AII-42-194	USNM 240340	
1501M	*M. metuenda*	AII-42-194	USNM 240278	
1504FJ–1	*Mh. turbida*	H-71-5-874	USNM 240777	
1505M	*Mn. schmitti*	UH 2739	USNM 239072	
1506J–2	*Mn. belizensis*	James Teeter	USNM 240809	
1507F	*Mn. vargata*	John Holden	USNM 239114	
1508M	*Mn. hortuli*	UH 1613	USNM 240893	
1509RV	*Mh. gyreae*	UH 1617	USNM 240661	Holotype

Specimen Number	Name	Collecting Locality	Repository	Notes
1510RV	*Mh. gyreae*	UH 1617	USNM 240669	
1512RV	*Mn.* sp. 34	NZOI RM1001	USNM 239118	
1513LV	*Mn.* sp. 34	NZOI RM1001	USNM 239119	
1514RVJ	*Mn. dispar*	GIL 616	USNM 240848	
1515LV	*Mn. dispar*	GIL 623	USNM 240849	
1516RVJ	*Mn. dispar*	GIL 623	USNM 240850	
1517RVJ	*Mn. dispar*	GIL 623	USNM 240850	
1518LV	*Mn. africana*	GIL 127	USNM 240790	
1519M	*Mx. adunca*	KN-25-303	USNM 240433	
1520M	*Mx. adunca*	KN-25-306	USNM 240429	Holotype
1521F	*Mx. adunca*	KN-25-306	USNM 240430	
1522F	*Mx. adrecta*	KN-25-307	USNM 240427	
1523F	*Mx. adunca*	KN-25-287	USNM 240437	
1524RV	*M. nimia*	C-106-313	USNM 240319	Holotype
1525M	*Mx. audens*	AII-42-195	USNM 240277	
1526F	*Mx. amanda*	AII-42-200	USNM 240446	
1527F	*Mx. adrecta*	AII-42-198	USNM 240423	
1528LV	*Mx. adrecta*	AII-42-198	USNM 240424	
1529M	*Mx. amanda*	AII-42-200	USNM 240444	
1530F	*Mk. siliquosa*	AII-31-145	USNM 240336	
1531F	*Mc. arcuata*	C-106-313	USNM 240602	
1532M	*Mc. arcuata*	C-106-313	USNM 240603	
1533M	*Mc. arcuata*	C-106-313	USNM 240601	
1534M	*Mc. arcuata*	C-106-313	USNM 240604	
1535M	*Mc. arcuata*	C-106-313	USNM 240605	
1536F	*Mc. arcuata*	C-106-313	USNM 240606	
1538M	*Mn. schmitti*	USNM 88852	USNM 168088	
1539RV	*Mn. parcens*	UH 2741	USNM 240993	
1540LVJ	*Mn. parcens*	UH 2741	USNM 240993	
1689LV	*Mx. bathyalensis*	Ingolf 38	UCZM	
1697LV	*Mn. quadrimaculata*	Labutis 1305	USNM 240996	
1698RV	*Mn. quadrimaculata*	Labutis 1305	USNM 240997	
1699RV	*Mn. quadrimaculata*	Labutis 1305	USNM 240995	Holotype
1700LV	*Mn. quadrimaculata*	Labutis 1306	USNM 239055	
1701	*Mn. quadrimaculata*	Labutis 1305	USNM 240998	
1702LV	*Mn. quadrimaculata*	Labutis 1305	USNM 240999	
1703LV	*Mn. quadrimaculata*	Labutis 1306	USNM 239056	
1704RV	*Mn.* sp. 34	NZOI RM1001	USNM 239117	
1705RV	*Mn.* sp. 34	NZOI RM1001	USNM 239126	
1706LVJ	*Mn.* sp. 36	NZOI RM1001	USNM 239127	
1707LV	*Mn.* sp. 33	Wynyard Beach	USNM 239116	
1708RV	*Mn.* sp. 35	Wynyard Beach	USNM 239125	
1709F	*Mn. vargata*	John Holden	USNM 239115	
1710F	*Ms. bensoni*	AII-31-159	USNM 240616	
1711FJ–1	*Ms. bensoni*	AII-31-159	USNM 240617	
1712FJ–1	*Mk. siliquosa*	AII-31-145	USNM 240338	
1713FJ–2	*Mk. siliquosa*	AII-31-145	USNM 240338	
1714FJ–3	*Mk. siliquosa*	AII-31-145	USNM 240337	
1715FJ–4	*Mk. siliquosa*	AII-42-194	USNM 240341	
1716FJ–2	*Mk. siliquosa*	AII-42-194	USNM 240342	
1717MJ–1	*Mk. siliquosa*	AII-42-194	USNM 240343	
1718MJ–1	*Mk. siliquosa*	AII-42-194	USNM 240345	
1719FJ–1	*Mk. siliquosa*	AII-42-194	USNM 240344	
1730J–3	*Mc. arcuata*	C-106-313	USNM 240612	
1731FJ–3	*Mc. arcuata*	C-106-313	USNM 240612	

Specimen Number	Name	Collecting Locality	Repository	Notes
1732MJ–1	*Mc. arcuata*	C-106-313	USNM 240607	
1733FJ–1	*Mc. arcuata*	C-106-313	USNM 240608	
1734MJ–1	*Mc. arcuata*	C-106-313	USNM 240609	
1735FJ–1	*Mc. arcuata*	C-106-313	USNM 240612	
1736FJ–2	*Mc. arcuata*	C-106-313	USNM 240610	
1737MJ–2	*Mc. arcuata*	C-106-313	USNM 240611	
1738LV	*M. nimia*	C-106-313	USNM 240320	Etched surface
1739LVJ	*M. nimia*	C-106-313	USNM 240321	
1740RVJ	*M. nimia*	C-106-313	USNM 240322	
1741RV	*Mx. bathyalensis*	Ingolf 18	UCZM	
1742LV	*Mx. bathyalensis*	Ingolf 18	UCZM	
1743LV	*Mx. bathyalensis*	Ingolf 18	UCZM	
1744RVJ	*Mx. bathyalensis*	Ingolf 18	UCZM	
1745LVJ	*Mx. bathyalensis*	Ingolf 18	UCZM	
1746LVJ	*Mx. bathyalensis*	Ingolf 18	UCZM	
1747LVJ	*Mx. bathyalensis*	Ingolf 18	UCZM	
1748RV	*Mn. africana*	GIL 127	USNM 240791	
1749LVJ	*Mn. africana*	GIL 127	USNM 240792	
1750RVJ	*Mn. africana*	GIL 127	USNM 240793	
1751LVJ	*Mn. africana*	GIL 127	USNM 240794	
1752RVJ	*Mn. africana*	GIL 127	USNM 240795	
1752LVJ	*Mn. africana*	GIL 127	USNM 240796	
1754F	*Mh. opaca*	E-6-344	USNM 240715	
1755FJ	*Mh. opaca*	E-6-344	USNM 240713	
1756MJ	*Mh. opaca*	E-6-344	USNM 240714	
1757M	*Mn. madagascarensis*	Nosy Be 362	USNM 240914	Holotype
1758F	*Mn. bermudae*	UH 1497	USNM 240813	
1759M	*Mn. bermudae*	UH 1497	USNM 240810	Holotype, decalcified
1760M	*Mn. bermudae*	UH 1497	USNM 240814	
1761F	*Mn. hortuli*	UH 2433	USNM 240876	
1762M	*Mn. hortuli*	UH 2433	USNM 240875	Holotype
1763M	*Mn. schmitti*	UH 2740	USNM 239074	
1764M	*Mn. schmitti*	UH 2739	USNM 239073	
1765FJ–1	*M. miranda*	AII-31-145	USNM 240304	
1766MJ–1	*M. miranda*	AII-31-145	USNM 240305	
1767MJ–2	*M. miranda*	AII-31-145	USNM 240306	
1768J–4	*M. miranda*	AII-31-145	USNM 240306	
1769F	*M. maioris*	AII-42-198	USNM 240261	
1770FJ–1	*M. maioris*	AII-42-198	USNM 240262	
1771MJ–1	*M. maioris*	AII-42-198	USNM 240263	
1772J–2	*M. maioris*	AII-42-198	USNM 240264	
1773J–4	*M. maioris*	AII-42-198	USNM 240265	
1774M	*M. maioris*	AII-42-198	USNM 240258	Holotype
1775FJ–1	*M. metuenda*	AII-42-194	USNM 240279	
1776FJ–1	*M. metuenda*	AII-42-194	USNM 240284	
1777MJ–1	*M. metuenda*	AII-42-194	USNM 240280	
1778J–2	*M. metuenda*	AII-42-194	USNM 240281	
1779J–3	*M. metuenda*	AII-42-194	USNM 240282	
1780M	*M. metuenda*	AII-42-194	USNM 240283	
1781F	*Mx. audens*	AII-42-195	USNM 240278	
1782F	*Mx. adunca*	KN-25-303	USNM 240434	
1783FJ–1	*Mx. adunca*	KN-25-303	USNM 240435	
1784RV	*Mx.* sp. 20	KN-25-306	USNM 240593	
1785FJ–1	*Mx. adunca*	KN-25-306	USNM 240431	
1786F	*Mx. adrecta*	KN-25-307	USNM 240428	

Specimen Number	Name	Collecting Locality	Repository	Notes
1787MJ–1	*Mx. adrecta*	AII-42-197	USNM 240425	
1788J–2	*Mx. adrecta*	AII-42-197	USNM 240426	
1789FJ–2	*Mx. audens*	AII-42-201	USNM 240280	
1790J–4	*Mx. audens*	AII-42-201	USNM 240280	
1791LV	*Mx. amanda*	AII-42-200	USNM 240446	
1792F	*Mx. amanda*	AII-42-200	USNM 240445	Just molted
1793RVJ–1	*Mn. hortuli*	UH 1985	USNM 240896	
1794LVJ–1	*Mn. hortuli*	UH 1985	USNM 240897	
1795RVJ–2	*Mn. hortuli*	UH 1220	USNM 240878	
1796LVJ–2	*Mn. hortuli*	UH 1220	USNM 240879	
1797RVJ–3	*Mn. hortuli*	UH 1495	USNM 240885	
1798LVJ–3	*Mn. hortuli*	UH 1495	USNM 240886	
1799RVJ–4	*Mn. hortuli*	UH 1220	USNM 240880	
1800LVJ–5	*Mn. hortuli*	UH 1495	USNM 240887	
1801RVJ–1	*Mn. bermudae*	UH 1497	USNM 240815	
1802LVJ–2	*Mn. bermudae*	UH 1497	USNM 240816	
1803RVJ–2	*Mn. bermudae*	UH 1497	USNM 240817	
1804LVJ–2	*Mn. bermudae*	UH 1497	USNM 240818	
1805WJ–3	*Mn. bermudae*	UH 1497	USNM 240819	
1806F	*Mn. schmitti*	UH 2738	USNM 239062	
1807RVJ–1	*Mn. schmitti*	UH 2738	USNM 239063	
1808LVJ–1	*Mn. schmitti*	UH 2738	USNM 239064	
1809RVJ–2	*Mn. schmitti*	UH 2738	USNM 239065	
1810LVJ–2	*Mn. schmitti*	UH 2738	USNM 23906	
1811RVJ–3	*Mn. schmitti*	UH 2738	USNM 239067	
1812LVJ–3	*Mn. schmitti*	UH 2738	USNM 239068	
1813RVJ–4	*Mn. schmitti*	UH 2738	USNM 239069	
1814LVJ–4	*Mn. schmitti*	UH 2738	USNM 239070	
1815F	*M. miranda*	AII-42-200	USNM 240312	
1816F	*M. miranda*	AII-42-200	USNM 240313	
1817M	*Mn. hawkae*	UH 2371	USNM 240851	Holotype
1818M	*Mn. hawkae*	UH 2371	USNM 240852	
1819F	*Mn. hawkae*	UH 2371	USNM 240853	
1820RVJ–1	*Mn. hawkae*	UH 2371	USNM 240854	
1821LVJ–1	*Mn. hawkae*	UH 2371	USNM 240855	
1822RVJ–2	*Mn. hawkae*	UH 2371	USNM 240856	
1823LVJ–2	*Mn. hawkae*	UH 2371	USNM 240857	
1824RVJ–3	*Mn. hawkae*	UH 2371	USNM 240858	
1825WJ–4	*Mn. haekae*	UH 2371	USNM 240859	
1828RV	*Mn. belizensis*	UH 2742	USNM 240798	Holotype
1829LV	*Mn. belizensis*	UH 2742	USNM 240799	
1830RVJ–1	*Mn. belizensis*	UH 2742	USNM 240800	
1831LVJ–1	*Mn. belizensis*	UH 2742	USNM 240801	
1832RVJ–2	*Mn. belizensis*	UH 2742	USNM 240802	
1833LVJ–2	*Mn. belizensis*	UH 2742	USNM 240803	
1834RVJ–3	*Mn. belizensis*	UH 2742	USNM 240804	
1835RV	*Mn. jamaicae*	UH 2648	USNM 240900	Holotype
1836LV	*Mn. jamaicae*	UH 2648	USNM 240901	
1837RVJ–1	*Mn. jamaicae*	UH 2648	USNM 240902	
1838LVJ–1	*Mn. jamaicae*	UH 2648	USNM 240903	
1839RVJ–2	*Mn. jamaicae*	UH 2645	USNM 240911	
1840LVJ–2	*Mn. jamaicae*	UH 2645	USNM 240910	
1841M	*M. metuenda*	AII-42-194	USNM 240284	
1842M	*M. metuenda*	AII-42-194	USNM 240284	
1843F	*M. metuenda*	AII-42-194	USNM 240284	

Specimen Number	Name	Collecting Locality	Repository	Notes
1844F	*M. metuenda*	AII-42-194	USNM 240284	
1843AW	*Mn. bermudae*	UH 1558	USNM 193790	
1844ARV	*Mn. skinneri*	UH 1986	USNM 239089	
1845LV	*Mn. skinneri*	UH 1986	USNM 239090	
1846RVJ–1	*Mn. skinneri*	UH 1263	USNM 239085	
1847LVJ–1	*Mn. skinneri*	UH 1986	USNM 239091	
1848RVJ–2	*Mn. skinneri*	UH 270	USNM 239082	
1849LVJ–2	*Mn. skinneri*	UH 1263	USNM 239086	
1850RVJ–3	*Mn. skinneri*	UH 1263	USNM 239087	
1851LVJ–3	*Mn. skinneri*	UH 270	USNM 239083	
1852M	*Mn. hawkae*	UH 2371	USNM 240860	
1853M	*Mn. hawkae*	UH 2371	USNM 240861	
1854F	*Mn.* sp. 39	F. Caraion	USNM 239130	
1855RVJ–1	*Mh. heroica*	H-69-5-53	USNM 240674	
1856LVJ–1	*Mh. heroica*	H-69-5-53	USNM 240675	
1857RVJ–2	*Mh. heroica*	H-69-5-53	USNM 240676	
1858LVJ–2	*Mh. heroica*	H-69-5-53	USNM 240677	
1859RVJ–3	*Mh. heroica*	H-69-5-53	USNM 240678	
1860LVJ–3	*Mh. heroica*	H-69-5-53	USNM 240679	
1861RVJ–4	*Mh. heroica*	H-69-5-53	USNM 240680	
1862LVJ–4	*Mh. heroica*	H-69-5-53	USNM 240681	
1863LVJ–5	*Mh. heroica*	H-69-5-53	USNM 240682	
1864F	*Mx. amoena*	H-69-5-213	USNM 240454	
1865RVJ–2	*Mx. amoena*	H-69-5-53	USNM 240450	
1866WJ–3	*Mx. amoena*	H-69-5-53	USNM 240451	
1867RVJ–4	*Mx. amoena*	H-69-5-53	USNM 240452	
1868RVJ–5	*Mx. amoena*	H-69-5-53	USNM 240453	
1869M	*Ms. bensoni*	AII-31-159	USNM 240614	Holotype
1870FJ–1	*Ms. bensoni*	AII-31-159	USNM 240618	
1899FJ–1	*Mh. turbida*	E-32-1996	USNM 240771	
1900MJ–1	*Mn.* sp. 40	Pequegnat 0146	USNM 239131	
1901F	*Mn.* sp. 40	Pequegnat 0131	USNM 239132	
1902F	*Mn.* sp. 40	Pequegnat 0131	USNM 239133	
1903LVJ–2	*Mn. skinneri*	UH 2369	USNM 239093	
1904M	*Mn. succinea*	Bonaduce 1	USNM 239106	
1905M	*Mn. succinea*	Bonaduce 1	USNM 239107	
1906F	*Mn. succinea*	Bonaduce 1	USNM 239108	
1907MJ–1	*Mn. succinea*	Bonaduce 1	USNM 239109	
1908J–2	*Mn. succinea*	Bonaduce 1	USNM 239110	
1909M	*Mn. skinneri*	TA&MU OBS 28F3	USNM 239078	
1910M	*Mn. skinneri*	TA&MU OBS 28F3	USNM 239079	
1911F	*Mn. skinneri*	TA&MU OBS 28F3	USNM 239080	
1912WM?	*Mk. gregalis*	E-39-32	USNM 240371	Holotype
1913WF?	*Mk. gregalis*	E-39-32	USNM 240372	
1914WJ–1	*Mk. gregalis*	E-39-32	USNM 240373	
1915WJ–2	*Mk. gregalis*	E-39-32	USNM 240374	
1916WJ–3	*Mk. gregalis*	E-39-32	USNM 240375	
1917WJ–5	*Mk. gregalis*	E-39-32	USNM 240376	
1918WJ–6	*Mk. gregalis*	E-39-32	USNM 240377	
1921W	*Mn. jiangi*	E-39-32	USNM 240700	
1922W	*Mn. jiangi*	E-39-32	USNM 240699	Holotype
1923WJ–1	*Mn. jiangi*	E-39-32	USNM 240701	
1924WJ–2	*Mn. jiangi*	E-39-32	USNM 240702	
1930WJ–4	*Mk. gregalis*	E-39-32	USNM 240378	
1931F	*Mn. dispar*	ZMHUB 13130		

Specimen Number	Name	Collecting Locality	Repository	Notes
1932F	*Mn. dispar*	ZMHUB 13130		
1933M	*Mn. dispar*	ZMHUB 13130		Lectotype
1934M	*Mh. turbida*	ZMHUB 13131		
1935F	*Mh. tensa*	ZMHUB 13131		Lectotype
1936F	*Mn. africana*	ZMHUB 13132		
1937M	*Mn. africana*	ZMHUB 13132		Lectotype
1938F	*Mn. africana*	ZMHUB 13132		
1939F	*Mh. inaequalis*	ZMHUB 13129		
1940	*Mh. inaequalis*	ZMHUB 13129		Lectotype
1941M	*Mh. inaequalis*	ZMHUB 13129		
1942RV	*Mh. turbida*	ZMHUB 13133		
1943M	*Mh. turbida*	ZMHUB 13133		Lectotype
1944M	*Mh. turbida*	ZMHUB 13133		
1945W	*Mh. turbida*	ZMHUB 13133		
1946M	*Mh. turbida*	ZMHUB 13133		
1947F	*Mh. turbida*	ZMHUB 13133		
1948M	*Mh. turbida*	ZMHUB 13133		
1949W	*Mk. siliquosa*	HM 1.45.29		Lectotype
1950W	*Mk. siliquosa*	HM 1.45.30		
1951RV	*Mx. tenuicauda*	BMNH 80.38.15		
1952M	*M. metuenda*	V-14-33	USNM 240291	
1953MF?	*M. metuenda*	V-14-33	USNM 240292	Indeterminate sex
1954F	*M. metuenda*	V-14-33	USNM 240292	
1955M	*M. miranda*	V-14-33	USNM 240316	
1956F	*M. miranda*	V-14-33	USNM 240317	
1957F	*Mk. glacierae*	V-14-21	USNM 240369	
1958F	*Mh. opaca*	V-14-21	USNM 240719	
1959M	*Mh. opaca*	V-14-21	USNM 240720	
1960W	*Mk.* sp. 2	V-18-9	USNM 240392	Etched surface?
1961W	*Mh. opaca*	V-17-101	USNM 240727	
1962F	*Mx.* sp. 21	V-16-15	USNM 240594	
1963W	*Mh. opaca*	V-2-9	USNM 240730	
1964MF?	*Mx. eltaninae*	V-15-70	USNM 240497	Pathological female
1965F	*Mx.* sp. 46	V-17-5	USNM 240595	
1966M	*Mx. antonbruunae*	V-15-84	USNM 240466	
1967M	*Mx. kaesleri*	V-15-42	USNM 240504	Holotype
1968F	*Mx. kaesleri*	V-15-42	USNM 240505	
1969F	*Mx. kaesleri*	V-15-67	USNM 240507	
1970M	*Mx. kalbi*	V-15-55	USNM 240536	Just molted
1971MJ–1	*Mx. kalbi*	V-15-55	USNM 240537	
1972F	*Mx. kalbi*	V-15-40	USNM 240534	
1973F	*Mx. labutisi*	V-16-65	USNM 240564	
1974FJ–1	*Mx. labutisi*	V-16-65	USNM 240564	
1975F	*Mx. labutisi*	V-16-65	USNM 240564	
1976MJ–1	*Mx. labutisi*	V-16-65	USNM 240564	
1977M	*Mx. labutisi*	V-16-65	USNM 240563	
1978M	*Mx. labutisi*	BLM-A1	USNM 240566	
1979M	*Mx. sapeloensis*	BLM-A1	USNM 240412	
1980M	*Mh. atlantica*	BLM-F2	USNM 240650	
1981M	*Mh. atlantica*	BLM-F2	USNM 240651	
1982M	*Mh. atlantica*	BLM-F2	USNM 240649	Holotype
1983F	*Mh. atlantica*	BLM-F2	USNM 240652	Both fifth limbs missing
1984F	*Mh. atlantica*	BLM-F2	USNM 240653	
1985FJ–1	*Mh. atlantica*	BLM-F2	USNM 240655	
1986FJ–1	*Mh. atlantica*	BLM-F2	USNM 240654	

Specimen Number	Name	Collecting Locality	Repository	Notes
1987FJ–1	*Mh. atlantica*	BLM-K4	USNM 240656	
1988RV	*M. metuenda*	V-12-4	USNM 240289	
1991RV	*Mn. parcens*	UH 2741	USNM 240993	
1992M	*Mn. swaini*	UMnPM Scam.90		
1993F	*Mn. swaini*	UMnPM Scam.90		
1994F	*Mn. swaini*	UMnPM Scam.76		Decalcified
1995F	*Mk.* sp. 3	Y-2-11	USNM 240393	
1995AW	*Mn. swaini*	UMnPM Scam.90		
1995BRV	*Mn. swaini*	UMnPM 11278		
1996RV	*Mn. belizensis*	UH 2742	USNM 240805	
1997LV	*Mn. belizensis*	UH 2742	USNM 240806	
1998M	*Ma. sarsi*	UOZM F1484		
1999F	*Ma. sarsi*	UOZM F1484		Reversed overlap
2000F	*Ma. sarsi*	UOZM F1484		
2001FJ	*Ma. sarsi*	UOZM F1484		
2002M	*M. minna*	UOZM F1485		
2003F	*M. minna*	UOZM F1485		
2004RV	*Mn.* sp. 38	UH 2648	USNM 239129	
2005LV	*Mn. jamaicae*	UH 2645	USNM 240912	
2012LV	*Mh. gyreae*	UH 1617	USNM 240662	
2013W	*Mh. gyreae*	UH 1617	USNM 240663	
2014RV	*Mh. gyreae*	UH 1617	USNM 240669	
2015LV	*Mh. gyreae*	UH 1617	USNM 240669	
2016RV	*Mh. gyreae*	UH 1617	USNM 240664	
2017LV	*Mh. gyreae*	UH 1617	USNM 240665	
2018RV	*Mh. gyreae*	UH 1617	USNM 240666	
2019RV	*Mh. gyreae*	UH 1617	USNM 240667	
2020W	*Ms. texana*	UH 1617	USNM 240634	Holotype
2021RV	*Ms. texana*	UH 1617	USNM 240635	
2022LV	*Ms. texana*	UH 1617	USNM 240636	
2023W	*Ms. texana*	UH 1617	USNM 240637	Just molted
2024W	*Ms. texana*	UH 1617	USNM 240638	
2025RV	*Mn. madagascarensis*	Nosy Be 366	USNM 240940	
2026LV	*Mn. madagascarensis*	Nosy Be 366	USNM 240941	
2027M	*Mh. opaca*	Y-2-11	USNM 240731	
2058F	*Mn. noharai*	Nohara Sesoko	USNM 240973	Holotype
2059W	*Mn. moza*	Nohara 20	USNM 240970	
2060W	*Mn. moza*	Nohara 20	USNM 240971	
2061RV	*Mn. noharai*	Nohara Sesoko	USNM 240974	
2062W	*Mn. noharai*	Nohara Sesoko	USNM 240977	
2063RV	*Mn. noharai*	Nohara Sesoko	USNM 240978	
2064LV	*Mn. okinawae*	Nohara 18	USNM 240988	
2065LV	*Mn. noharai*	Nohara Sesoko	USNM 240979	
2066RV	*Mn. noharai*	Nohara Sesoko	USNM 240975	
2067W	*Mn. noharai*	Nohara Sesoko	USNM 240976	
2068RV	*Mn. okinawae*	Nohara 4	USNM 240980	Holotype
2069RV	*Mn. okinawae*	Nohara 14	USNM 240982	
2070LV	*Mn. okinawae*	Nohara 14	USNM 240983	
2071RV	*Mn. okinawae*	Nohara 18	USNM 240989	
2072LV	*Mn. okinawae*	Nohara 14	USNM 240984	
2073RV	*Mn. okinawae*	Nohara 4	USNM 240981	
2074RV	*Mn. okinawae*	Nohara 15	USNM 240986	
2075RV	*Mn. okinawae*	Nohara 14	USNM 240985	
2076LV	*Mn. okinawae*	Nohara 15	USNM 240987	
2077LV	*Mx. adriatica*	VUA EB-NS-223A		

Specimen Number	Name	Collecting Locality	Repository	Notes
2078LV	*Mx. adriatica*	VUA EB-NS-223A		
2079LV	*Mx. adriatica*	VUA EB-NS-223A		
2080LV	*Mx. adriatica*	VUA EB-NS-223A		
2081LV	*Mx. adriatica*	VUA EB-NS-223A		
2082LV	*Mx. adriatica*	VUA EB-NS-223A		
2083LV	*Mx. adriatica*	VUA EB-NS-223A		
2084LV	*Mx. adriatica*	VUA EB-NS-223A		
2085RV	*Mx. adriatica*	VUA EB-NS-223A		
2086RV	*Mx. adriatica*	VUA EB-NS-223A		
2087RV	*Mx. adriatica*	VUA EB-NS-223A		
2088RV	*Mx. adriatica*	VUA EB-NS-223A		
2089RV	*Mx. adriatica*	VUA EB-NS-223A		
2090RV	*Mx. adriatica*	VUA EB-NS-223A		
2091RV	*Mx. adriatica*	VUA EB-NS-223A		
2096RV	*Mx. steinecki*	Steineck M27A	USNM 438231	
2097RV	*Mx. steinecki*	Steineck M27A	USNM 438232	
2098RV	*Mx. steinecki*	Steineck M27A	USNM 438233	
2099RV	*Mx. steinecki*	Steineck M27A	USNM 438234	
2100RV	*Mx. steinecki*	Steineck M27A	USNM 438235	
2101W	*Mx. steinecki*	Steineck M27A	USNM 438230	Holotype
2102W	*Mx. steinecki*	Steineck M27A	USNM 438236	
2103LV	*Mx. steinecki*	Steineck M27A	USNM 438237	
2104W	*Mx. steinecki*	Steineck M29	USNM 438242	
2105RV	*Mx. steinecki*	Steineck M29	USNM 438243	
2106LVJ	*Mx. steinecki*	Steineck M29	USNM 438244	
2107LVJ	*Mx. steinecki*	Steineck M29	USNM 438245	
2108LVJ	*Mx. steinecki*	Steineck M29	USNM 438246	
2118RV	*Mc. vandenboldi*	Steineck M27A	USNM 438258	Holotype
2119LV	*Mc. vandenboldi*	Steineck M27A	USNM 438259	
2120LVJ	*Mc. vandenboldi*	Steineck M27A	USNM 438261	
2121W	*Mc. vandenboldi*	Steineck M27A	USNM 438260	
2122LV	*Mc. vandenboldi*	Steineck M15	USNM 438263	
2123RV	*Mc. vandenboldi*	Steineck M15	USNM 438264	
2124RV	*Mc. vandenboldi*	Steineck M15	USNM 438265	
2125LV	*Mc. vandenboldi*	Steineck M29	USNM 438278	
2126RV	*Mc. vandenboldi*	Steineck M29	USNM 438279	
2127W	*Mc. vandenboldi*	Steineck M29	USNM 438280	
2128W	*Mc. vandenboldi*	Steineck M15	USNM 438266	
2129W	*Mc. vandenboldi*	Steineck M15	USNM 438267	
2130M	*Mn. hartmanni*	UHZM K-31358	UHZM K-33987	Holotype
2131F	*Mn. hartmanni*	UHZM K-31358	UHZM K-33988	
2132F	*Mn. hartmanni*	UHZM K-31358	UHZM K-33989	
2133FJ–1	*Mn. hartmanni*	UHZM K-31358	UHZM K-33990	
2134J–2	*Mn. hartmanni*	UHZM K-31358	UHZM K-33991	
2135RVJ	*Mn. hartmanni*	UHZM K-31358	UHZM K-33992	
2148RV	*Mx. similis*	BMNH 80.38.14		Lectotype
2149RV	*Mx. similis*	BMNH 80.38.14		
2150R V	*Mx. similis*	BMNH 80.38.14		
2151RV	*Mx. similis*	BMNH 80.38.14		
2152RV	*Mx. similis*	BMNH 80.38.14		
2153LV	*Mx.* unidentified	HM Chall. 305		
2154LV	*Mx.* unidentified	HM Chall. 305		
2155W	*Mx. similis*	HM Chall. 120		
2156LV	*Mx. similis*	HM Chall. 120		
2157RV	*Mx. similis*	HM Chall. 120		

Specimen Number	Name	Collecting Locality	Repository	Notes
2158LV	*Mx. similis*	HM Chall. 120		
2159LV	*Mx. similis*	HM Chall. 120		
2160LV	*Mx. tenuicauda*	BMNH 80.38.16		Lectotype
2161LV	*Mx. tenuicauda*	BMNH 80.38.16		
2162RV	*Ms. bensoni*	BMNH 80.38.15		
2163LV	*Ms. bensoni*	BMNH 80.38.15		
2164LV	*Ms. bensoni*	BMNH 80.38.15		
2165RV	*Ms. bensoni*	BMNH 80.38.15		
2166RV	*Ms. bensoni*	BMNH 80.38.15		
2167RV	*Ms. bensoni*	BMNH 80.38.15		
2168RV	*Ms. bensoni*	BMNH 80.38.15		
2169RV	*Ms. bensoni*	BMNH 80.38.15		
2170RV	*Ms. bensoni*	BMNH 196112465		
2171RV	*Ms. bensoni*	BMNH 196112465		
2172RV	*Ms. bensoni*	BMNH 196112465		
2173RV	*Ms. bensoni*	BMNH 196112465		
2174LV	*Ms. bensoni*	BMNH 196112465		
2175RV	*Ms. bensoni*	BMNH 196112465		
2176RV	*Ms. bensoni*	BMNH 196112465		
2177RV	*Ms. bensoni*	HM Chall. 122		
2178RV	*Ms. bensoni*	HM Chall. 122		
2179W	*Ms. bensoni*	HM Chall. 122		
2180RV	*Ms. bensoni*	HM Chall. 122		
2181LV	*Ms. bensoni*	HM Chall. 122		
2182RV	*Ms. bensoni*	HM Chall. 122		
2183RV	*Ms. bensoni*	HM Chall. 122		
2184RV	*Ms. bensoni*	HM Chall. 122		
2185RV	*Ms. bensoni*	HM Chall. 122		
2186RV	*Ms. bensoni*	HM Chall. 122		
2187LV	*Ms. bensoni*	HM Chall. 122		
2188LV	*Ms. bensoni*	HM Chall. 122		
2189RV	*Ms. bensoni*	HM Chall. 122		
2190RV	*Ms. bensoni*	HM Chall. 122		
2191RV	*Ms. bensoni*	HM Chall. 122		
2192RV	*Ms. bensoni*	HM Chall. 122		
2193RV	*Ms. bensoni*	HM Chall. 122		
2194RV	*Ms. bensoni*	HM Chall. 122		
2195W	*Ms. bensoni*	HM Chall. 122		
2196W	*Ma. canariensis*	BMNH 81.5.6		Lectotype
2198LV	*Mx. steinecki*	Steineck M27A	USNM 438238	
2201LV	*Mc. vandenboldi*	Steineck M27A	USNM 438262	
2203W	*Mc. vandenboldi*	Steineck M32	USNM 438270	
2204LV	*Mc. vandenboldi*	Steineck M32	USNM 438271	
2205LV	*Mc. vandenboldi*	Steineck M32	USNM 438272	
2206RV	*Mc. vandenboldi*	Steineck M32	USNM 438273	
2209RV	*Mx. steinecki*	Steineck M28	USNM 438254	
2210LV	*Mx. steinecki*	Steineck M28	USNM 438255	
2211LV	*Mx. steinecki*	Steineck M28	USNM 438256	
2212W	*Mx. steinecki*	Steineck M28	USNM 438257	
2213W	*Mc. vandenboldi*	Steineck M28	USNM 438275	
2214RV	*Mc. vandenboldi*	Steineck M28	USNM 438276	
2215W	*Mc. vandenboldi*	Steineck M28	USNM 438277	
2216LV	*Mx. steinecki*	Steineck M29	USNM 438247	
2217RV	*Mc. vandenboldi*	Steineck M29	USNM 438281	
2218RV	*Mc. vandenboldi*	Steineck M27	USNM 437274	

Specimen Number	Name	Collecting Locality	Repository	Notes
2219LVJ	*Mx. steinecki*	Steineck M27	USNM 438253	
2223RV	*Mc. vandenboldi*	Steineck M25	USNM 438268	
2224RV	*Mc. vandenboldi*	Steineck M25	USNM 438269	
2226LV	*Mx. steinecki*	Steineck M25	USNM 438240	
2227RV	*Mx. steinecki*	Steineck M25	USNM 438241	
2228RV	*Mx. steinecki*	Steineck M25	USNM 438239	
2232LV	*Mx. steinecki*	Steineck M23	USNM 438251	
2233RV	*Mx. steinecki*	Steineck M23	USNM 438252	
2234LVJ	*Mx. steinecki*	Steineck M17	USNM 438248	
2235LVJ	*Mx. steinecki*	Steineck M17	USNM 438249	
2236LVJ	*Mx. steinecki*	Steineck M17	USNM 438250	
2239RV	*Ms. texana*	UH 1618	USNM 240642	
2240LVJ	*Ms. texana*	UH 1618	USNM 240643	
2241RV	*Ms. texana*	UH 1617	USNM 240639	
2242LV	*Ms. texana*	UH 1617	USNM 240640	
2243RVJ	*Mh. gyreae*	UH 1618	USNM 240670	
2244LVJ	*Mh. gyreae*	UH 1618	USNM 240670	
2245RV	*Mh. gyreae*	UH 1617	USNM 240668	
2246RV	*Mn. jamaicae*	UH 2648	USNM 240904	
2247RV	*Mn. jamaicae*	UH 2638	USNM 240909	
2248LV	*Mn. jamaicae*	UH 2648	USNM 240905	
2249LV	*Mn. jamaicae*	UH 2648	USNM 240906	
2250RV	*Mn. jamaicae*	UH 2648	USNM 240907	
2251W	*Mx. longana*		USNM 563495	
2252W	*Mx. longana*		USNM 563495	
2255LV	*Mk. ligustica*	Bonaduce 2	Bonaduce	
2256RV	*Mk. ligustica*	Bonaduce 2	Bonaduce	
2257LV	*Mk. ligustica*	Bonaduce 2	Bonaduce	
2258LV	*Mk. ligustica*	Bonaduce 2	Bonaduce	
2259RV	*Mk. ligustica*	Bonaduce 2	Bonaduce	
2260LV	*Mn. bonaducei*	Bonaduce 5	USNM 240833	
2261LV	*Mn. bonaducei*	Bonaduce 5	USNM 240831	
2262RV	*Mn. bonaducei*	Bonaduce 5	USNM 240834	
2263RV	*Mn. bonaducei*	Bonaduce 5	USNM 240832	
2264RV	*Mn. bonaducei*	Bonaduce 5	USNM 240830	Holotype
2265LV	*Mn. parcens*	UH 2741	USNM 240991	
2266RV	*Mn. parcens*	UH 2741	USNM 240990	Holotype
2267LV	*Mn. parcens*	UH 2741	USNM 240992	
2268RV	*Mn. parcens*	UH 2741	USNM 240992	
2269LV	*Mn. parcens*	UH 2741	USNM 240992	
2270W	*Ms. graysonensis*	UH 1672	USNM 438282	
2271W	*Ms. graysonensis*	UH 1672	USNM 438283	
2272W	*Ms. graysonensis*	UH 1672	USNM 438284	
2273W	*Ms. graysonensis*	UH 1672	USNM 438285	
2274F	*Mk. ligustica*	Bonaduce 3	USNM 240382	
2275F	*Mk. ligustica*	Bonaduce 3	USNM 240383	
2276W	*Mk. ligustica*	Bonaduce 3	USNM 240384	
2277M	*Mn. succinea*	Bonaduce 7	USNM 239104	
2278F	*Mn. succinea*	Bonaduce 7	USNM 239105	
2279LV	*Mn. hawkae*	Fithian 1076	Fithian	
2280LV	*Mn. hawkae*	Fithian 1076	Fithian	
2281RV	*Mn. hawkae*	Fithian 1076	Fithian	
2282LV	*Mn. hawkae*	Fithian 1055	Fithian	
2283RV	*Mn. hawkae*	Fithian 1047	Fithian	
2284W	*Mn. swaini*	UH 4286	USNM 239111	Holotype

Specimen Number	Name	Collecting Locality	Repository	Notes
2285LV	*Mn. swaini*	UH 4286	USNM 239112	
2286W	*Ms. texana*	UH 4125	USNM 240644	
2287LVJ	*Ms. texana*	UH 3086	USNM 240646	
2288RVJ	*Ms. texana*	UH 3086	USNM 240646	
2289RV	*Mn. hawkae*	UH 2740	USNM 240868	
2290LV	*Mn. hawkae*	UH 2740	USNM 240869	
2291RV	*Mn.* sp. 37	UH 3046	USNM 239128	
2296RV	*Mn. hawkae*	UH 2742	USNM 240870	
2297LV	*Mn. hawkae*	UH 2742	USNM 240871	
2298RV	*Mn. hawkae*	UH 2638	USNM 240864	
2299LV	*Mn. hawkae*	UH 2638	USNM 240865	
2300LV	*Mn. hawkae*	UH 2963	USNM 240873	
2301RV	*Mn. belizensis*	UH 2972	USNM 240808	
2302RVJ	*Mn. belizensis*	UH 2961	USNM 240807	
2303W	*Ms. bensoni*	UH 4132	USNM 240622	Just molted
2304WJ	*Ms. bensoni*	UH 4132	USNM 240622	
2305LV	*Mc. cylindracea*	NMFIS Xe 3359		
2306LV	*Mc. cylindracea*	NMFIS Xe 3359		
2307RV	*Mc. cylindracea*	NMFIS Xe 3359		
2308RV	*Mc. cylindracea*	NMFIS Xe 3359		
2309RV	*Mk. swansoni*	Swanson P464	USNM 240386	
2310RV	*Mk. swansoni*	Swanson P464	USNM 240389	
2311LV	*Mk. swansoni*	Swanson P464	USNM 240387	
2312W	*Mk. swansoni*	Swanson P464	USNM 240388	
2313W	*Mh. jiangi*	Swanson P464	USNM 240707	
2314RV	*Mk. swansoni*	Swanson P461	USNM 240391	
2315RV	*Mk. swansoni*	Swanson P461	USNM 240391	
2316LV	*Mk. swansoni*	Swanson P461	USNM 240391	
2317LV	*Mk. swansoni*	Swanson P461	USNM 240391	
2318RV	*Mh. jiangi*	Swanson P461	USNM 240705	
2319F	*Mk.* sp. 6	Swanson P665	USNM 240397	
2322LV	*Mn. hawkae*	Fithian 1108	HVH 10883	
2323LV	*Mn. hawkae*	Fithian 1108	HVH 10884	
2324LV	*Ms.* sp. 24	BMNH 1911.11.8.M.3071		
2325W	*Ms.* sp. 24	BMNH 1911.11.8.M.3071		
2326W	*Mk. gregalis*	E-39-32	USNM 240380	
2327RV	*Mk. gregalis*	E-39-32	USNM 240381	
2328LV	*Mk. gregalis*	E-39-32	USNM 240381	
2329W	*Mk. gregalis*	E-39-32	USNM 240381	
2330W	*Mk. gregalis*	E-39-32	USNM 240379	
2331LV	*Mk. swansoni*	Swanson P462	USNM 240390	
2332RV	*Mk. swansoni*	Swanson P462	USNM 240385	Holotype
2333W	*Mh. jiangi*	E-39-32	USNM 240703	
2334W	*Mh. jiangi*	E-39-32	USNM 240706	
2335W	*Mh. jiangi*	E-39-32	USNM 240704	
2336RV	*Mc.* sp. 22	UB IGBA 1086		
2337W	*Mx.* sp. 10	UB IGBA 196		
2338RV	*Mx.* sp. 9	UB IGBA 693		
2344F	*Mn. moza*	Nosy Be 270	USNM 240958	Holotype
2345W	*Mn. moza*	Nosy Be 270	USNM 240959	
2346RV	*Mn. moza*	Nosy Be 230	USNM 240964	
2347LVJ	*Mn. moza*	Nosy Be 230	USNM 240965	
2348RVJ	*Mn. moza*	Nosy Be 230	USNM 240965	
2349WJ	*Mn. moza*	Nosy Be 230	USNM 240965	
2350WJ	*Mn. moza*	Nosy Be 230	USNM 240965	

Specimen Number	Name	Collecting Locality	Repository	Notes
2351M	*Mn. captiosa*	AB-8-412C	USNM 240839	Holotype
2352F	*Mn. captiosa*	AB-8-412C	USNM 240841	
2353M	*Mn. captiosa*	AB-8-412C	USNM 240842	
2354RV	*Mn. captiosa*	Nosy Be 366	USNM 240845	
2355LV	*Mn. captiosa*	Nosy Be 366	USNM 240846	
2356M	*Ms. hiulca*	AB-7-381C	USNM 240629	Holotype
2357F	*Ms. hiulca*	AB-7-381C	USNM 240630	
2358F	*Ms. hiulca*	AB-7-371C	USNM 240632	
2359J	*Ms. hiulca*	AB-7-381C	USNM 240631	
2360M	*Ms. capacis*	AB-8-403F	USNM 240623	Holotype
2361F	*Ms. capacis*	AB-8-403F	USNM 240624	
2362F	*Ms. capacis*	AB-8-403F	USNM 240625	
2363F	*Ms. capacis*	AB-8-403F	USNM 240626	
2364M	*Mn. madagascarensis*	JR-29	USNM 240917	
2365M	*Mn. moza*	JR-29	USNM 240972	
2366F	*Ms. capacis*	AB-8-403F	USNM 240627	
2367LV	*Mn. quadrimaculata*	Labutis 1305	USNM 239050	
2368LV	*Mn. quadrimaculata*	Labutis 1305	USNM 239051	
2369RV	*Mn. quadrimaculata*	Labutis 1305	USNM 239052	
2370RV	*Mn. quadrimaculata*	Labutis 1305	USNM 239053	
2371F	*Mh. turbida*	HU.13.CA.3.N.582-10		
2372F	*Mh. turbida*	HU.13.CA.3.N.582-10		
2373LVJ	*Mk. ligustica*	Bonaduce 9	Bonaduce	
2374LV	*Mn. bonaducei*	Bonaduce 6	USNM 240835	
2375RV	*Mn. bonaducei*	Bonaduce 6	USNM 240835	
2376RV	*Mx.* sp. 13	AB-7-365D	USNM 240583	
2377RV	*Mx.* sp. 13	AB-7-365D	USNM 240584	
2378LV	*Mx.* sp. 13	AB-7-365D	USNM 240585	
2379LV	*Mx.* sp. 13	AB-7-365D	USNM 240586	
2380M	*Mh. inaequata*	GL-2-0001	USNM 240695	
2382M	*Mx. similis*	AII-31-169A	USNM 240570	
2383F	*Mx. similis*	AII-31-169A	USNM 240571	
2384M	*Mx. kornickeri*	AII-31-169A	USNM 240539	Holotype
2385F	*Mx. kornickeri*	AII-31-169A	USNM 240540	
2386M	*Mx. bathyalensis*	AII-24-118H	USNM 240282	
2387M	*Mx. bathyalensis*	AII-24-118H	USNM 240283	
2388F	*Mx. bathyalensis*	AII-24-118H	USNM 240284	
2389M	*Mx. bathyalensis*	AII-24-118H	USNM 240288	
2390F	*Mx. bathyalensis*	C-50-85	USNM 240289	
2391W	*Mx. bathyalensis*	AII-12-65	USNM 240287	
2392M	*Mx. sapeloensis*	C # 1	USNM 240419	
2400M	*Mn. barbara*	SBMNH 29	USNM 239150	Holotype
2401F	*Mn. barbara*	SBMNH 1	USNM 239151	
2402J–2	*Mn. barbara*	SBMNH 14	USNM 239152	
2403FJ–1	*Mn. barbara*	SBMNH 1	USNM 239153	
2404RV	*M. opinabilis*	AB-7-365D	USNM 240323	Holotype
2405LV	*M. opinabilis*	AB-7-365D	USNM 240324	
2406RV	*Mk.* sp. 4	AB-7-361B	USNM 240394	
2407W	*Mh.* sp. 29	E-39-32	USNM 240786	
2408LV	*Mh.* sp. 28	E-39-32	USNM 240785	
2409W	*Mn.* sp. 43	Nosy Be 070	USNM 239138	
2410LV	*Mh.* sp. 27	E-39-32	USNM 240783	
2411RV	*Mx.* sp. 12	UH 4132	USNM 240581	
2412LV	*Mx. improcera*	UH 1617	USNM 240502	
2413RV	*Mx. improcera*	UH 4125	USNM 240498	Holotype

Specimen Number	Name	Collecting Locality	Repository	Notes
2414LV	*Mx. improcera*	UH 4125	USNM 240499	
2415RV	*Mx. improcera*	UH 4125	USNM 240500	
2416RV	*Mx. simulans*	UH 4132	USNM 240574	Holotype
2417LV	*Mx. simulans*	UH 4132	USNM 240575	
2418RV	*Mn. caiman*	UH 2860	USNM 240836	Holotype
2419LV	*Mn. caiman*	UH 2860	USNM 240837	
2420RV	*Mn.* sp. 44	UH 3046	USNM 239139	
2421LV	*Mn.* sp. 41	UH 2882	USNM 239134	
2422F	*Mn.* sp. 42	AB-8-412L	USNM 239136	
2423W	*Mh.* sp. 31	Swanson P484	USNM 240788	
2424RV	*Mx.* sp. 14	Swanson P667	USNM 240587	
2425RV	*Mx.* sp. 15	Swanson P654	USNM 240588	
2426LV	*Mx.* sp. 15	Swanson P654	USNM 240589	
2427W	*Mh.* sp. 32	Swanson P566	USNM 240789	
2428RV	*Mn.* sp. 45	Swanson P462	USNM 239141	
2429LV	*Mn.* sp. 45	Swanson P462	USNM 239142	
3029J–3	*M. maioris*	AII-31-156		Lost

Figure 1

Mostly right and left valve exteriors, *Macrocypris* and *Macropyxis*, ×35.——*1–4. Macrocypris metuenda* n. sp.; *1,2,* 1405M; *3,4,* 1401F. ——*5,6. Macropyxis* sp. 16, 327F, *5,* interior and *6,* exterior of right valve.

Figure 2

Right valve exteriors, *Macrocypris*, ×35.——*1–3. Macrocypris minna* (Baird); *1,* 1346; *2,* 2002M; *3,* 2003F.——*4. Macrocypris nimia* n. sp., 1524.——*5,6. Macrocypris miranda* n. sp.; *5,* 1419M; *6,* 1420F.——*7,8. Macrocypris maioris* n. sp.; *7,* 1774M; *8,* 1769F.

Figure 3

Left valve exteriors, *Macrocypris*, ×35.——*1–3. Macrocypris minna* (Baird); *1,* 1348; *2,* 2002M; *3,* 2003F.——*4. Macrocypris nimia* n. sp., 1738.——*5,6. Macrocypris miranda* n. sp.; *5,* 1419M; *6,* 1420F.——*7,8. Macrocypris maioris* n. sp.; *7,* 1774M; *8,* 1769F.

Figure 4

Mostly right valve exteriors, *Macrocypris* and *Macromckenziea*, ×35.——*1. Macromckenziea* sp. 2, 1960.——*2. Macrocypris opinabilis* n. sp., 2404.——*3–5. Macrocypris proclivis* n. sp.; *3,4,* 128F, interior and exterior; *5,* 361F.——*6. Macrocypris* sp. 1, 858F.——*7. Macromckenziea* sp. 4, 2406.——*8. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2276.——*9. Macromckenziea swansoni* n. sp., 2332. ——*10,11. Macromckenziea gregalis* n. sp.; *10,* 1912M?; *11,* 1913F?.——*12,13. Macromckenziea siliquosa* (Brady); *12,* 1414M; *13,* 1412F. ——*14,15. Macromckenziea glacierae* n. sp.; 14, 719F; *15,* 880M.

Figure 5

Left valve exteriors, *Macrocypris* and *Macromckenziea*, ×35.——*1. Macromckenziea* sp. 2, 1960.——*2. Macrocypris opinabilis* n. sp., 2405. ——*3–5. Macrocypris proclivis* n. sp.; *3,4,* 128F; *5,* 361F.——*6. Macrocypris* sp. 1, 858F.——*7. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2276.——*8. Macromckenziea swansoni* n. sp., 2331.——*9,10. Macromckenziea gregalis* n. sp.; *9,* 1912M?; *10,* 1913F?. ——*11,12. Macromckenziea siliquosa* (Brady); *11,* 1414M; *12,* 1412F.——*13,14. Macromckenziea glacierae* n. sp.; *13,* 719F; *14,* 880M.

Figure 6

Right valve exteriors, *Macromckenziea* and *Macropyxis*, ×35.——*1. Macromckenziea* sp. 5, 1460F.——*2. Macromckenziea* sp. 6, 2319F.——*3. Macropyxis* sp. 14, 2424.——*4. Macromckenziea* sp. 19, 1495M.——*5. Macropyxis* sp. 15, 2425.——*6,7. Macropyxis kaesleri* n. sp.; *6,* 1967M; *7,* 1968F.——*8. Macropyxis eltaninae* n. sp., 833F.——*9. Macromckenziea australiana* (Neale, 1975, from pl. 1, fig. 11).——*10. Macromckenziea* sp. 3, 1995F.——*11. Macromckenziea* sp. 7, 836.——*12. Macropyxis* sp. 13, 2377.——*13,14. Macropyxis improcera* n. sp.; *13,* 2413; *14,* 2415.——*15,16. Macropyxis amoena* n. sp.; *15,* 1864F; *16,* 1463M.——*17,18. Macropyxis antonbruunae* n. sp.; *17,* 333F; *18,* 332M. ——*19. Macropyxis* sp. 21, 1962F.——*20,21. Macropyxis kalbi* n. sp.; *20,* 351M; *21,* 352F.

Figure 7

Left valve exteriors, *Macromckenziea* and *Macropyxis*, ×35.——*1. Macromckenziea* sp. 5, 1460F.——*2. Macromckenziea* sp. 6, 2319F.——*3. Macromckenziea* sp. 19, 1495M.——*4. Macropyxis* sp. 15, 2426.——*5,6. Macropyxis kaesleri* n. sp.; *5,* 1967M; *6,* 1968F.——*7. Macropyxis eltaninae* n. sp., 833F.——*8. Macromckenziea* sp. 3, 1995F.——*9. Macromckenziea* sp. 7, 836.——*10. Macropyxis* sp. 13, 2378.——*11,12. Macropyxis improcera* n. sp.; *11,* 2412; *12,* 2414.——*13,14. Macropyxis amoena* n. sp.; *13,* 1864F; *14,* 1463M.——*15,16. Macropyxis antonbruunae* n. sp.; *15,* 333F; *16,* 332M.——*17. Macropyxis* sp. 21, 1962F.——*18,19. Macropyxis kalbi* n. sp.; *18,* 351M; *19,* 352F.

Figure 8

Right valve exteriors of *Macropyxis*, ×35.——*1. Macropyxis* sp. 11, 1416F.——*2,3. Macropyxis adunca* n. sp.; *2,* 1520M; *3,* 1521F.——*4,5. Macropyxis audens* n. sp.; *4,* 1446M; *5,* 1444F.——*6,7. Macropyxis amanda* n. sp.; *6,* 1406M; *7,* 1425F.——*8. Macropyxis simulans* n. sp., 2416.——*9,10. Macropyxis adriatica* (Breman); *9,* 2085; *10,* 2086.——*11,12. Macropyxis arta* n. sp.; *11,* 1454F; *12,* 1456M.——*13,14. Macropyxis adrecta* n. sp.; *13,* 1448M; *14,* 1527F.

Figure 9

Left valve exteriors of *Macropyxis*, ×35.——*1. Macropyxis* sp. 11, 1416F.——*2,3. Macropyxis adunca* n. sp.; *2,* 1520M; *3,* 1521F.——*4,5. Macropyxis audens* n. sp.; *4,* 1446M; *5,* 1444F.——*6,7. Macropyxis amanda* n. sp.; *6,* 1406M; *7,* 1425F.——*8. Macropyxis simulans* n. sp., 2417.——*9,10. Macropyxis adriatica* (Breman); *9,* 2083; *10,* 2082.——*11,12. Macropyxis arta* n. sp.; *11,* 1454F; *12,* 1456M.——*13,14. Macropyxis adrecta* n. sp.; *13,* 1527F; *14,* 1448M.

Figure 10

Mostly right valve exteriors, *Macropyxis*, ×35.——*1. Macropyxis* sp. 17, 1150F.——*2–4. Macropyxis bathyalensis* (Hulings); *2,* 1741; *3,* 2390F; *4,* 2389M.——*5. Macropyxis* sp. 20, 1784.——*6,7. Macropyxis similis* (Brady); *6,* 2382M; *7,* 2383F.——*8,9. Macropyxis labutisi* n. sp.; *8,* 1353F; *9,* 1351M.——*10,11. Macropyxis sapeloensis* (Darby); *10,* 1355M; *11,* 1357F.——*12,13. Macropyxis* sp. 8, 126F, interior and exterior.——*14. Macropyxis* sp. 18, 1443F.——*15,16. Macropyxis kornickeri* n. sp.; *15,* 2385F; *16,* 2384M.

Figure 11

Mostly left valve exteriors, *Macropyxis,* ×35.——*1. Macropyxis* sp. 12, 2411, right valve exterior.——*2–4. Macropyxis bathyalensis* (Hulings); *2,* 1742; *3,* 2390F; *4,* 2389M.——*5,6. Macropyxis similis* (Brady); *5,* 2382M; *6,* 2383F.——*7,8. Macropyxis labutisi* n. sp.; *7,* 1353F; *8,* 1351M.——*9,10. Macropyxis sapeloensis* (Darby); *9,* 1355M; *10,* 1357F.——*11,12. Macropyxis* sp. 8, 126F, left valve interior and exterior.——*13,14. Macropyxis kornickeri* n. sp.; *13,* 2385F; *14,* 2384M.

Figure 12

Right valve exteriors, *Macrocypria, Macrocyprissa, Macrosarisa,* and *Macroscapha,* ×35.——*1,2. Macroscapha jiangi* n. sp.; *1,* 1922M?; *2,* 1921F?.——*3,4. Macroscapha marchilensis* (Hartmann); *3,* K-27321B(FZ)F; *4,* K-27321A(FZ)M.——*5,6. Macroscapha heroica* n. sp.; *5,* 1462M; *6,* 1461F.——*7. Macrocypria semesa* n. sp., 857F.——*8,9. Macrosarisa bensoni* n. sp.; *8,* 1710F; *9,* 1869M.——*10,11. Macrosarisa hiulca* n. sp.; *10,* 2357F; *11,* 2356M.——*12. Macrosarisa texana* n. sp., 2020.——*13. Macroscapha gyreae* n. sp., 1509.——*14,15. Macrocypria sarsi* (Müller); *14,* 1998M; *15,* 2000F.——*16. Macrosarisa* sp. 23, 1415M.——*17,18. Macrocyprissa arcuata* (Colalongo and Pasini); *17,* 1533M; *18,* 1536F.——*19,20. Macrosarisa capacis* n. sp.; *19,* 2360M; *20,* 2361F.——*21,22. Macroscapha atlantica* n. sp.; *21,* 1982M; *22,* 1983F.

Figure 13

Left valve exteriors, *Macrocypria, Macrocyprissa, Macrosarisa,* and *Macroscapha,* ×35.——*1,2. Macroscapha jiangi* n. sp.; *1,* 1922M?; *2,* 1921F?.——*3,4. Macroscapha marchilensis* (Hartmann); *3,* K-27321B(FZ)F; *4,* K-27321A(FZ)M.——*5,6. Macroscapha heroica* n. sp.; *5,* 1462M; *6,* 1461F.——*7. Macrocypria semesa* n. sp.; 857F.——*8,9. Macrosarisa bensoni* n. sp.; *8,* 1710F; *9,* 1869M.——*10,11. Macrosarisa hiulca* n. sp.; *10,* 2357F; *11,* 2356M.——*12. Macrosarisa texana* n. sp., 2020.——*13. Macroscapha gyreae* n. sp., 2012.——*14,15. Macrocypria sarsi* (Müller); *14,* 1998M; *15,* 2000F.——*16. Macroscapha* sp. 28, 2408.——*17,18. Macrocyprissa arcuata* (Colalongo and Pasini); *17,* 1533M; *18,* 1536F.——*19,20. Macrosarisa capacis* n. sp.; *19,* 2360M; *20,* 2361F.——*21,22. Macroscapha atlantica* n. sp.; *21,* 1982M; *22,* 1983F.

Figure 14

Right valve exteriors, *Macroscapha,* ×35.——*1,2. Macroscapha opaca* n. sp.; *1,* 1479M; *2,* 1480F.——*3,4. Macroscapha sinuata* n. sp.; *3,* 845M; *4,* 852F.——*5–7. Macroscapha tensa* (Müller); *5,* 861M; *6,* 860F; *7,* 1935F.——*8. Macroscapha* sp. 29, 2407.——*9. Macroscapha* sp. 32, 2427.——*10–12. Macroscapha turbida* (Müller); *10,* 1475M; *11,* 1488F; *12,* 1943M.——*13,14. Macroscapha inaequalis* (Müller); *13,* 1940M; *14,* 1939F.——*15,16. Macroscapha inaequata* n. sp.; *15,* 714M; *16,* 715F.

Figure 15

Left valve exteriors, *Macroscapha,* ×35.——*1,2. Macroscapha opaca* n. sp.; *1,* 1479M; *2,* 1480F.——*3,4. Macroscapha sinuata* n. sp.; *3,* 845M; *4,* 852F.——*5–7. Macroscapha tensa* (Müller); *5,* 861M; *6,* 860F; *7,* 1935F.——*8. Macroscapha* sp. 29, 2407.——*9. Macroscapha* sp. 32, 2427.——*10. Macroscapha* sp. 27, 2410.——*11–13. Macroscapha turbida* (Müller); *11,* 1475M; *12,* 1488F; *13,* 1943M.——*14,15. Macroscapha inaequalis* (Müller); *14,* 1940M; *15,* 1939F.——*16,17. Macroscapha inaequata* n. sp.; *16,* 714M; *17,* 715F.

Figure 16

Right valve exteriors of *Macrocyprina,* ×35.——*1,2. Macrocyprina propinqua* Triebel; *1,* Xe 3362M; *2,* Xe 3364F.——*3,4. Macrocyprina hortuli* n. sp.; *3,* 1762M; *4,* 1761F.——*5–7. Macrocyprina skinneri* Kontrovitz; *5,* HVH 9439; *6,* HVH 9438; *7,* 1844.——*8. Macrocyprina belizensis* n. sp., 1828.——*9,10. Macrocyprina schmitti* (Tressler); *9,* 1763M; *10,* 1806F.——*11,12. Macrocyprina hawkae* n. sp.; *11,* 1817M; *12,* 1819F.——*13. Macrocyprina parcens* n. sp., 2266.——*14,15. Macrocyprina barbara* n. sp.; *14,* 2400M; *15,* 2401F.——*16. Macrocyprina vargata* Allison and Holden, 1507F.——*17,18. Macrocyprina succinea* (Müller); *17,* 1906F; *18,* 1904M.——*19. Macrocyprina caiman* n. sp., 2418.——*20. Macrocyprina* sp. 44, 2420.——*21. Macrocyprina bermudae* n. sp., 1843a.——*22. Macrocyprina* sp. 35, 1708.——*23. Macrocyprina* sp. 36, 1705.——*24. Macrocyprina* sp. 34, 1704.——*25. Macrocyprina quadrimaculata* n. sp., composite of specimens 2369 and 2370.——*26,27. Macrocyprina hartmanni* n. sp.; *26,* 2130M; *27,* 2132F.——*28. Macrocyprina* sp. 45, 2428.——*29. Macrocyprina okinawae* n. sp., 2068.——*30,31. Macrocyprina noharai* n. sp.; *30,* 2058F; *31,* 2063.——*32. Macrocyprina jamaicae* n. sp., 1835.——*33. Macrocyprina bonaducei* n. sp., 2263.——*34,35. Macrocyprina captiosa* n. sp.; *34,* 2351M; *35,* 2352F.——*36. Macrocyprina* sp. 43, 2409.——*37. Macrocyprina moza* n. sp., 2344F.——*38. Macrocyprina* sp. 42, 2422.——*39,40. Macrocyprina madagascarensis* n. sp.; *39,* 1757M; *40,* 1149F.——*41,42. Macrocyprina dispar* (Müller); *41,* 1933M; *42,* 1931F.——*43,44. Macrocyprina africana* (Müller); *43,* 1938F; *44,* 1937M.

Figure 17

Left valve exteriors of *Macrocyprina,* ×35.——*1,2. Macrocyprina propinqua* Triebel; *1,* Xe 3362M; *2,* Xe 3364F.——*3,4. Macrocyprina hortuli* n. sp.; *3,* 1762M; *4,* 1761F.——*5,6. Macrocyprina skinneri* Kontrovitz; *5,* 1845; *6,* HVH 9437.——*7. Macrocyprina belizensis* n. sp., 1829.——*8–10. Macrocyprina schmitti* (Tressler); *8,* HVH 9440; *9,* 1763M; *10,* 1806F.——*11,12. Macrocyprina hawkae* n. sp.; *11,* 1819F; *12,* 1817M.——*13. Macrocyprina parcens* n. sp., 2265.——*14,15. Macrocyprina barbara* n. sp.; *14,* 2400M; *15,* 2401F.——*16. Macrocyprina swaini* n. sp., 2285.——*17. Macrocyprina vargata* Allison and Holden, 1507F.——*18,19. Macrocyprina succinea* (Müller); *18,* 1906F; *19,* 1904M.——*20. Macroyprina caiman,* 2419.——*21. Macrocyprina bermudae* n. sp., 1843A.——*22. Macrocyprina* sp. 45, 2429.——*23. Macrocyprina* sp. 33, 1707.——*24. Macrocyprina* sp. 34, 1513.——*25. Macrocyprina quadrimaculata* n. sp., composite of specimens 2367 and 2368.——*26,27. Macrocyprina hartmanni* n. sp.; *26,* 2130M; *27,* 2132F.——*28. Macrocyprina okinawae* n. sp., 2064.——*29. Macrocyprina noharai* n. sp., 2058F.——*30. Macrocyprina jamaicae* n. sp., 1836.——*31. Macrocyprina* sp. 41, 2421.——*32. Macrocyprina bonaducei* n. sp., 2261.——*33,34. Macrocyprina captiosa* n. sp.; *33,* 2351M; *34,* 2352F.——*35. Macrocyprina* sp. 43, 2409.——*36. Macrocyprina moza* n. sp., 2344F.——*37. Macrocyprina* sp. 42, 2422.——*38,39. Macrocyprina madagascarensis* n. sp.; *38,* 1757M; *39,* 1149F.——*40,41. Macrocyprina dispar* (Müller); *40,* 1933M; *41,* 1931F.——*42. Macrocyprina africana* (Müller), 1936F.

Figure 18

Left anterior radial pore canals, *Macrocypris, Macropyxis,* and *Macromckenziea,* ×100.——*1. Macrocypris metuenda* n. sp., 1405M.——*2. Macrocypris maioris* n. sp., 1774M.——*3. Macrocypris miranda* n. sp., 1419M.——*4. Macrocypris minna* (Baird), 2002M.——*5. Macromckenziea siliquosa* (Brady), 1414M.——*6. Macropyxis similis* (Brady), 2382M.——*7. Macropyxis kornickeri* n. sp., 2384M.——*8. Macropyxis bathyalensis* (Hulings), 2389M.——*9. Macrocypris proclivis* n. sp., 128F.——*10. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2276.——*11. Macropyxis* sp. 8, 126F.——*12. Macropyxis amoena* n. sp., 1463M.——*13. Macromckenziea glacierae* n. sp., 880M.

Figure 19

Left anterior radial pore canals, *Macropyxis,* ×100.——*1. Macropyxis amanda* n. sp., 1425F.——*2. Macropyxis audens* n. sp., 1444F.——*3. Macropyxis arta* n. sp., 1456M.——*4. Macropyxis bathyalensis* (Hulings), 1742.——*5. Macropyxis adrecta* n. sp., 1527F.——*6. Macropyxis adunca* n. sp., 1521F.——*7. Macropyxis* sp. 11, 1416F.——*8. Macropyxis sapeloensis* (Darby), 1355M.——*9. Macropyxis labutisi* n. sp., 1351M.——*10. Macropyxis adriatica* (Breman), 2082.

Figure 20

Left anterior radial pore canals, *Macropyxis, Macroscapha,* and *Macrosarisa,* ×100.——*1. Macroscapha tensa* (Müller), 860F.——*2. Macroscapha inaequata* n. sp., 715F.——*3. Macroscapha sinuata* n. sp., 852F.——*4. Macroscapha gyreae* n. sp., 2012.——*5. Macroscapha heroica* n. sp., 1462M.——*6. Macroscapha turbida* (Müller), 1488F.——*7. Macroscapha atlantica* n. sp., 1983F.——*8. Macrosarisa capacis* n. sp., 2360M.——*9. Macropyxis kalbi* n. sp., 351M.——*10. Macropyxis antonbruunae* n. sp., 333F.——*11,12. Macropyxis kaesleri* n. sp.; *11,* 1968F; *12,* 1967M.

Figure 21

Mostly left anterior radial pore canals, *Macrocypria, Macrocyprissa, Macrosarisa,* and *Macrocyprina,* ×100.——*1. Macrocyprina africana* (Müller), 1936F.——*2. Macrocyprina dispar* (Müller), 1933M.——*3. Macrocyprina hartmanni* n. sp., 2130M.——*4. Macrocyprina moza,* 2344F.——*5. Macrocyprina captiosa* n. sp., 2351M.——*6. Macrocyprina noharai* n. sp., 2058F.——*7. Macrocyprina parcens* n. sp., 2265.——*8. Macrocyprina swaini* n. sp., 2285.——*9. Macrocyprina bonaducei* n. sp., 2261.——*10. Macrocyprina hortuli* n. sp., 1761F.——*11. Macrocyprina bermudae* n. sp., 1843a.——*12. Macrocyprina succinea* (Müller), 1904M.——*13. Macrocyprina vargata* Allison and Holden, 1507F.——*14. Macrocyprina jamaicae* n. sp., 1836.——*15. Macrocyprina hawkae* n. sp., 1817M.——*16. Macrocyprina schmitti* (Tressler), 1763M.——*17. Macrocyprina belizensis* n. sp., 1829.——*18. Macrocyprina skinneri* Kontrovitz, 1845.——*19. Macrocyprina propinqua* Triebel, Xe3362M.——*20. Macrosarisa bensoni* n. sp., 1710F.——*21,22. Macrosarisa texana* n. sp., 2020; part 22 is a right valve.——*23. Macrosarisa hiulca* n. sp., 2356M.——*24. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*25. Macrocypria sarsi* (Müller), 1998M.

Figure 22

Left posterior radial pore canals, *Macrocypris* and *Macropyxis,* ×100.——*1. Macropyxis kornickeri* n. sp., 2384M.——*2,10. Macropyxis bathyalensis* (Hulings); *2,* 2389M; *10,* 1742.——*3,4. Macropyxis arta* n. sp.; *3,* 1456M; *4,* 1454F.——*5. Macropyxis kalbi* n. sp., 351M.——*6. Macropyxis antonbruunae* n. sp., 333F.——*7. Macropyxis amanda* n. sp., 1425F.——*8. Macropyxis adrecta* n. sp., 1527F.——*9. Macropyxis* sp. 11, 1416F.——*11. Macropyxis adunca* n. sp., 1521F.——*12. Macropyxis audens* n. sp., 1444F.——*13. Macropyxis similis* (Brady), 2382M.——*14. Macropyxis labutisi* n. sp., 1351M.——*15. Macropyxis sapeloensis* (Darby), 1355M.——*16. Macropyxis amoena* n. sp., 1463M.——*17. Macrocypris miranda* n. sp., 1419M, note the terminal spine.——*18. Macrocypris maioris* n. sp., 1774M.——*19. Macrocypris metuenda* n. sp., 1405M.——*20. Macropyxis adriatica* (Breman), 2082.

Figure 23

Left posterior radial pore canals, *Macrocypria, Macrocyprissa, Macrosarisa, Macroscapha,* and *Macrocyprina,* ×100.——*1. Macrocyprina propinqua* Triebel, Xe 3362M.——*2. Macrocyprina bermudae* n. sp., 1843a.——*3. Macrocyprina hortuli* n. sp., 1761F.——*4. Macrocyprina skinneri* Kontrovitz, 1845.——*5. Macrocyprina schmitti* (Tressler), 1763M.——*6. Macrocyprina belizensis* n. sp., 1829.——*7. Macrocyprina hawkae* n. sp., 1817M.——*8. Macrocyprina jamaicae* n. sp., 1836.——*9. Macrocyprina succinea* (Müller), 1904M.——*10. Macrocyprina moza* n. sp., 2344M.——*11. Macrocyprina hartmanni* n. sp., 2130M.——*12. Macrocyprina bonaducei* n. sp., 2261.——*13. Macrocyprina noharai* n. sp., 2058F.——*14. Macrocyprina swaini* n. sp., 2285.——*15. Macrocyprina vargata* Allison and Holden, 1507F.——*16. Macroscapha sinuata* n. sp., 852F.——*17. Macroscapha heroica* n. sp., 1462M.——*18. Macroscapha turbida* (Müller), 1488F.——*19. Macroscapha inaequata* n. sp., 715F.——*20. Macroscapha tensa* (Müller), 860F.——*21. Macrocypria sarsi* (Müller), 1998M.——*22. Macrosarisa texana* n. sp., 2020.——*23. Macrosarisa bensoni* n. sp., 1710F.——*24. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*25. Macrosarisa capacis* n. sp., 2360M.

Figure 24

Left exterior muscle scar patterns, ×100.——*1. Macrocypris minna* (Baird), 2002M.——*2. Macrocypris miranda* n. sp., 1419M.——*3. Macrocypris maioris* n. sp., 1774M.——*4. Macrocypris metuenda* n. sp., 1405M.——*5. Macropyxis bathyalensis* (Hulings), 1742.——*6. Macropyxis adriatica* (Breman), 2082.——*7. Macropyxis adrecta* n. sp., 1527F.——*8. Macropyxis audens* n. sp., 1444F.——*9. Macropyxis amanda* n. sp., 1425F.——*10. Macropyxis kalbi* n. sp., 351M.——*11. Macropyxis antonbruunae* n. sp., 333F.——*12,13. Macropyxis kaesleri* n. sp.; *12,* 1967M; *13,* 1968F.——*14. Macropyxis* sp. 11, 1416F.——*15. Macropyxis labutisi,* 1351M.——*16,17. Macropyxis arta* n. sp.; *16,* 1456M; *17,* 1454F.——*18. Macropyxis adunca* n. sp., 1521F.——*19. Macromckenziea glacierae* n. sp., 880M.——*20. Macromckenziea gregalis* n. sp., 1913F.——*21. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2276.——*22. Macropyxis amoena* n. sp., 1463M.——*23. Macromckenziea siliquosa* (Brady), 1414M.——*24. Macroscapha tensa* (Müller), 860F.——*25. Macroscapha sinuata* n. sp., 852F.——*26. Macroscapha inaequata* n. sp., 715F.——*27. Macroscapha turbida* (Müller), 1488F.——*28. Macrosarisa capacis* n. sp., 2360M.——*29. Macroscapha atlantica* n. sp., 1983F.——*30. Macroscapha gyreae* n. sp., 2012.——*31. Macrosarisa bensoni* n. sp., 1710F.——*32. Macrosarisa hiulca* n. sp., 2356M.——*33. Macrosarisa texana* n. sp., 2020.——*34. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*35. Macrocypria sarsi* (Müller), 1998M.——*36. Macrocyprina propinqua* Triebel, Xe 3362.——*37. Macrocyprina hortuli* n. sp., 1761F.——*38. Macrocyprina bermudae* n. sp., 1843A.——*39. Macrocyprina skinneri* Kontrovitz, 1845.——*40. Macrocyprina belizensis* n. sp., 1829.——*41. Macrocyprina jamaicae* n. sp., 1836.——*42. Macrocyprina moza* n. sp., 2344F.——*43. Macrocyprina captiosa* n. sp., 2351M.——*44. Macrocyprina bonaducei* n. sp., 2261.——*45. Macrocyprina hartmanni* n. sp., 2130M.——*46. Macrocyprina noharai* n. sp., 2058F.——*47. Macrocyprina succinea* (Müller), 1904M.——*48. Macrocyprina swaini* n. sp., 2285.

Figure 25

Male right and left fifth limbs (maxillae) of *Macrocypris, Macromckenziea,* and *Macropyxis,* ×155.——*1,2. Macrocypris minna* (Baird), 2002M.——*3,4. Macrocypris maioris* n. sp., 1744M.——*5,6. Macromckenziea siliquosa* (Brady), 1410M.——*7,8. Macromckenziea glacierae* n. sp., 880M.——*9,10. Macropyxis amoena* n. sp., 1463M.——*11,12. Macrocypris miranda* n. sp., 1419M.——*13,14. Macrocypris metuenda* n. sp., 1405M.

Figure 26

Male right and left fifth limbs (maxillae) of *Macropyxis* and *Macromckenziea,* ×155.——*1–3. Macropyxis sapeloensis* (Darby); *1,2,* 1354M; *3,* 1358MF? (pathological intersex or incompletely metamorphosed male).——*4,5. Macropyxis arta* n. sp., 1456M.——*6–9. Macropyxis antonbruunae* n. sp.; *6,7,* 332M; *8,9,* 358M.——*10,11. Macropyxis eltaninae* n. sp., 831M.——*12,13. Macropyxis labutisi* n. sp., 1351M.——*14,15. Macropyxis kornickeri* n. sp., 2384M.——*16,17. Macropyxis bathyalensis* (Hulings), 2389M.——*18,19. Macropyxis kaesleri* n. sp., 1967M.——*20,21. Macromckenziea* sp. 19, 1495M.——*22,23. Macropyxis audens* n. sp., 1446M.——*24,25. Macropyxis adrecta* n. sp., 1448M.——*26,27. Macropyxis amanda* n. sp., 1406M.——*28,29. Macropyxis similis* (Brady), 2382M.——*30,31. Macropyxis adunca* n. sp., 1520M.——*32,33. Macropyxis kalbi* n. sp., 351M.

Figure 27

Male right and left fifth limbs (maxillae) of *Macroscapha,* ×155.——*1. Macroscapha marchilensis* (Hartmann), K-27321 (GL) M.——*2,3. Macroscapha heroica* n. sp., 1462M.——*4,5,16,17. Macroscapha sinuata* n. sp.; *4,5,* 845M; *16,17,* 848MF?, pathological.——*6–9. Macroscapha turbida* (Müller); *6,7,* 1475M; *8,9,* 1943M.——*10,11. Macroscapha inaequata* n. sp., 714M.——*12,13. Macroscapha atlantica* n. sp., 1982M.——*14,15. Macroscapha* sp. 25, 198M.——*18,19. Macroscapha opaca* n. sp., 1479M.——*20,21. Macroscapha inaequalis* (Müller), 1940M.——*22,23. Macroscapha tensa* (Müller), 861M.

Figure 28

Male right and left fifth limbs (maxillae) of *Macrocypria, Macrocyprissa, Macrosarisa,* and *Macrocyprina,* ×155.——*1,2. Macrocyprina propinqua* Triebel, Xe 3362M.——*3–5. Macrocyprina schmitti* (Tressler); *3,4,* 1763M; *5,* 1538M.——*6,7. Macrocyprina moza* n. sp., 2365M.——*8,9. Macrocyprina madagascarensis* n. sp., 1757M.——*10,11. Macrocyprina africana* (Müller), 1937M.——*12,13. Macrocyprina hortuli* n. sp., 1762M.——*14–16. Macrocyprina hawkae* n. sp.; *14,* 1817M; *15,* 1853M; *16,* 1852M.——*17,18. Macrocyprina dispar* (Müller), 1933M.——*19,20. Macrosarisa hiulca* n. sp., 2356M.——*21,22. Macrocyprina bermudae* n. sp., 1759M.——*23,24. Macrocyprina succinea* (Müller), 1905M.——*25,26. Macrocyprina hartmanni* n. sp., 2130M.——*27,28. Macrocyprina captiosa* n. sp., 2351M.——*29,30. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*31,32. Macrosarisa bensoni* n. sp., 1869M.——*33–35. Macrocyprina skinneri* Kontrovitz; *33,* 1910M; *34,35,* 1909M.——*36,37. Macrocyprina swaini* n. sp., 1992M.——*38,39. Macrocyprina barbara* n. sp., 2400M.——*40,41. Macrocypria sarsi* (Müller), 1998M.——*42,43. Macrocypria semesa* n. sp., 843M.——*44,45. Macrosarisa* sp. 23, 1415M.

Figure 29

Female fifth limbs (maxillae) of *Macrocypris, Macromckenziea, Macrocypria, Macrocyprissa,* and *Macrosarisa,* ×155.——*1. Macromckenziea glacierae* n. sp., 719F.——*2. Macromckenziea* sp. 3, 1995F.——*3. Macromckenziea* sp. 5, 1460F.——*4. Macromckenziea* sp. 6, 2319F.——*5. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2774F.——*6. Macromckenziea siliquosa* (Brady), 1412F.——*7. Macrosarisa bensoni* n. sp., 1710F.——*8. Macrosarisa hiulca* n. sp., 2357F.——*9. Macrocyprissa arcuata* (Colalongo and Pasini), 1536F.——*10. Macrocypria semesa* n. sp., 857F.——*11. Macrocypria sarsi* (Müller), 2000F.——*12. Macrocypris maioris* n. sp., 1769F.——*13. Macrocypris miranda* n. sp., 1420F.——*14,16,17. Macrocypris minna* (Baird); *14,* 2003F; *16,17,* 1339F.——*15. Macrocypris metuenda* n. sp., 1402F.——*18. Macrocypris* sp. 1, 858F.——*19. Macrocypris proclivis* n. sp., 361F.

Figure 30

Female fifth limbs (maxillae) of *Macropyxis*, ×155.——*1. Macropyxis sapeloensis* (Darby), 1357F.——*2. Macropyxis* sp. 11, 1416F.——*3. Macropyxis adunca* n. sp., 1521F.——*4. Macropyxis audens* n. sp., 1444F.——*5. Macropyxis similis* (Brady), 2383F.——*6. Macropyxis adrecta* n. sp., 1527F.——*7, 12. Macropyxis bathyalensis* (Hulings); *7,* 2390F; *12,* 1341F.——*8. Macropyxis kornickeri* n. sp., 2385F.——*9. Macropyxis arta* n. sp., 1454F.——*10. Macropyxis amanda* n. sp., 1425F.——*11. Macropyxis* sp. 18, 1443F.——*13. Macropyxis antonbruunae* n. sp., 333F.——*14. Macropyxis kalbi* n. sp., 352F.——*15. Macropyxis* sp. 21, 1962F.——*16. Macropyxis labutisi* n. sp., 1353F.——*17. Macropyxis kaesleri* n. sp., 1968F.——*18. Macropyxis eltaninae* n. sp., 833F.——*19. Macropyxis* sp. 16, 327F.——*20. Macropyxis amoena* n. sp., 1864F.

Figure 31

Female fifth limbs (maxillae) of *Macrosarisa, Macroscapha,* and *Macrocyprina,* ×155.——*1. Macrosarisa capacis* n. sp., 2361F.——*2. Macroscapha marchilensis* (Hartmann), K-27321 (GL) F.——*3. Macroscapha sinuata* n. sp., 852F.——*4. Macroscapha tensa* (Müller), 860F.——*5. Macrocyprina moza* n. sp., 2344F.——*6. Macrocyprina captiosa* n. sp., 2352F.——*7. Macroscapha opaca* n. sp., 1480F.——*8. Macroscapha inaequalis* (Müller), 1939F.——*9. Macroscapha inaequata* n. sp., 715F (pathological, with extra seta).——*10, 11. Macroscapha turbida* (Müller); *10,* 1488F; *11,* 1947F.——*12. Macrocyprina vargata* Allison and Holden, 1507F.——*13. Macrocyprina barbara* n. sp., 2401F.——*14. Macrocyprina bermudae* n. sp., 1758F.——*15. Macrocyprina succinea* (Müller), 1906F.——*16. Macrocyprina propinqua* Triebel, Xe 3364F.——*17. Macrocyprina hortuli* n. sp., 1761F.——*18. Macrocyprina hawkae* n. sp., 1819F.——*19. Macrocyprina skinneri* Kontrovitz, 1911F.——*20. Macrocyprina hartmanni* n. sp., 2132F.——*21. Macrocyprina madagascarensis* n. sp., 1149F.——*22. Macrocyprina africana* (Müller), 1936F.——*23. Macrocyprina dispar* (Müller), 1931F.——*24, 25. Macroscapha atlantica* n. sp., 1984F; *24,* normal leg; *25,* pathological leg with extra seta.——*26. Macroscapha heroica* n. sp., 1461F.

Figure 32

Sixth limbs (first thoracic legs) of *Macrocypris* and *Macromckenziea,* ×95.——*1. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2274F.——*2. Macromckenziea glacierae* n. sp., 718F.——*3, 9. Macrocypris minna* (Baird); *3,* 2002M; *9,* 1339F.——*4. Macromckenziea* sp. 3, 1995F.——*5. Macromckenziea* sp. 5, 1460F.——*6. Macromckenziea* sp. 6, 2319F.——*7. Macromckenziea siliquosa* (Brady), 1410M.——*8. Macrocypris* sp. 1, 858F.——*10. Macrocypris maioris* n. sp., 1431M.——*11. Macrocypris miranda* n. sp., 1419M.——*12. Macrocypris proclivis* n. sp., 361F.——*13. Macrocypris metuenda* n. sp., 1405M.

Figure 33

Sixth limbs (first thoracic legs) of *Macropyxis,* ×95.——*1. Macropyxis antonbruunae* n. sp., 358M.——*2. Macropyxis adunca* n. sp., 1520M.——*3. Macropyxis* sp. 16, 327F.——*4. Macropyxis kalbi* n. sp., 351M.——*5. Macropyxis bathyalensis* (Hulings), 2389M.——*6. Macropyxis* sp. 18, 1443F.——*7. Macropyxis audens* n. sp., 1446M.——*8. Macropyxis amanda* n. sp., 1406M.——*9. Macropyxis eltaninae* n. sp., 831M.——*10. Macropyxis labutisi* n. sp., 1367M.——*11. Macropyxis kaesleri* n. sp., 1967M.

Figure 34

Sixth limbs (first thoracic legs) of *Macropyxis, Macromckenziea, Macrosarisa,* and *Macroscapha,* ×95.——*1. Macrosarisa capacis* n. sp., 2361F.——*2. Macropyxis arta* n. sp., 1456M.——*3. Macropyxis* sp. 11, 1416F.——*4. Macromckenzia* sp. 19, 1495M.——*5. Macropyxis bathyalensis* (Hulings), 1341F.——*6. Macropyxis adrecta* n. sp., 1448M.——*7. Macropyxis kornickeri* n. sp., 2384M.——*8. Macroscapha opaca* n. sp., 1479M.——*9. Macropyxis sapeloensis* (Darby), 1354M.——*10, 15. Macroscapha turbida* (Müller); *10,* 1475M; *15,* 1943M.——*11. Macroscapha tensa* (Müller), 861M.——*12. Macroscapha inaequata* n. sp., 715F.——*13. Macroscapha inaequalis* (Müller), 1940M.——*14. Macropyxis* sp. 21, 1962F.——*16. Macropyxis similis* (Brady), 2382M.

Figure 35

Sixth limbs (first thoracic legs) of *Macrocypria, Macrocyprissa, Macrosarisa, Macroscapha,* and *Macrocyprina,* ×95.——*1. Macrocyprina succinea* (Müller), 1905M.——*2. Macrocyprina barbara* n. sp., 2400M.——*3. Macrocyprina swaini* n. sp., 1992M.——*4. Macrocyprina vargata* Allison and Holden, 1507F.——*5. Macrocyprina bermudae* n. sp., 1759M.——*6. Macrocyprina hortuli* n. sp., 1761F.——*7. Macrocyprina propinqua* Triebel, Xe 3368M.——*8. Macrocyprina skinneri* Kontrovitz, 1909M.——*9. Macrocyprina schmitti* (Tressler), 1538M.——*10. Macrocyprina hawkae* n. sp., 1818M.——*11. Macrocyprina moza* n. sp., 2365M.——*12. Macrocyprina madagascarensis* n. sp., 1757M.——*13. Macrocyprina captiosa* n. sp., 2352F.——*14. Macrocyprina hartmanni* n. sp., 2130M.——*15. Macrocyprina dispar* (Müller), 1931F.——*16. Macrocyprina africana* (Müller), 1937M.——*17. Macrocypria semesa* n. sp., 857M.——*18. Macrosarisa* sp. 23, 1415M.——*19. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*20. Macrocypria sarsi* (Müller), 1998M.——*21. Macroscapha* sp. 25, 198M.——*22. Macrosarisa hiulca* n. sp., 2356M.——*23. Macrosarisa bensoni* n. sp., 1417F.——*24. Macroscapha sinuata* n. sp., 845M.——*25. Macroscapha atlantica* n. sp., 1982M.——*26. Macroscapha marchilensis* (Hartmann), K-27321 (G).

Figures 36 and 37

Seventh limbs (second thoracic legs) of *Macrocypris, Macropyxis,* and *Macromckenziea,* ×155.——*1. Macropyxis* sp. 16, 327F.——*2. Macrocypris* sp. 1, 858F.——*3. Macrocypris minna* (Baird), 1339F.——*4. Macrocypris metuenda* n. sp., 1405M.——*5. Macromckenziea siliquosa* (Brady), 1414M.——*6. Macromckenziea* sp. 3, 1995F.——*7. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2274F.——*8. Macromckenziea glacierae* n. sp., 880M.——*9. Macrocypris maioris* n. sp., 1774M.——*10. Macropyxis amoena* n. sp., 1463M.

Figure 38

Seventh limbs (second thoracic legs) of *Macrocypris* and *Macropyxis*, ×155.——*1. Macropyxis sapeloensis* (Darby), 1355M.——*2. Macrocypris proclivis* n. sp., 361F.——*3. Macrocypris miranda* n. sp., 1419M.——*4. Macropyxis similis* (Brady), 2382M.——*5. Macropyxis labutisi* n. sp., 1351M.

Figure 39

Seventh limbs (second thoracic legs) of *Macrocypris* and *Macropyxis*, ×155.——*1. Macropyxis audens* n. sp., 1446M.——*2. Macropyxis* sp. 11, 1416F.——*3. Macropyxis adrecta* n. sp., 1448M.——*4. Macrocypris minna* (Baird), 2002M.——*5,6. Macropyxis bathyalensis* (Hulings); *5*, 2389M; *6*, 1341F.

Figure 40

Seventh limbs (second thoracic legs) of *Macropyxis* and *Macromckenziea*, ×155.——*1. Macropyxis arta* n. sp., 1456M.——*2. Macropyxis eltaninae* n. sp., 831M.——*3. Macropyxis antonbruunae* n. sp., 332M.——*4. Macropyxis* sp. 19, 1495M.——*5. Macropyxis kaesleri* n. sp., 1967M.——*6. Macropyxis kalbi* n. sp., 351M.——*7. Macromckenziea* sp. 5, 1460F.

Figure 41

Seventh limbs (second thoracic legs) of *Macropyxis* and *Macromckenziea*, ×155.——*1. Macropyxis* sp. 18, 1443F.——*2. Macropyxis kornickeri* n. sp., 2384M.——*3. Macropyxis* sp. 21, 1962F.——*4. Macromckenziea* sp. 6, 2319F.——*5. Macropyxis amanda* n. sp., 1406M.——*6. Macropyxis adunca* n. sp., 1520M.

Figure 42

Seventh limbs (second thoracic legs) of *Macrosarisa* and *Macroscapha*, ×155.——*1. Macroscapha opaca* n. sp., 1479M.——*2. Macroscapha inaequata* n. sp., 714M.——*3. Macroscapha* sp. 25, 198M.——*4. Macrosarisa capacis* n. sp., 2361F.——*5. Macroscapha inaequalis* (Müller), 1940M.

Figure 43

Seventh limbs (second thoracic legs) of *Macroscapha*, ×155.——*1. Macroscapha sinuata* n. sp., 845M.——*2,3. Macroscapha turbida* (Müller); *2*, 1475M; *3*, 1943M.——*4. Macroscapha tensa* (Müller), 861M.——*5. Macroscapha atlantica* n. sp., 1982M.

Figure 44

Seventh limbs (second thoracic legs) of *Macrocypria*, *Macrocyprissa*, *Macrosarisa*, and *Macroscapha*, ×155.——*1. Macrosarisa* sp. 23, 1415M.——*2. Macrocypria semesa* n. sp., 857F.——*3. Macroscapha marchilensis* (Hartmann), K-27321 (GL).——*4. Macrosarisa bensoni* n. sp., 1710F.——*5. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*6. Macrosarisa hiulca* n. sp., 2356M.——*7. Macrocypria sarsi* (Müller), 1998M.

Figure 45

Seventh limbs (second thoracic legs) of *Macrocyprina*, ×155.——*1. Macrocyprina schmitti* (Tressler), 1538M.——*2. Macrocyprina bermudae* n. sp., 1759M.——*3. Macrocyprina hortuli* n. sp., 1762M.——*4. Macrocyprina vargata* Allison and Holden, 1507F.——*5. Macrocyprina propinqua* Triebel, Xe 3362M.——*6. Macrocyprina succinea* (Müller), 1905M.——*7. Macrocyprina hawkae* n. sp., 1818M.——*8. Macrocyprina skinneri* Kontrovitz, 1909M.——*9. Macrocyprina barbara* n. sp., 2400M.——*10. Macrocyprina swaini* n. sp., 1992M.——*11. Macrocyprina captiosa* n. sp., 2353M.——*12. Macrocyprina hartmanni* n. sp., 2130M.——*13. Macrocyprina madagascarensis* n. sp., 1757M.——*14. Macrocyprina moza* n. sp., 2365M.——*15. Macrocyprina africana* (Müller), 1937M.——*16. Macrocyprina dispar* (Müller), 1933M.

Figure 46

Furcae of *Macrocypris*, *Macromckenziea*, and *Macropyxis*, ×155, (except parts *2, 14, 15, 17, 18, 20, 21, 33, 40*, ×320; parts *18, 22, 25, 31, 34*, ×578).——*1–4. Macrocypris minna* (Baird); *1,2*, 2002M; *3*, 1339F; *4*, 2003F.——*5,6. Macrocypris metuenda* n. sp.; *5*, 1405M; *6*, 1402F.——*7,8. Macrocypris miranda* n. sp.; *7*, 1419M; *8*, 1420F.——*9,11. Macrocypris maioris* n. sp.; *9*, 1432F; *11*, 1774M.——*10. Macrocypris proclivis* n. sp., 361F.——*12. Macropyxis* sp. 16, 327F.——*13. Macromckenziea* sp. 3, 1995F.——*14,15. Macromckenziea* sp. 19, 1495M.——*16–19. Macropyxis amoena* n. sp.; *16–18*, 1463M; *19*, 1864F.——*20–25. Macromckenziea glacierae* n. sp.; *20–22*, 719F; *23–25*, 880M.——*26–28. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese); *26*, 2275F, with genital lobes and posterior part of body; *27,28*, 2274F.——*29–34. Macromckenziea siliquosa* (Brady); *29–31*, 1410M; *32–34*, 1412F.——*35,36. Macropyxis sapeloensis* (Darby); *35*, 1355M; *36*, 1357F.——*37. Macrocypris* sp. 1, 858F.——*38–40. Macropyxis labutisi* n. sp.; *38*, 1353F, with genital lobes and posterior part of body; *39,40*, 1351M.——*41–43. Macropyxis bathyalensis* (Hulings); *41*, 1341F; *42*, 2389M; *43*, 2388F.——*44. Macropyxis* sp. 17, 1150F.——*45. Macropyxis* sp. 11, 1416F.——*46. Macropyxis* sp. 18, 1443F.——*47,48. Macropyxis kornickeri* n. sp.; *47*, 2385; *48*, 2384M.——*49,50. Macropyxis similis* (Brady); *49*, 2383F; *50*, 2382M.——*51. Macromckenziea* sp. 6, 2319F.——*52. Macropyxis* sp. 21, 1962F.——*53. Macromckenziea* sp. 5, 1460F.——*54,55. Macropyxis amanda* n. sp.; *54*, 1406M; *55*, 1408F.——*56,57. Macropyxis audens* n. sp.; *56*, 1446M; *57*, 1444F.——*58,59. Macropyxis adunca* n. sp.; *58*, 1521F; *59*, 1520M.——*60,61. Macropyxis arta* n. sp.; *60*, 1456M; *61*, 1454F.——*62,63. Macropyxis adrecta* n. sp.; *62*, 1786F; *63*, 1448M.——*64,65. Macropyxis kaesleri* n. sp.; *64*, 1967M; *65*, 1968F.——*66–68. Macropyxis* *antonbruunae* n. sp.; *66,* 354F; *67,* 332M; *68,* 358M.——*69,70. Macropyxis eltaninae* n. sp.; *69,* 831M; *70,* 833F.——*71. Macropyxis kalbi* n. sp., 351M.

FIGURE 47

Furcae of *Macrocypria, Macrosarisa, Macrocyprissa, Macroscapha,* and *Macrocyprina,* ×155 (except part *33,* ×578).——*1. Macrocypria semesa* n. sp., 843M.——*2,3. Macrocypria sarsi* (Müller); *2,* 1340F; *3,* 1998M.——*4,5. Macrosarisa bensoni* n. sp.; *4,* 1710F; *5,* 1869M.——*6,7. Macrocyprissa arcuata* (Colalongo and Pasini); *6,* 1531F; *7,* 1533M.——*8. Macrosarisa hiulca* n. sp., 2357F.——*9. Macrosarisa* sp. 23, 1415M.——*10,11. Macroscapha marchilensis* (Hartmann), K 27321 (GL).——*12. Macroscapha atlantica* n. sp., 1982M.——*13. Macrosarisa capacis* n. sp., 2361F.——*14. Macrocyprina moza* n. sp., 2365M.——*15. Macrocyprina captiosa* n. sp., 2352F.——*16. Macrocyprina madagascarensis* n. sp., 1757M.——*17. Macrocyprina africana* (Müller), 1937M.——*18. Macrocyprina dispar* (Müller), 1933M.——*19. Macrocyprina hartmanni* n. sp., 2130M.——*20. Macrocyprina hawkae* n. sp., 1818M.——*21. Macrocyprina hortuli* n. sp., 1762M.——*22. Macrocyprina schmitti* (Tressler), 1538M.——*23. Macrocyprina skinneri* Kontrovitz, 1909M.——*24. Macrocyprina propinqua* Triebel, Xe 3362M.——*25. Macrocyprina swaini* n. sp., 1992M.——*26. Macrocyprina succinea* (Müller), 1905M.——*27. Macrocyprina vargata* Allison and Holden, 1507F.——*28. Macrocyprina barbara* n. sp., 2400M.——*29. Macrocyprina bermudae* n. sp., 1759M.——*30. Macroscapha heroica* n. sp., 1462M.——*31. Macroscapha* sp. 25, 198M.——*32. Macroscapha sinuata,* 845M.——*33–35. Macroscapha turbida* (Müller); *33,* 1475M; *34,* 1943M; *35,* 1488F.——*36. Macroscapha opaca* n. sp., 1479M.——*37. Macroscapha inaequata* n. sp., 714M.——*38. Macroscapha inaequalis* (Müller), 1940M.——*39,40. Macroscapha tensa* (Müller); *39,* 861M; *40,* 1935F.

FIGURE 48

Right valve exteriors of juveniles of *Macrocypris,* ×35.——*1–4. Macrocypris maioris* n. sp.; *1,* 1773J–4; *2,* 1772J–2; *3,* 1770F–1; *4,* 1771M–1.——*5. Macrocypris nimia* n. sp., 1740J.——*6–9. Macrocypris metuenda* n. sp.; *6,* 1779J–3; *7,* 1778J–2; *8,* 1777M–1; *9,* 1775F–1.——*10–13. Macrocypris miranda* n. sp.; *10,* 1424J–4; *11,* 1423J–3; *12,* 1422J–2; *13,* 1421F–1.

FIGURE 49

Left valve exteriors of juveniles of *Macrocypris,* ×35.——*1–4. Macrocypris maioris* n. sp.; *1,* 1773J–4; *2,* 1772J–2; *3,* 1770F–1; *4,* 1771M–1.——*5. Macrocypris nimia* n. sp., 1739J.——*6–9. Macrocypris metuenda* n. sp.; *6,* 1779J–3; *7,* 1778J–2; *8,* 1777M–1; *9,* 1775F–1.——*10–13. Macrocypris miranda* n. sp.; *10,* 1424J–4; *11,* 1423J–3; *12,* 1422J–2; *13,* 1421F–1.

FIGURE 50

Right valve exteriors of juveniles of *Macropyxis, Macrocypria, Macrocyprissa,* and *Macrosarisa,* ×35.——*1. Macrocypria semesa* n. sp., 1485F–1.——*2. Macrocypria sarsi* (Müller), 2001F–1.——*3. Macrosarisa bensoni* n. sp., 1711F–1.——*4. Macropyxis antonbruunae* n. sp., 356F–1.——*5. Macropyxis eltaninae,* 834F–1.——*6–11. Macropyxis labutisi* n. sp.; *6,* 1378J–4; *7,* 1377F–3; *8,* 1398M–2; *9,* 1396F–2; *10,* 1369M–1; *11,* 1381F–1.——*12–14. Macrosarisa texana* n. sp.; *12,* 2024J–3; *13,* 2023J–2; *14,* 2021J–1.——*15–19. Macrocyprissa arcuata* (Colalongo and Pasini); *15,* 1731J–3; *16,* 1736F–2; *17,* 1737M–2; *18,* 1733F–1; *19,* 1734M–1.——*20,21. Macropyxis adrecta* n. sp.; *20,* 1450F–2; *21,* 1787M–1.——*22. Macropyxis adunca* n. sp., 1785F–1.——*23. Macropyxis audens* n. sp., 1447F–1.——*24. Macropyxis bathyalensis* (Hulings), 1744J–1.——*25–27. Macropyxis sapeloensis* (Darby); *25,* 1374F–2; *26,* 1383M–1; *27,* 1361F–1.——*28–31. Macropyxis kalbi* n. sp.; *28,* 357J–3; *29,* 349M–2; *30,* 844F–2; *31,* 353M–1.

FIGURE 51

Left valve exteriors of juveniles of *Macrocypria, Macrocyprissa, Macrosarisa,* and *Macropyxis,* ×35.——*1–3. Macrocypria semesa* n. sp.; *1,* 1484F–2; *2,* 1486F–2; *3,* 1485F–1.——*4–6. Macrosarisa texana* n. sp.; *4,* 2024J–3; *5,* 2023J–2; *6,* 2022J–1.——*7. Macrocypria sarsi* (Müller), 2001F–1.——*8. Macrosarisa bensoni* n. sp., 1711F–1.——*9–13. Macrocyprissa arcuata* (Colalongo and Pasini); *9,* 1731J–3; *10,* 1737M–2; *11,* 1736F–2; *12,* 1734M–1; *13,* 1733F–1.——*14. Macropyxis antonbruunae* n. sp., 356–1.——*15. Macropyxis eltaninae* n. sp., 834F–1.——*16–18. Macropyxis sapeloensis* (Darby); *16,* 1374F–2; *17,* 1361F–1; *18,* 1383M–1.——*19,20. Macropyxis bathyalensis* (Hulings); *19,* 1746J–2; *20,* 1745J–1.——*21–24. Macropyxis kalbi* n. sp.; *21,* 357J–3; *22,* 844F–2; *23,* 349M–2; *24,* 353M–1.——*25–30. Macropyxis labutisi* n. sp.; *25,* 1378J–4; *26,* 1377J–3; *27,* 1398M–2; *28,* 1396F–2; *29,* 1369M–1; *30,* 1381F–1.——*31,32. Macropyxis adrecta* n. sp.; *31,* 1450F–2; *32,* 1787M–1.——*33. Macropyxis adunca* n. sp., 1785F–1.——*34. Macropyxis audens* n. sp., 1447F–1.

FIGURE 52

Right valve exteriors of juveniles of *Macroscapha* and *Macrocyprina,* ×35.——*1,2. Macroscapha turbida* (Müller); *1,* 1478F–1; *2,* 1474M–1.——*3–7. Macrocyprina okinawae* n. sp.; *3,* 2075J–5; *4,* 2074J–4; *5,* 2073J–3; *6,* 2071J–2; *7,* 2069J–1.——*8–11. Macrocyprina noharai* n. sp.; *8,* 2062J–4; *9,* 2061J–3; *10,* 2067J–2; *11,* 2066J–1.——*12–15. Macroscapha gyreae* n. sp.; *12,* 2019J–4; *13,* 2018J–3; *14,* 2016J–2; *15,* 2013J–1.——*16–18. Macrocyprina africana* (Müller); *16,* 1752J–3; *17,* 1750J–2; *18,* 1748J–1.——*19. Macroscapha opaca* n. sp., 1756M–1.——*20,21. Macroscapha sinuata* n. sp.; *20,* 855M–1; *21,* 853F–1.——*22–25. Macroscapha heroica* n. sp.; *22,* 1861J–4; *23,* 1859J–3; *24,* 1857J–2; *25,* 1855J–1.——*26,27. Macrocyprina hartmanni* n. sp.; *26,* 2134J–2; *27,* 2133F–1.——*28. Macrocyprina dispar* (Müller), 1514J–1.——*29. Macroscapha inaequata* n. sp., 717F–1.——*30. Macroscapha atlantica* n. sp., 1987F–1.——*31,32. Macrocyprina quadrimaculata* n. sp.; *31,* 1699J; *32,* 1698J.——*33–35. Macroscapha tensa* (Müller); *33,* 874F–2; *34,* 871M–1; *35,* 870F–1.——*36,37. Macroscapha jiangi* n. sp.; *36,* 1924J–2; *37,* 1923J–1.——*38. Macroscapha* sp. 26, HU.13.R.12.90.——*39,40. Macrocyprina madagascarensis* n. sp.; *39,* 1039J–2; *40,* 670J–1.——*41. Macroscapha* sp. 30, 1418F–1.

FIGURE 53

Left valve exteriors of juveniles of *Macrocyprina* and *Macroscapha*, ×35.——*1,2. Macrocyprina hartmanni* n. sp.; *1,* 2134J–2; *2,* 2133F–1.——*3–5. Macrocyprina noharai* n. sp.; *3,* 2062J–4; *4,* 2067J–2; *5,* 2065J–1.——*6–8. Macrocyprina okinawae* n. sp.; *6,* 2076J–4; *7,* 2072J–2; *8,* 2070J–1.——*9,10. Macroscapha gyreae* n. sp.; *9,* 2017J–2; *10,* 2013J–1.——*11,12. Macroscapha turbida* (Müller); *11,* 1476F–1; *12,* 1474M–1.——*13. Macroscapha opaca* n. sp., 1756M–1.——*14–18. Macroscapha heroica* n. sp.; *14,* 1863J–5; *15,* 1862J–4; *16,* 1860J–3; *17,* 1858J–2; *18,* 1856J–1.——*19–22. Macrocyprina africana* (Müller); *19,* 1753J–4; *20,* 1751J–3; *21,* 1749J–2; *22,* 1518J–1.——*23. Macrocyprina dispar* (Müller), 1515J–1.——*24,25. Macroscapha sinuata* n. sp.; *24,* 855M–1; *25,* 853F–1.——*26. Macroscapha atlantica* n. sp.; 1987F–1.——*27–30. Macrocyprina quadrimaculata* n. sp.; *27,* 1703J–4; *28,* 1702J–3; *29,* 1700J–2; *30,* 1697J–1.——*31–33. Macroscapha tensa* (Müller); *31,* 874F–2; *32,* 871M–1; *33,* 870F–1.——*34,35. Macroscapha jiangi* n. sp.; *34,* 1924J–2; *35,* 1923J–1.——*36,37. Macroscapha* sp. 26; *36,* HU.13.R.12.89; *37,* HU.13.R.12.90.——*38,39. Macrocyprina madagascarensis* n. sp.; *38,* 1039J–2; *39,* 670J–1.——*40. Macroscapha* sp. 30, 1418F–1.

FIGURE 54

Right valve exteriors of juveniles of *Macropyxis, Macromckenziea,* and *Macrocyprina,* ×35.——*1–3. Macrocyprina skinneri* Kontrovitz; *1,* 1850J–3; *2,* 1848J–2; *3,* 1846J–1.——*4–7. Macrocyprina schmitti* (Tressler); *4,* 1813J–4; *5,* 1811J–3; *6,* 1809J–2; *7,* 1807J–1.——*8–10. Macrocyprina bermudae* n. sp.; *8,* 1805J–3; *9,* 1803J–2; *10,* 1801J–1.——*11–14. Macrocyprina hawkae* n. sp.; *11,* 1825J–4; *12,* 1824J–3; *13,* 1822J–2; *14,* 1821J–1.——*15,16. Macrocyprina succinea* (Müller); *15,* 1908J–2; *16,* 1907M–1.——*17–20. Macrocyprina hortuli* n. sp.; *17,* 1799J–4; *18,* 1797J–3; *19,* 1795J–2; *20,* 1793J–1.——*21–23. Macrocyprina belizensis* n. sp.; *21,* 1834J–3; *22,* 1832J–2; *23,* 1830J–1.——*24, 25. Macrocyprina barbara* n. sp.; *24,* 2402F–2; *25,* 2403F–1.——*26–30. Macropyxis amoena* n. sp.; *26,* 1868J–5; *27,* 1867J–4; *28,* 1866J–3; *29,* 1865J–2; *30,* 1464F–1.——*31–36. Macromckenziea gregalis* n. sp.; *31,* 1918J–6; *32,* 1917J–5; *33,* 1930J–4; *34,* 1916J–3; *35,* 1915J–2; *36,* 1914J–1.——*37,38. Macrocyprina jamaicae* n. sp.; *37,* 1839J–2; *38,* 1837J–1.——*39–43. Macromckenziea siliquosa* (Brady); *39,* 1715J–4; *40,* 1714J–3; *41,* 1716F–2; *42,* 1717M–1; *43,* 1719F–1.——*44–46. Macromckenziea glacierae* n. sp.; *44,* 724F–3; *45,* 1469F–2; *46,* 879F–1.

FIGURE 55

Left valve exteriors of juveniles of *Macromckenziea, Macropyxis,* and *Macrocyprina,* ×35.——*1–3. Macrocyprina skinneri* Kontrovitz; *1,* 1851J–3; *2,* 1849J–2; *3,* 1847J–1.——*4–7. Macrocyprina schmitti* (Tressler); *4,* 1814J–4; *5,* 1812J–3; *6,* 1810J–2; *7,* 1808J–1.——*8–10. Macrocyprina bermudae* n. sp.; *8,* 1805J–3; *9,* 1804J–2; *10,* 1802J–1.——*11–13. Macrocyprina hawkae* n. sp.; *11,* 1825J–4; *12,* 1823J–2; *13,* 1820J–1.——*14,15. Macrocyprina succinea* (Müller); *14,* 1908J–2; *15,* 1907M–1.——*16–19. Macrocyprina hortuli* n. sp.; *16,* 1800J–5; *17,* 1798J–3; *18,* 1796J–2; *19,* 1794J–1.——*20,21. Macrocyprina jamaicae* n. sp.; *20,* 1840J–2; *21,* 1838J–1.——*22,23. Macrocyprina belizensis* n. sp.; *22,* 1833J–2; *23,* 1831J–1.——*24,25. Macrocyprina barbara* n. sp.; *24,* 2402J–2; *25,* 2403J–1.——*26–31. Macromckenziea gregalis* n. sp.; *26,* 1918J–6; *27,* 1917J–5; *28,* 1930J–4; *29,* 1916J–3; *30,* 1915J–2; *31,* 1914J–1.——*32–36. Macromckenziea siliquosa* (Brady); *32,* 1715J–4; *33,* 1714J–3; *34,* 1716F–2; *35,* 1717M–1; *36,* 1719F–1.——*37. Macropyxis amoena* n. sp., 1464F–1.——*38–40. Macromckenziea glacierae* n. sp.; *38,* 724J–3; *39,* 1469F–2; *40,* 879F–1.

FIGURE 56

Juvenile fifth limbs (maxillae), ×155 (*1–13,* male instar–1; *14–32,* instar–2; *33–36,* instar–4).——*1,14. Macrocypris metuenda* n. sp.; *1,* 1777M–1, molting; *14,* 1778M–2.——*2,20,35. Macrocypris maioris* n. sp.; *2,* 1771M–1; *20,* 1772M–2; *35,* 1773J–4.——*3,21. Macropyxis adrecta* n. sp.; *3,* 1787M–1; *21,* 1450M–2.——*4,23. Macropyxis sapeloensis* (Darby); *4,* 1383M–1; *23,* 1374F–2.——*5,19. Macroscapha tensa* (Müller); *5,* 871M–1; *19,* 874F–2.——*6,26,29,33,34. Macropyxis labutisi* n. sp.; *6,* 1369M–1; *26,* 1398M–2; *29,* 1396F–2; *33,34,* 1378J–4.——*7. Macroscapha turbida* (Müller), 1474M–1.——*8. Macroscapha sinuata* n. sp., 856M–1.——*9,30. Macrocyprina succinea* (Müller); *9,* 1907M–1, molting; *30,* 1908M–2.——*10,24,27. Macrocyprissa arcuata* (Colalongo and Pasini); *10,* 1734M–1; *24,* 1736F–2; *27,* 1737M–2.——*11,28. Macromckenziea siliquosa* (Brady); *11,* 1717M–1; *28,* 1716F–2.——*12. Macrocypria semesa* n. sp., 1486M–1.——*13. Macroscapha opaca* n. sp., 1756M–1, molting.——*15,16. Macropyxis kalbi* n. sp.; *15,* 844F–2; *16,* 349M–2.——*17,36. Macropyxis miranda* n. sp.; *17,* 1422M–2; *36,* 1424J–4.——*18. Macropyxis arta* n. sp., 1453M–2.——*22. Macrocyprina hartmanni* n. sp., 2134J–2.——*25,31. Macromckenziea glacierae* n. sp.; *25,* 881M–2; *31,* 1469F–2.——*32. Macrocyprina barbara* n. sp., 2402J–2.

FIGURE 57

Juvenile fifth limbs (maxillae), ×155 (*1–27,* female instar–1; *28–34,* instar–3).——*1,31. Macrocypris miranda* n. sp.; *1,* 1421F–1; *31,* 1423J–3.——*2,29. Macrocypris metuenda* n. sp.; *2,* 1775F–1; *29,* 1779J–3——*3,28. Macrocypris kalbi* n. sp.; *3,* 353F–1; *28,* 357J–3.——*4. Macropyxis arta* n. sp., 1452F–1.——*5. Macropyxis audens* n. sp., 1447F–1.——*6. Macropyxis eltaninae* n. sp., 834F–1.——*7. Macropyxis antonbruunae* n. sp., 356F–1.——*8. Macropyxis adunca* n. sp., 1785F–1.——*9. Macrocypria sarsi* (Müller), 2001F–1.——*10. Macrocypria semesa* n. sp., 1484F–1.——*11,32. Macrocyprissa arcuata* (Colalongo and Pasini); *11,* 1733F–1; *32,* 1731J–3.——*12. Macrosarisa bensoni* n. sp., 1711F–1.——*13. Macrocyprina madagascarensis* n. sp., 669F–1.——*14. Macrocyprina hartmanni* n. sp., 2133F–1.——*15,33. Macromckenziea siliquosa* (Brady); *15,* 1719F–1; *33,* 1714J–3.——*16. Macropyxis sapeloensis* (Darby), 1361F–1.——*17,18,30. Macropyxis labutisi* n. sp.; *17,* 1381F–1; *18,* 1389F–1; *30,* 1377J–3.——*19. Macroscapha opaca* n. sp., 1755F–1.——*20. Macroscapha inaequata* n. sp., 717F–1.——*21. Macrocyprina barbara* n. sp., 2403J–1.——*22. Macroscapha turbida* (Müller), 1476F–1.——*23. Macroscapha tensa* (Müller), 870F–1.——*24. Macroscapha sinuata* n. sp., 853F–1.——*25. Macroscapha atlantica* n. sp., 1986F–1.——*26,34. Macromckenziea glacierae* n. sp.; *26,* 879F–1; *34,* 724J–3.——*27. Macropyxis amoena* n. sp., 1464F–1.

Figure 58

Juvenile sixth limbs (first thoracic legs), of *Macrocypris, Macropyxis, Macromckenziea, Macrocypria, Macrocyprissa,* and *Macrosarisa,* instar–1, ×95.——*1. Macrocypris miranda* n. sp., 1421F–1.——*2. Macrocypris maioris* n. sp., 1770F–1.——*3. Macrocypris metuenda* n. sp., 1777M–1.——*4. Macropyxis arta* n. sp., 1452F–1.——*5. Macromckenziea glacierae* n. sp., 879F–1.——*6. Macromckenziea siliquosa* (Brady), 1717M–1.——*7. Macropyxis amoena* n. sp., 1464F–1.——*8. Macropyxis sapeloensis* (Darby); 1361F–1.——*9. Macropyxis labutisi* n. sp., 1389F–1.——*10. Macropyxis antonbruunae* n. sp., 356F–1.——*11. Macropyxis eltaninae* n. sp., 834F–1.——*12. Macropyxis adunca* n. sp., 1785F–1.——*13. Macropyxis adrecta* n. sp., 1787M–1.——*14. Macropyxis kalbi* n. sp., 353M–1.——*15. Macropyxis audens* n. sp., 1447F–1.——*16. Macrocypria sarsi* (Müller), 2001F–1.——*17. Macrosarisa bensoni* n. sp., 1711F–1.——*18. Macrocyprissa arcuata* (Colalongo and Pasini), 1734M–1.——*19. Macrocypria semesa* n. sp., 1484F–1.

Figure 59

Juvenile sixth limbs (first thoracic legs) of *Macrocypris, Macropyxis, Macromckenziea, Macrocyprissa, Macroscapha,* and *Macrocyprina,* ×95 (*1–10,* instar–1; *11–26,* instar–2; *27–33,* instar–3; *34–38,* instar–4.)——*1. Macroscapha atlantica* n. sp., 1986F–1.——*2. Macroscapha opaca* n. sp., 1756M–1.——*3. Macroscapha inaequata* n. sp., 717F–1.——*4,19. Macroscapha tensa* (Müller); *4,* 871M–1; *19,* 874F–2.——*5. Macroscapha turbida* (Müller), 1474M–1.——*6. Macroscapha sinuata* n. sp., 855M–1.——*7,24. Macrocyprina hartmanni* n. sp.; *7,* 2133F–1; *24,* 2134J–2.——*8,25. Macrocyprina succinea* (Müller); *8,* 1907M–1; *25,* 1908–2.——*9,18. Macrocyprina barbara* n. sp.; *9,* 2403F–1; *18,* 2402J–2.——*10,23. Macrocyprina madagascarensis* n. sp.; *10,* 669F–1; *23,* 671J–2.——*11,27. Macrocypris metuenda* n. sp.; *11,* 1778J–2; *27,* 1779J–3.——*12,29,34. Macrocypris miranda* n. sp.; *12,* 1422J–2; *29,* 1423J–3; *34,* 1424J–4.——*13,35. Macrocypris maioris* n. sp.; *13,* 1772J–2; *35,* 1773J–4.——*14,28. Macropyxis kalbi* n. sp.; *14,* 349M–2; *28,* 357J–3.——*15. Macropyxis arta* n. sp., 1453J–2.——*16,30. Macromckenziea glacierae* n. sp.; *16,* 881M–2; *30,* 724J–3.——*17,32,36. Macromckenziea siliquosa* (Brady); *17,* 1716F–2; *32,* 1714J–3; *36,* 1715J–4.——*20. Macropyxis adrecta* n. sp., 1788J–2.——*21. Macropyxis sapeloensis* (Darby), 1374F–2.——*22,31,37,38. Macropyxis labutisi* n. sp.; *22,* 1398M–2; *31,* 1377J–3; *37,38,* 1378J–4.——*26,33. Macrocyprissa arcuata* (Colalongo and Pasini); *26,* 1737M–2; *33,* 1731J–3.

Figure 60

Juvenile seventh limbs (second thoracic legs) of *Macrocypris, Macromckenziea, Macropyxis, Macrocypria,* and *Macrocyprissa,* instar–1, ×155.——*1. Macromckenziea glacierae* n. sp., 879F–1.——*2. Macrocypria maioris* n. sp., 1771M–1.——*3. Macrocypris miranda* n. sp., 1421F–1.——*4. Macrocyprissa arcuata* (Colalongo and Pasini), 1734M–1.——*5. Macrocypris metuenda* n. sp., 1777M–1.——*6. Macromckenziea siliquosa* (Brady), 1717M–1.——*7. Macrocypria semesa* n. sp., 1484F–1, reflexed seta missing.——*8. Macrocypria sarsi* (Müller), 2001F–1.——*9. Macropyxis amoena* n. sp., 1464F–1.

Figure 61

Juvenile seventh limbs (second thoracic legs) of *Macropyxis,* instar–1, ×155.——*1. Macropyxis antonbruunae* n. sp., 356F–1.——*2. Macropyxis kalbi* n. sp., 353M–1.——*3. Macropyxis eltaninae* n. sp., 835F–1.——*4. Macropyxis labutisi* n. sp., 1369M–1.——*5. Macropyxis adunca* n. sp., 1785F–1.——*6. Macropyxis sapeloensis* (Darby), 1383M–1.——*7. Macropyxis audens* n. sp., 1447F–1.——*8. Macropyxis adrecta* n. sp., 1787M–1.——*9. Macropyxis arta* n. sp., 1452F–1.

Figure 62

Juvenile seventh limbs (second thoracic legs) of *Macrosarisa, Macroscapha,* and *Macrocyprina,* instar–1, ×155.——*1. Macroscapha turbida* (Müller), 1474M–1.——*2. Macroscapha opaca* n. sp., 1758M–1.——*3. Macrocyprina hartmanni* n. sp., 2133F–1.——*4. Macrosarisa bensoni* n. sp., 1711F–1.——*5. Macroscapha inaequata* n. sp., 717F–1.——*6. Macrocyprina succinea* (Müller), 1907M–1.——*7. Macroscapha sinuata* n. sp., 855M–1.——*8. Macroscapha atlantica* n. sp., 1986F–1.——*9. Macroscapha tensa* (Müller), 871M–1.——*10. Macrocyprina madagascarensis* n. sp., 669F–1.——*11. Macrocyprina barbara* n. sp., 2403F–1.

Figure 63

Juvenile seventh limbs (second thoracic legs) of *Macrocypris, Macropyxis, Macromckenziea, Macrocyprissa, Macroscapha,* and *Macrocyprina,* ×155 (*1–16,* instar–2; *17–23,* instar–3).——*1,20. Macropyxis labutisi* n. sp.; *1,* 1373F–2; *20,* 1377J–3.——*2. Macropyxis adrecta* n. sp., 1450F–2.——*3,17. Macrocyprissa arcuata* (Colalongo and Pasini); *3,* 1737M–2; *17,* 1731J–3.——*4. Macropyxis sapeloensis* (Darby), 1374F–2.——*5. Macropyxis arta* n. sp., 1453M–2.——*6. Macroscapha tensa* (Müller), 874F–2.——*7,21. Macropyxis kalbi* n. sp.; *7,* 844F–2; *21,* 357J–3.——*8. Macroscapha marchilensis* (Hartmann), K27321(GL).——*9,19. Macromckenziea glacierae* n. sp.; *9,* 881M–2; *19,* 724J–3.——*10,18. Macromckenziea siliquosa* (Brady); *10,* 1716F–2; *18,* 1714J–3.——*11. Macrocyprina succinea* (Müller), 1908J–2.——*12. Macrocypris maioris* n. sp., 1772J–2.——*13,22. Macrocypris miranda* n. sp.; *13,* 1422J–2; *22,* 1423J–3.——*14. Macrocyprina madagascarensis* n. sp., 671J–2.——*15,23. Macrocypris metuenda* n. sp.; *15,* 1778J–2; *23,* 1779J–3.——*16. Macrocyprina hartmanni* n. sp., 2134J–2.

Figure 64

Juvenile furcae, ×155 (except parts *29, 34, 46, 49, 55, 57,* ×320; *30, 50, 53,* ×578) (*1–34,* instar–1; *35–50,* instar–2; *51–57,* instar–3).——*1,43,52,53. Macrocypris metuenda* n. sp.; *1,* 1777M–1; *43,* 1778J–2; *52,53,* 1779J–3.——*2. Macrocypris miranda* n. sp., 1421F–1.——*3. Macrocypris maioris* n. sp., 1770F–1.——*4,41. Macropyxis kalbi* n. sp.; *4,* 353M–1; *41,* 349M–2.——*5. Macropyxis eltaninae* n. sp., 823F–1.

——*6. Macropyxis antonbruunae* n. sp., 356F–1.——*7. Macropyxis adunca* n. sp., 1785F–1.——*8. Macropyxis adrecta* n. sp., 1787M–1. ——*9. Macropyxis audens* n. sp., 1447F–1.——*10,44. Macropyxis arta* n. sp.; *10,* 1452F–1; *44,* 1453M–2.——*11,12,42. Macropyxis sapeloensis* (Darby); *11,* 1395F–1; *12,* 1383M–1; *42,* 1374F–2.——*13. Macroscapha inaequata* n. sp., 717F–1.——*14,35. Macroscapha tensa* (Müller); *14,* 871M–1; *35,* 874F–2.——*15. Macroscapha opaca* n. sp., 1756M–1.——*16. Macroscapha sinuata* n. sp., 855M–1.——*17. Macroscapha atlantica* n. sp., 1986F–1.——*18. Macroscapha turbida* (Müller), 1474M–1.——*19. Macroscapha* sp. 30, 1418F–1.——*20,36. Macrocyprina madagascarensis* n. sp.; *20,* 669F–1; *36,* 671J–2.——*21,37. Macrocyprina hartmanni* n. sp.; *21,* 2133F–1; *37,* 2134J–2. ——*22,39. Macrocyprina barbara* n. sp.; *22,* 2403F–1; *39,* 2402J–2.——*23,40,51. Macrocyprissa arcuata* (Colalongo and Pasini); *23,* 1734M–1; *40,* 1737M–2; *51,* 1731J–3.——*24. Macrosarisa bensoni* n. sp., 1711F–1.——*25. Macrocypria sarsi* (Müller), 2001F–1.——*26. Macrocypria semesa* n. sp., 1484F–1.——*27. Macropyxis amoena* n. sp., 1464F–1.——*28–30. Macromckenziea siliquosa* (Brady), 1717M–1. ——*31–34,45–47,54–57. Macropyxis labutisi* n. sp.; *31,* 1380F–1; *32,* 1381F–1; *33,34,* 1369M–1; *45,* 1373F–2; *46,47,* 1398M–2; *54,55,* 1377J–3; *56,57,* 1376J–3.——*38. Macrocyprina succinea* (Müller), 1908J–2.——*48–50. Macromckenziea glacierae* n. sp., 881M–2.

FIGURE 65

Antennules of *Macrocypris, Macromckenziea,* and *Macropyxis,* ×155 (setae not shown for some).——*1. Macrocypris miranda* n. sp., 1419M.——*2. Macromckenziea* sp. 19, 1495M.——*3. Macropyxis* sp. 11, 1416F.——*4. Macropyxis eltaninae* n. sp., 833F.——*5. Macrocypris metuenda* n. sp., 1405M.——*6. Macropyxis antonbruunae* n. sp., 331M.——*7. Macrocypris minna* (Baird), 2002M.

FIGURE 66

Antennules of *Macrocypris, Macromckenziea,* and *Macropyxis,* ×155 (setae not shown for some).——*1. Macromckenziea* sp. 5, 1460F.——*2. Macromckenziea glacierae* n. sp., 880M.——*3. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese), 2274F.——*4. Macrocypris maioris* n. sp., 1774M.——*5. Macromckenziea* sp. 6, 2319F.——*6. Macromckenziea* sp. 3, 1995F.——*7. Macropyxis adunca* n. sp., 1520M.——*8. Macropyxis labutisi* n. sp., 1351M.——*9. Macromckenziea siliquosa* (Brady), 1500M.

FIGURE 67

Antennules of *Macropyxis,* ×155 (setae not shown for some).——*1. Macropyxis sapeloensis* (Darby), 1355M.——*2. Macropyxis arta* n. sp., 1456M.——*3. Macropyxis bathyalensis* (Hulings), 2389M.——*4. Macropyxis kaesleri* n. sp., 1967M.——*5. Macropyxis kalbi* n. sp., 351M. ——*6. Macropyxis similis* (Brady), 2382M.——*7. Macropyxis kornickeri* n. sp., 2385M.——*8. Macropyxis audens* n. sp., 1446M.——*9. Macropyxis adrecta* n. sp., 1448M.——*10. Macropyxis amanda* n. sp., 1406M.

FIGURE 68

Antennules of *Macrocypria, Macrocyprissa, Macrosarisa, Macroscapha,* and *Macrocyprina,* ×155 (setae not shown for some).——*1. Macrocypria semesa* n. sp., 843M.——*2. Macrocypria sarsi* (Müller), 1998M.——*3. Macrosarisa* sp. 23, 1415M.——*4. Macrosarisa bensoni* n. sp., 1710F.——*5. Macrocyprissa arcuata* (Colalongo and Pasini), 1533F.——*6. Macrocyprina madagascarensis* n. sp., 1757M.——*7. Macrosarisa hiulca* n. sp., 2356M.——*8. Macrocyprina hortuli* n. sp., 1762M.——*9. Macrosarisa capacis* n. sp., 2360M.——*10. Macrocyprina bermudae* n. sp., 1759M.——*11. Macrocyprina noharai* n. sp., 2058F.——*12. Macrosarisa* sp. 47, 127F.——*13. Macrocyprina succinea* (Müller), 1905M.——*14. Macroscapha opaca* n. sp., 1479M.——*15. Macropyxis* sp. 21, 1962F.——*16. Macrocyprina captiosa* n. sp., 2352F.——*17. Macrocyprina hartmanni* n. sp., 2132F.

FIGURE 69

Antennules of *Macroscapha* and *Macrocyprina,* ×155 (setae not shown for some).——*1. Macroscapha atlantica* n. sp., 1982M.——*2. Macroscapha inaequalis* (Müller), 1940M.——*3. Macroscapha turbida* (Müller), 1943M.——*4. Macrocyprina propinqua* Triebel, Xe 3367F. ——*5. Macrocyprina africana* (Müller), 1937M.——*6. Macrocyprina moza* n. sp., 2365M.——*7. Macrocyprina dispar* (Müller), 1933M. ——*8. Macrocyprina hawkae* n. sp., 1817M.——*9. Macrocyprina barbara* n. sp., 2400M.——*10. Macrocyprina schmitti* (Tressler), 1538M. ——*11. Macroscapha* sp. 25, 198M.——*12. Macroscapha tensa* (Müller), 861M.——*13. Macroscapha inaequata* n. sp., 714M.——*14. Macroscapha sinuata* n. sp., 845M.——*15. Macrocyprina skinneri* Kontrovitz, 1909M.

FIGURE 70

Antennae of *Macrocypris* and *Macromckenziea,* ×155.——*1. Macrocypris metuenda* n. sp., 1405M.——*2. Macrocypris minna* (Baird), 2003F.——*3. Macromckenziea siliquosa* (Brady), 1500M.

FIGURE 71

Antennae of *Macrocypris, Macromckenziea* and *Macropyxis,* ×310 (except parts *3, 4,* ×385).——*1. Macromckenziea glacierae* n. sp., 880M. ——*2. Macrocypris maioris* n. sp., 1774M.——*3,4. Macropyxis sapeloensis* (Darby); *3,* 1355M; *4,* 1357F.——*5. Macropyxis kaesleri* n. sp., 1967M.

FIGURE 72

Antennae of *Macrocypria* and *Macrocyprissa,* ×155 (except parts *1, 2, 4, 5,* ×385).——*1–3. Macrocyprissa arcuata* (Colalongo and Pasini); *1,* 1531F; *2,3,* 1533M.——*4–6. Macrocypria sarsi* (Müller); *4,6,* 1998M; *5,* 2000F.——*7. Macrocypria semesa* n. sp., 843M.

Figure 73

Antennae of *Macrosarisa* and *Macroscapha,* ×155 (except parts *1, 3, 5–7,* ×770).——*1,2. Macrosarisa hiulca* n. sp., 2356M.——*3,8. Macroscapha atlantica* n. sp., 1982M.——*4,5. Macrosarisa capacis* n. sp., 2360M.——*6,7,9. Macrosarisa bensoni* n. sp.; *6,* 1710F; *7,9,* 1869M.

Figure 74

Antennae of *Macroscapha* and *Macrocyprina,* ×155 (except part *7,* ×385).——*1. Macrocyprina schmitti* (Tressler), 1538M.——*2. Macroscapha turbida* (Müller), 1943M.——*3. Macrocyprina africana* (Müller), 1937M.——*4. Macrocyprina dispar* (Müller), 1933M.——*5. Macrocyprina propinqua* Triebel, Xe 3367F.——*6. Macroscapha inaequalis* (Müller), 1940M.——*7. Macrocyprina barbara* n. sp., 2400M.

Figure 75

Mandibles of *Macrocypris, Macromckenziea,* and *Macropyxis,* ×310 (except part *7,* ×385).——*1. Macromckenziea glacierae* n. sp., 880M.——*2. Macrocypris metuenda* n. sp., 1405M.——*3,4. Macrocypris minna* (Baird), 2003F.——*5. Macromckenziea siliquosa* (Brady), 1412F.——*6. Macropyxis kaesleri* n. sp., 1968F.——*7. Macropyxis sapeloensis* (Darby), 1354M.

Figure 76

Mandibles of *Macrocypria, Macrocyprissa,* and *Macrosarisa,* ×155 (except parts *2, 3, 7,* ×385).——*1,2. Macrosarisa bensoni* n. sp., 1710F.——*3. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.——*4,5. Macrocypria semesa* n. sp., 843M.——*6. Macrocypria sarsi* (Müller), 1998M.——*7. Macrosarisa hiulca* n. sp., 2356M.

Figure 77

Mandibles of *Macroscapha* and *Macrocyprina,* ×310 (except part *4,* ×320; *5, 9,* ×385).——*1. Macrocyprina propinqua* Triebel, Xe 3368M.——*2. Macrocyprina africana* (Müller), 1937M.——*3. Macrocyprina dispar* (Müller), 1933M.——*4. Macrocyprina schmitti* (Tressler), 1538M.——*5. Macrocyprina barbara* n. sp., 2400M.——*6. Macroscapha turbida* (Müller), 1943M.——*7,9. Macroscapha atlantica* n. sp., 1982M.——*8. Macroscapha inaequalis* (Müller), 1940M.

Figure 78

Maxillules of *Macrocypris, Macromckenziea, Macropyxis, Macrocypria,* and *Macrocyprissa,* ×310 (except part *9,* ×385).——*1. Macrocypris metuenda* n. sp., 1405M.——*2. Macrocypris minna* (Baird), 2002M.——*3. Macromckenziea glacierae* n. sp., 880M.——*4. Macromckenziea siliquosa* (Brady), 1410M.——*5. Macropyxis sapeloensis* (Darby), 1355M.——*6. Macropyxis kaesleri* n. sp., 1968F.——*7. Macrocypria semesa* n. sp., 843M.——*8. Macrocypria sarsi* (Müller), 1999F.——*9,10. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M.

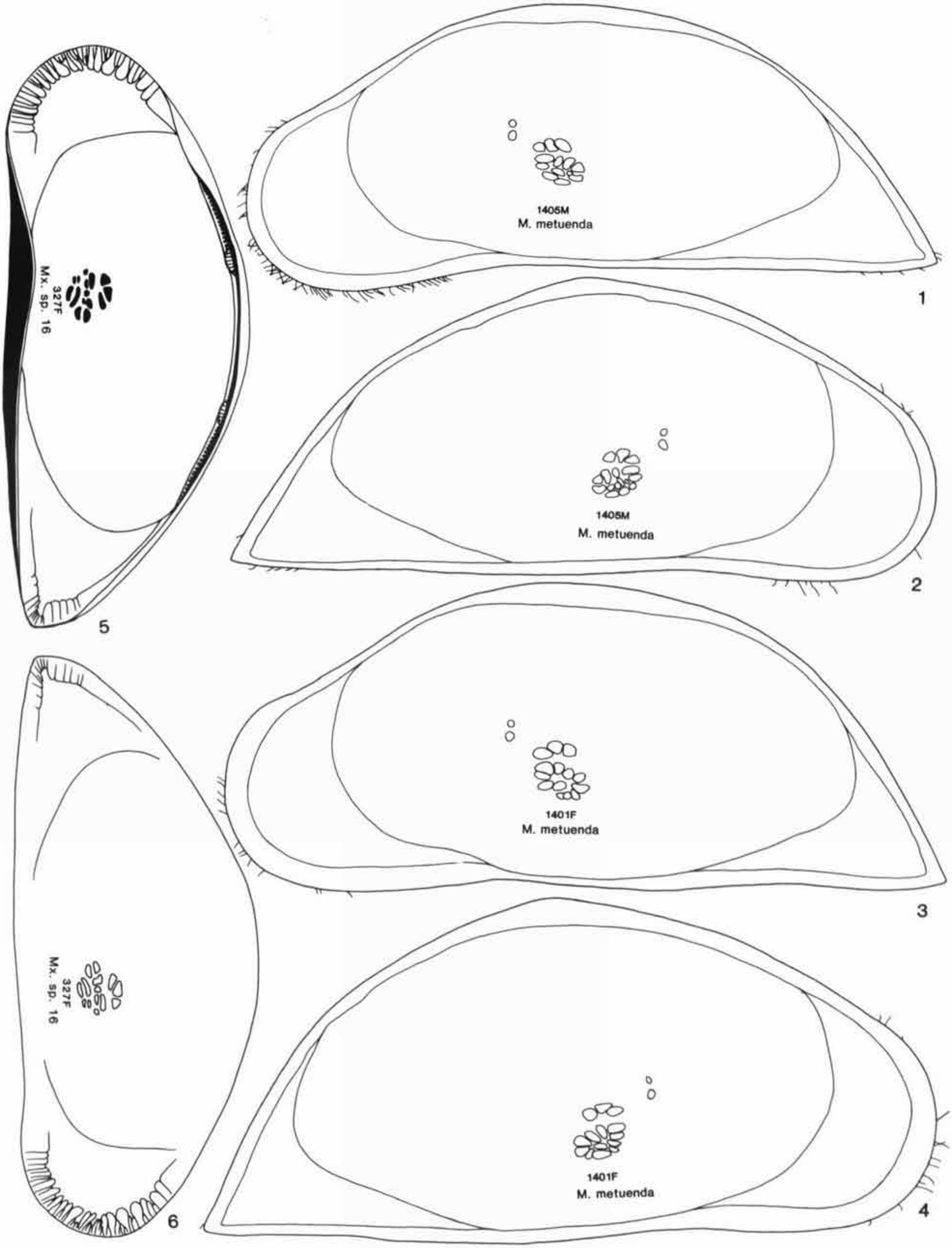
Figure 79

Maxillules of *Macrosarisa, Macroscapha,* and *Macrocyprina,* ×310 (except parts *1, 7, 8, 12, 13,* ×385; *9,* ×320).——*1. Macrocyprina barbara* n. sp., 2400M.——*2. Macroscapha inaequalis* (Müller), 1940M.——*3. Macroscapha turbida* (Müller), 1943M.——*4. Macrocyprina africana* (Müller), 1937M.——*5. Macrocyprina dispar* (Müller), 1932F.——*6,7. Macroscapha atlantica* n. sp., 1982M.——*8. Macrosarisa bensoni* n. sp., 1710F.——*9. Macrocyprina schmitti* (Tressler), 1538M.——*10–13. Macrosarisa hiulca* n. sp.; *10,12,* 2357F; *11,13,* 2356M.

Figure 80

Maxillule palps, without setae, ×385.——*1. Macrocypris maioris* n. sp., 1774M.——*2. Macrocypris miranda* n. sp., 1419M.——*3. Macropyxis* sp. 21, 1962F.——*4. Macropyxis amanda* n. sp., 1406M.——*5. Macropyxis kalbi* n. sp., 351M.——*6. Macropyxis similis* (Brady), 2382M.——*7. Macropyxis bathyalensis* n. sp., 2389M.——*8. Macropyxis kornickeri* n. sp., 2385M.——*9. Macropyxis* sp. 11, 1416F.——*10. Macropyxis adunca* n. sp., 1520M.——*11. Macropyxis audens* n. sp., 1444F.——*12. Macropyxis adrecta* n. sp., 1448M.——*13. Macropyxis arta* n. sp., 1456M.——*14. Macropyxis eltaninae* n. sp., 833F.——*15. Macropyxis antonbruunae* n. sp., 331M.——*16. Macropyxis labutisi* n. sp., 1351M.——*17. Macromckenziea* sp. 5, 1460F.——*18. Macromckenziea* sp. 19, 1495M.——*19. Macromckenziea* sp. 3, 1995M.——*20. Macromckenziea* sp. 6, 2319F.——*21. Macrosarisa* sp. 23, 1415M.——*22. Macrosarisa capacis* n. sp., 2361F.——*23. Macrosarisa* sp. 47, 127F.——*24. Macroscapha inaequata* n. sp., 714M.——*25. Macroscapha tensa* (Müller), 861M.——*26. Macroscapha sinuata* n. sp., 845M.——*27. Macroscapha* sp. 25, 198M.——*28. Macroscapha opaca* n. sp., 1479M.——*29. Macrocyprina madagascarensis* n. sp., 1757M.——*30. Macrocyprina hawkae* n. sp., 1817M.——*31. Macrocyprina moza* n. sp., 2365M.——*32. Macrocyprina skinneri* Kontrovitz, 1909M.——*33. Macrocyprina captiosa* n. sp., 2352F.——*34. Macrocyprina hartmanni* n. sp., 2132F.——*35. Macrocyprina bermudae* n. sp., 1759M.——*36. Macrocyprina hortuli* n. sp., 1762M.——*37. Macrocyprina succinea* (Müller), 1905M.

FIGURE 1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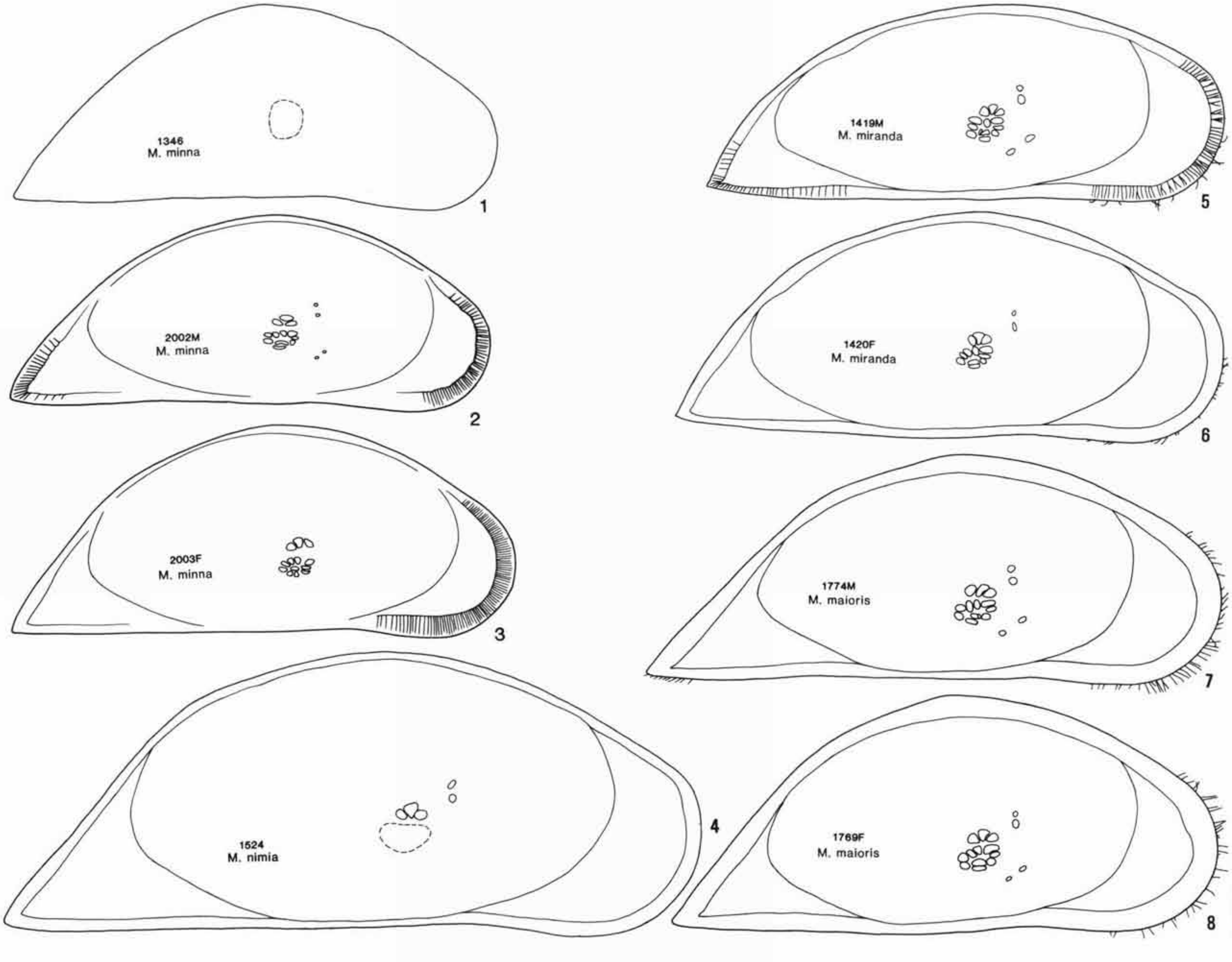
6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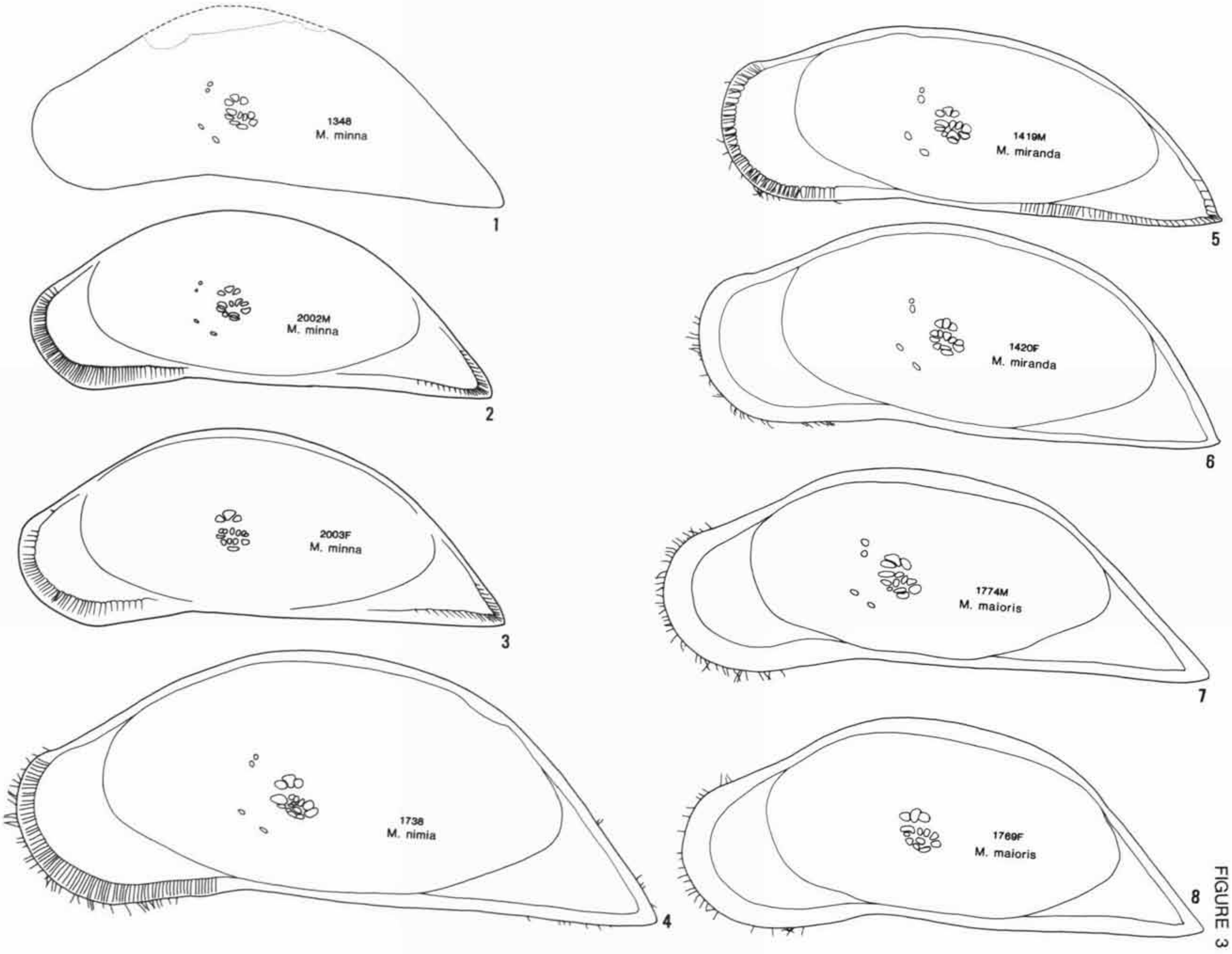
7
1769F
M. maioris
8

FIGURE 2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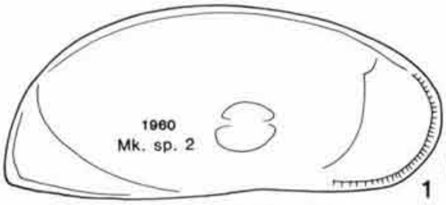
8

FIGURE 3

FIGURE 4



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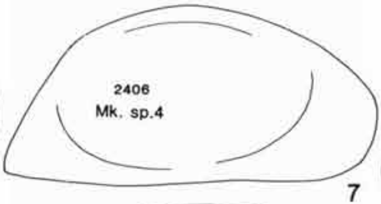
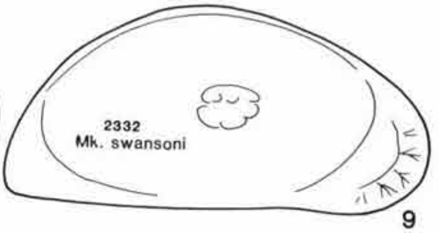


7



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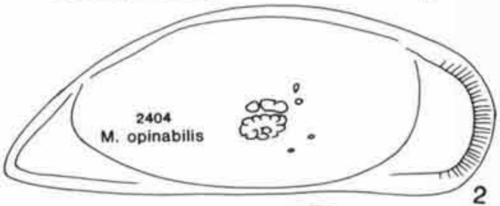

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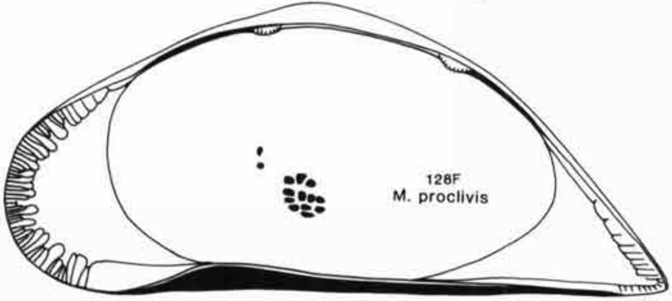

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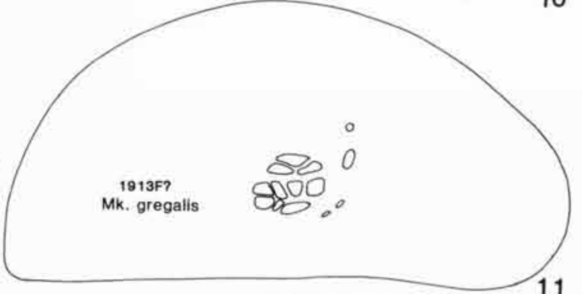

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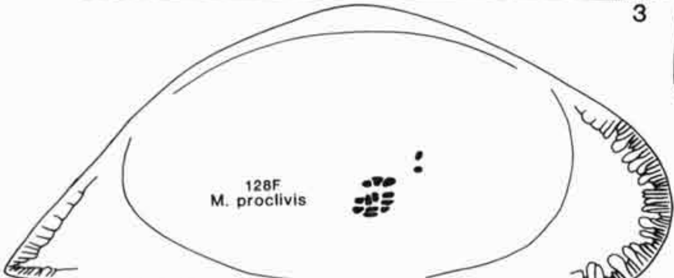

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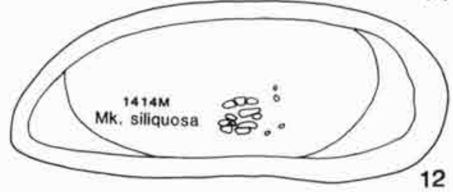

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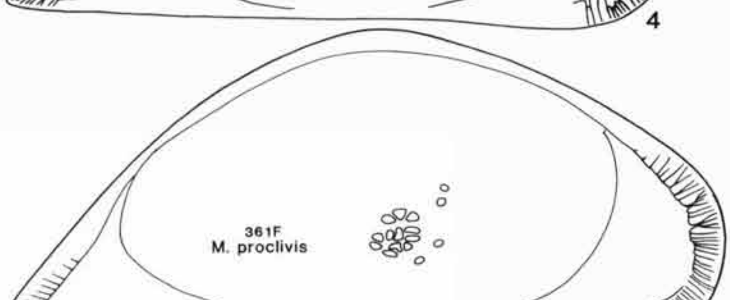

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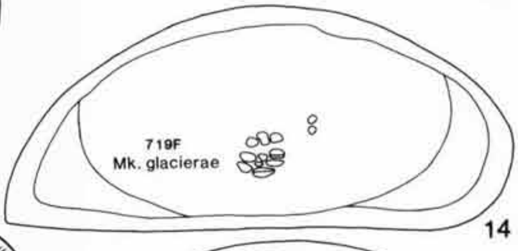

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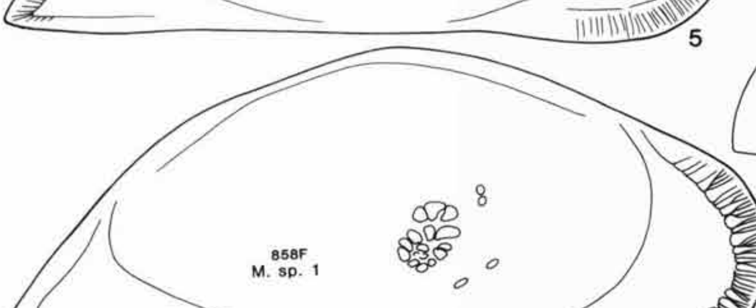

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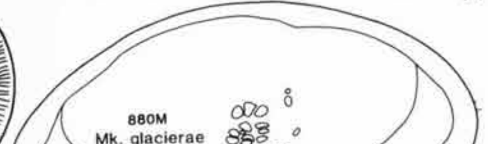


15

FIGURE 5

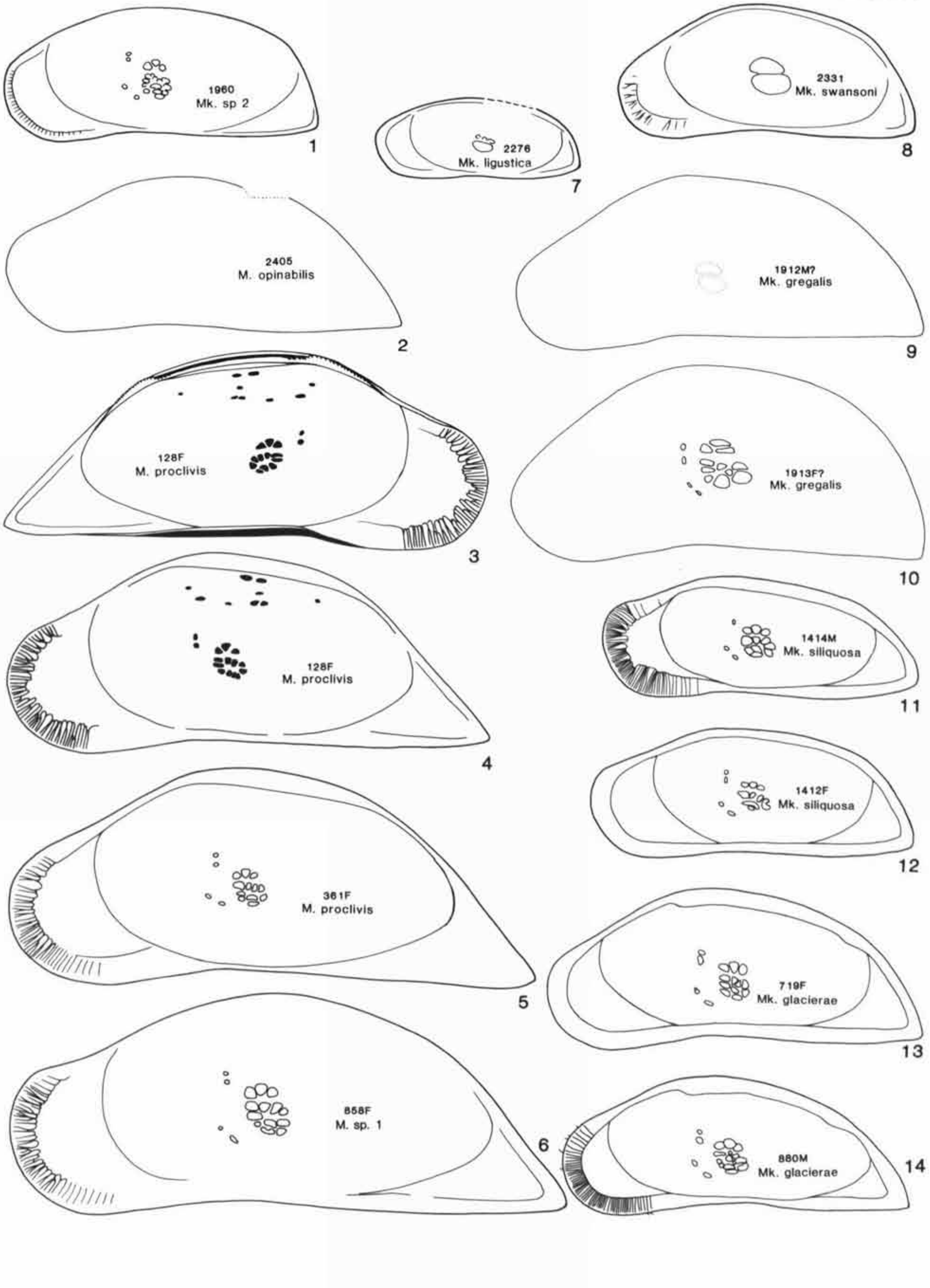

1960
Mk. sp 2
1
2276
Mk. ligustica
7
2331
Mk. swansoni
8
2405
M. opinabilis
2
1912M?
Mk. gregalis
9
128F
M. proclivis
3
1913F?
Mk. gregalis
10
128F
M. proclivis
4
1414M
Mk. siliquosa
11
1412F
Mk. siliquosa
12
361F
M. proclivis
5
719F
Mk. glacierae
13
858F
M. sp. 1
6
880M
Mk. glacierae
14

FIGURE 6

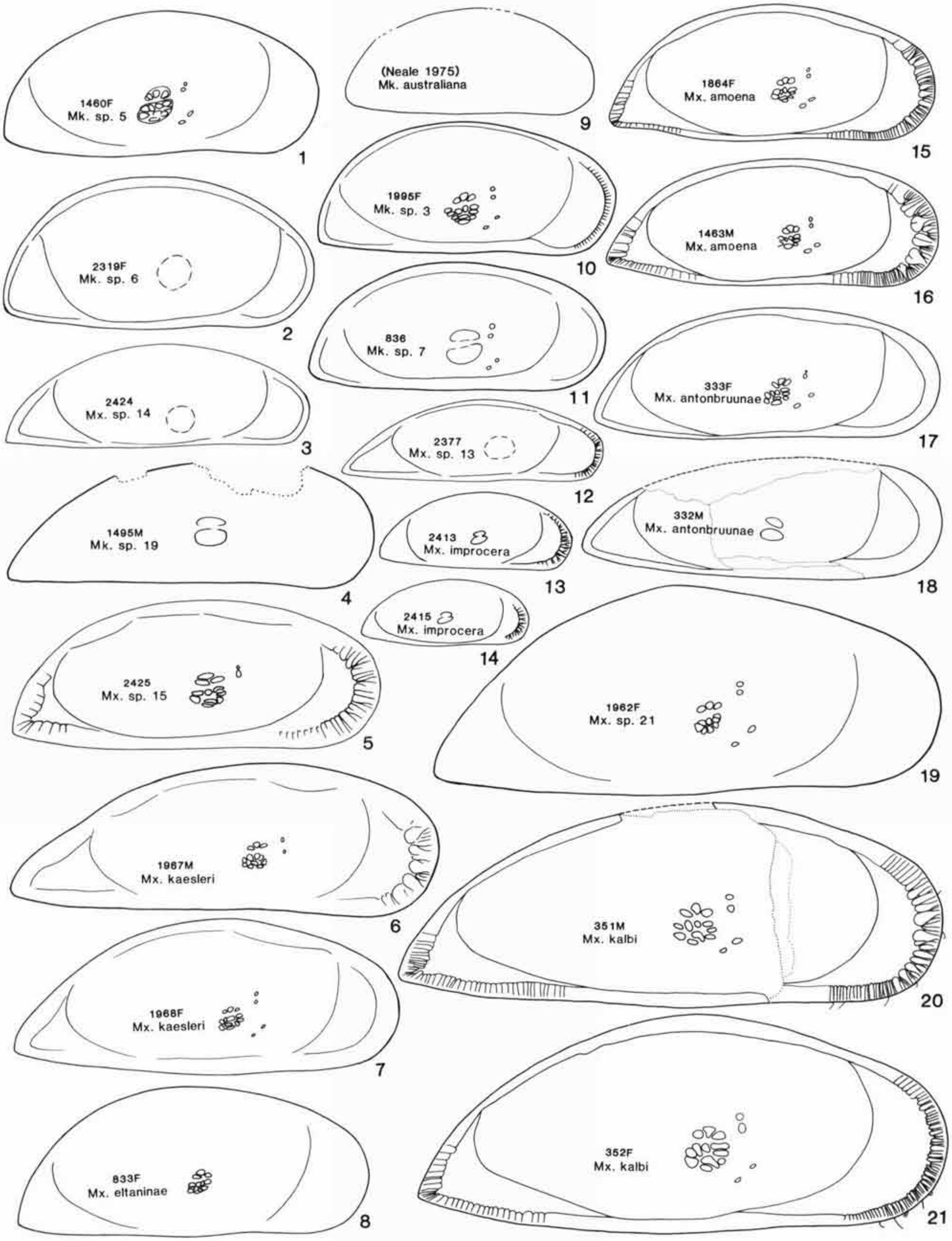

1460F
Mk. sp. 5
1
2319F
Mk. sp. 6
2
2424
Mx. sp. 14
3
1495M
Mk. sp. 19
4
2425
Mx. sp. 15
5
1967M
Mx. kaesleri
6
1968F
Mx. kaesleri
7
833F
Mx. eltaninae
8
(Neale 1975)
Mk. australiana
9
1995F
Mk. sp. 3
10
836
Mk. sp. 7
11
2377
Mx. sp. 13
12
2413
Mx. improcera
13
2415
Mx. improcera
14
1864F
Mx. amoena
15
1463M
Mx. amoena
16
333F
Mx. antonbruunae
17
332M
Mx. antonbruunae
18
1962F
Mx. sp. 21
19
351M
Mx. kalbi
20
352F
Mx. kalbi
21

FIGURE 7

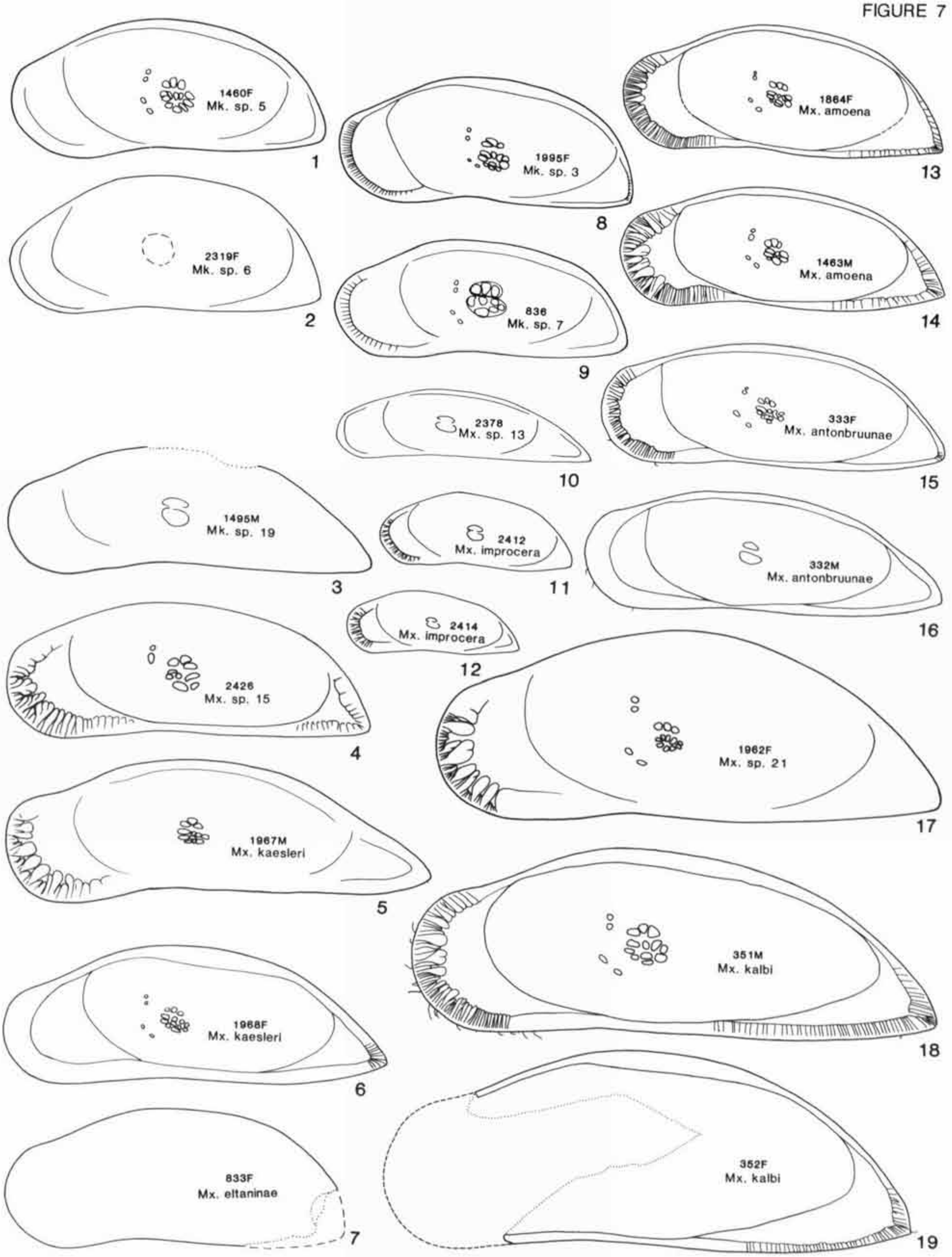

1460F
Mk. sp. 5
1
2319F
Mk. sp. 6
2
1495M
Mk. sp. 19
3
2426
Mx. sp. 15
4
1967M
Mx. kaesleri
5
1968F
Mx. kaesleri
6
833F
Mx. eltaninae
7
1995F
Mk. sp. 3
8
836
Mk. sp. 7
9
2378
Mx. sp. 13
10
2412
Mx. improcera
11
2414
Mx. improcera
12
1864F
Mx. amoena
13
1463M
Mx. amoena
14
333F
Mx. antonbruunae
15
332M
Mx. antonbruunae
16
1962F
Mx. sp. 21
17
351M
Mx. kalbi
18
352F
Mx. kalbi
19

FIGURE 8

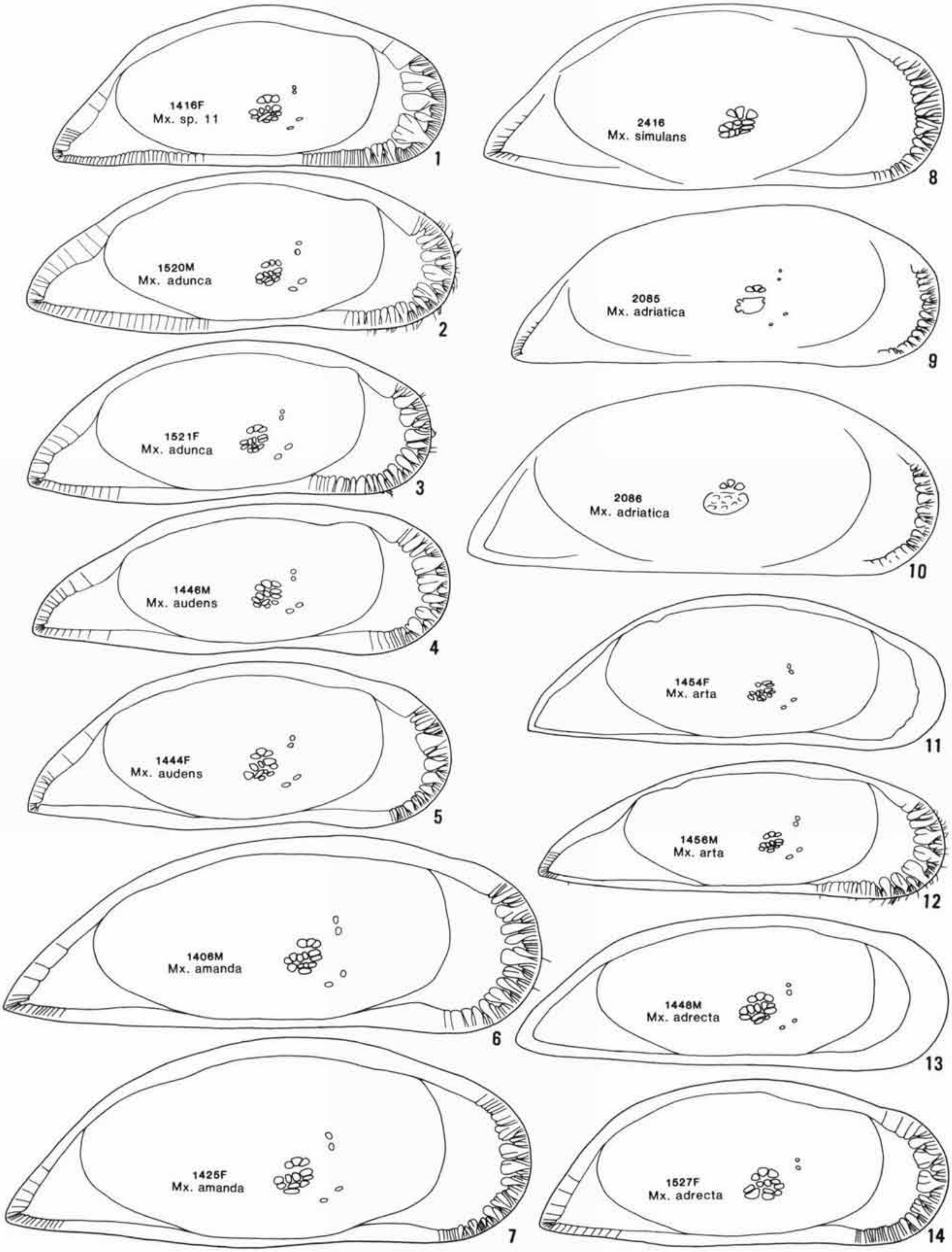
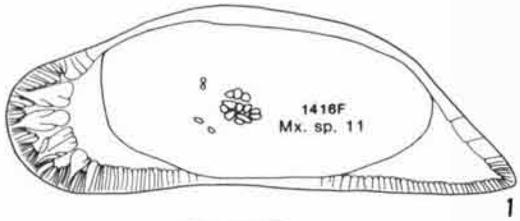
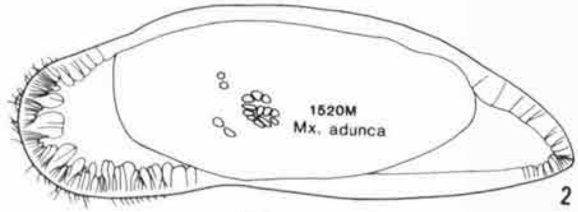

1416F
Mx. sp. 11
1
1520M
Mx. adunca
2
1521F
Mx. adunca
3
1446M
Mx. audens
4
1444F
Mx. audens
5
1406M
Mx. amanda
6
1425F
Mx. amanda
7
2416
Mx. simulans
8
2085
Mx. adriatica
9
2086
Mx. adriatica
10
1454F
Mx. arta
11
1456M
Mx. arta
12
1448M
Mx. adrecta
13
1527F
Mx. adrecta
14

FIGURE 9



1



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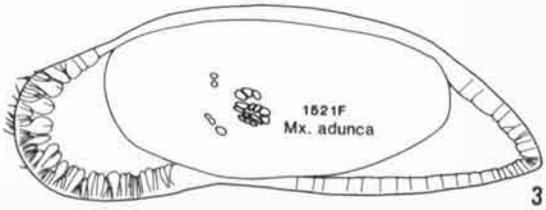

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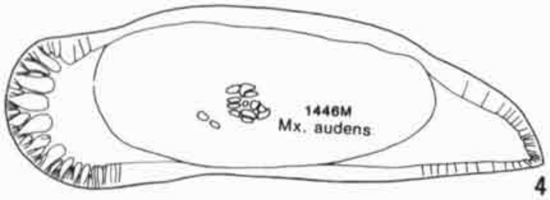
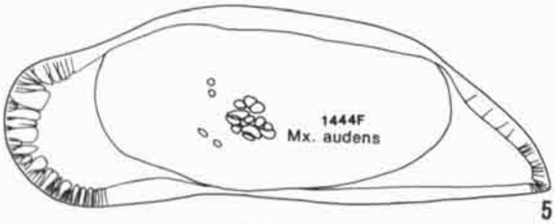
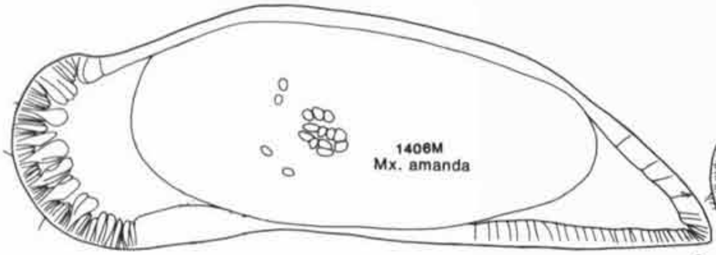


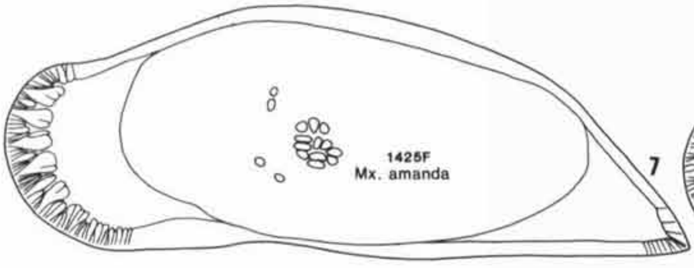
4



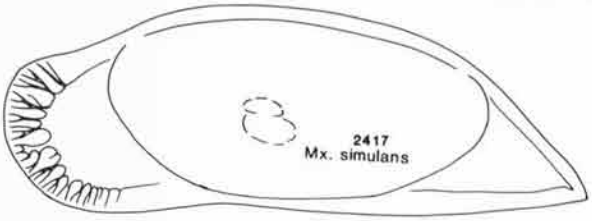
5



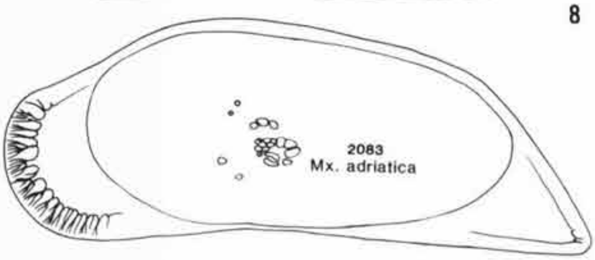
6



7



8



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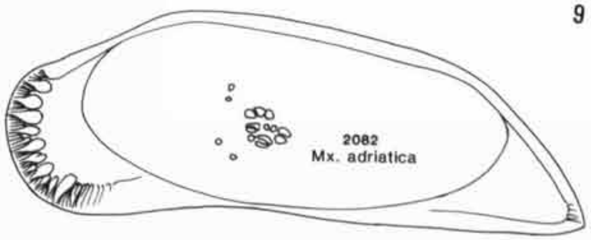

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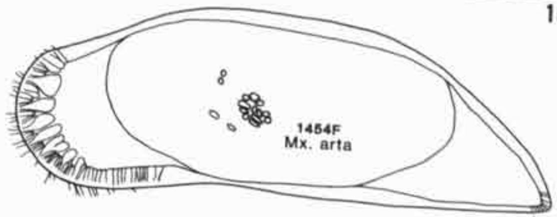
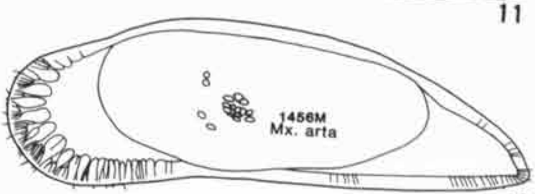
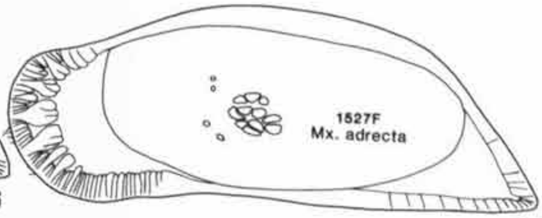


11



12



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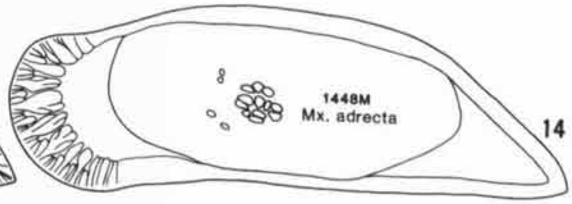


14

FIGURE 10

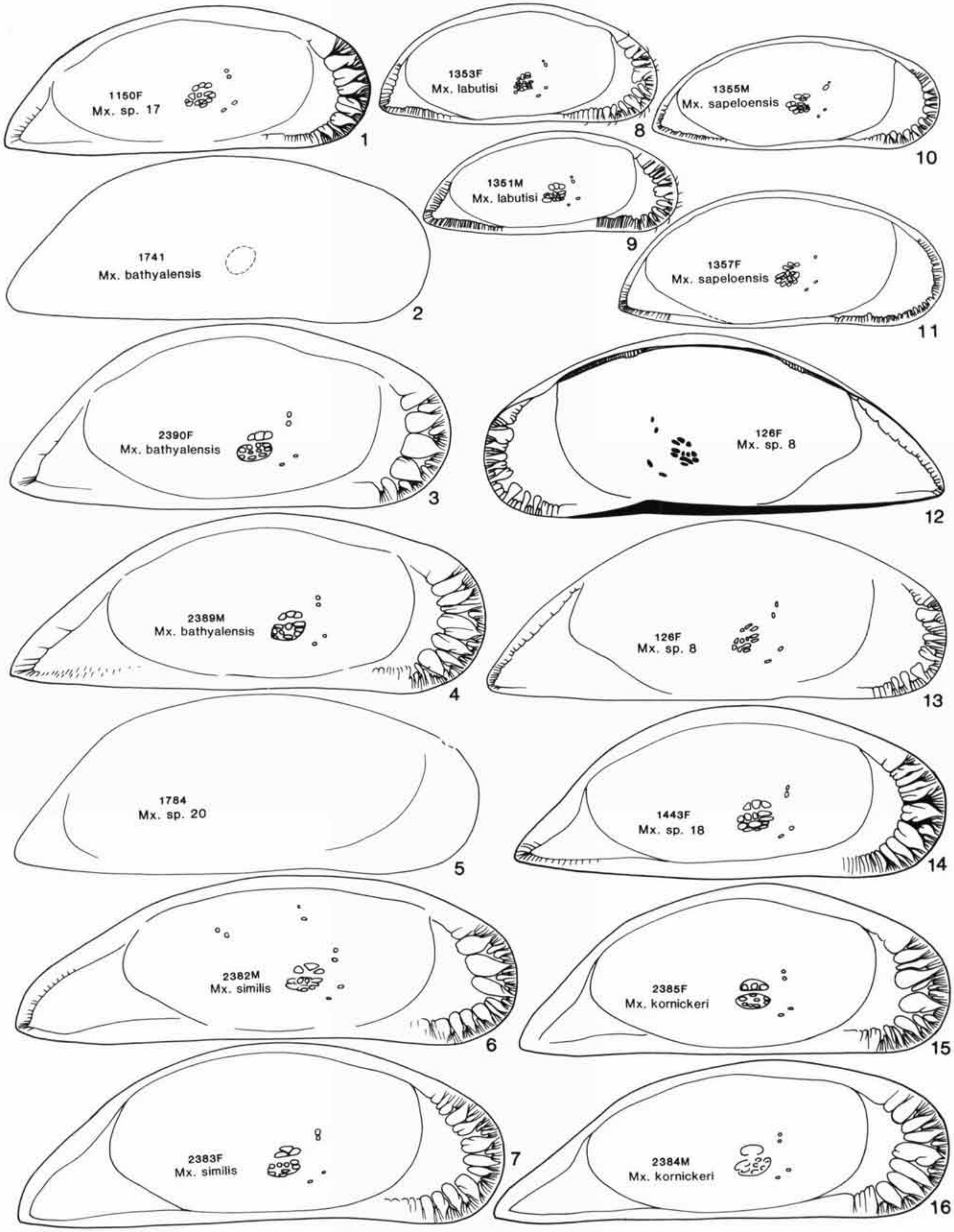

1150F
Mx. sp. 17
1
1741
Mx. bathyalensis
2
2390F
Mx. bathyalensis
3
2389M
Mx. bathyalensis
4
1784
Mx. sp. 20
5
2382M
Mx. similis
6
2383F
Mx. similis
7
1353F
Mx. labutisi
8
1351M
Mx. labutisi
9
1355M
Mx. sapeloensis
10
1357F
Mx. sapeloensis
11
126F
Mx. sp. 8
12
126F
Mx. sp. 8
13
1443F
Mx. sp. 18
14
2385F
Mx. kornickeri
15
2384M
Mx. kornickeri
16

FIGURE 11

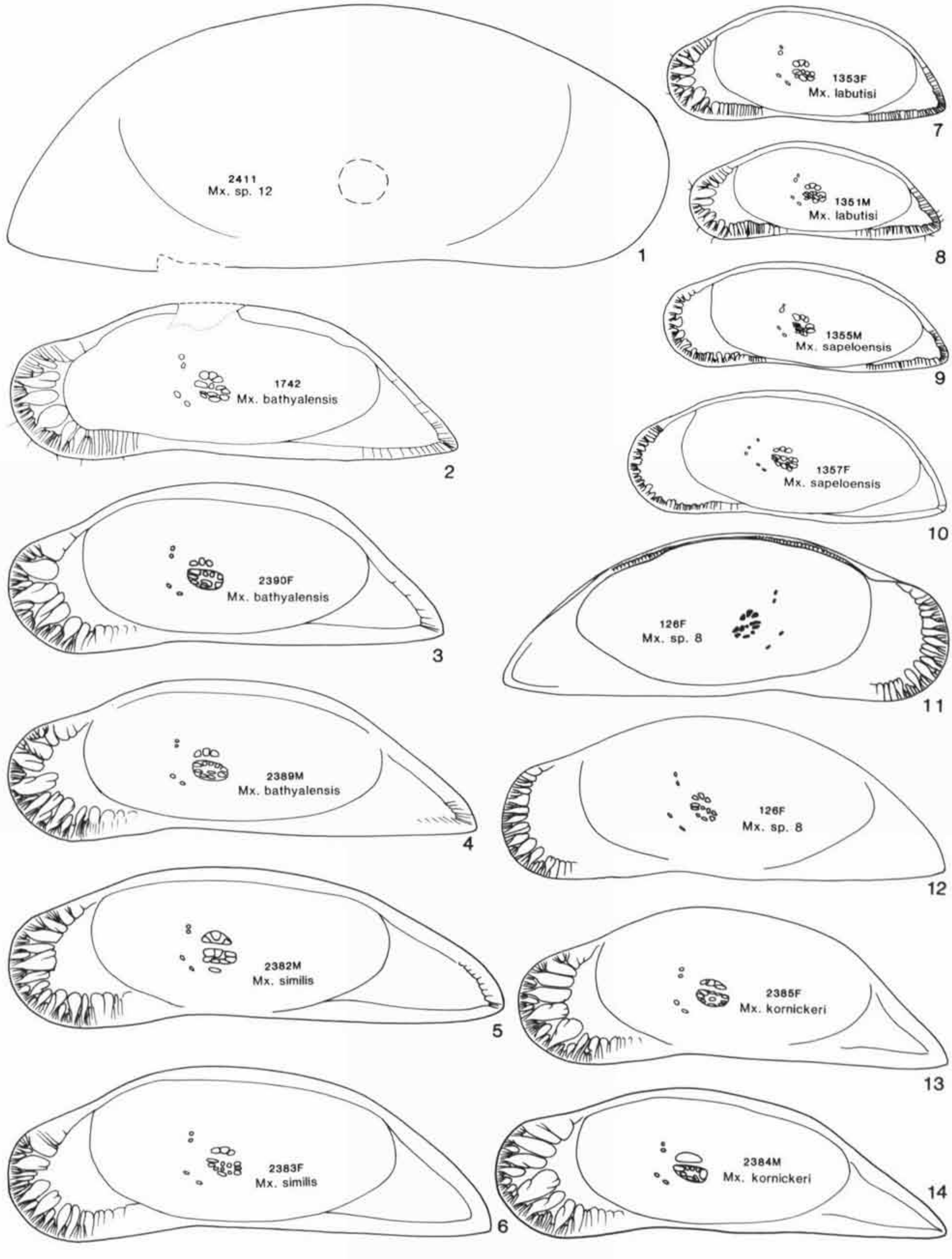

2411
Mx. sp. 12
1
1742
Mx. bathyalensis
2
2390F
Mx. bathyalensis
3
2389M
Mx. bathyalensis
4
2382M
Mx. similis
5
2383F
Mx. similis
6
1353F
Mx. labutisi
7
1351M
Mx. labutisi
8
1355M
Mx. sapeloensis
9
1357F
Mx. sapeloensis
10
126F
Mx. sp. 8
11
126F
Mx. sp. 8
12
2385F
Mx. kornickeri
13
2384M
Mx. kornickeri
14

FIGURE 12

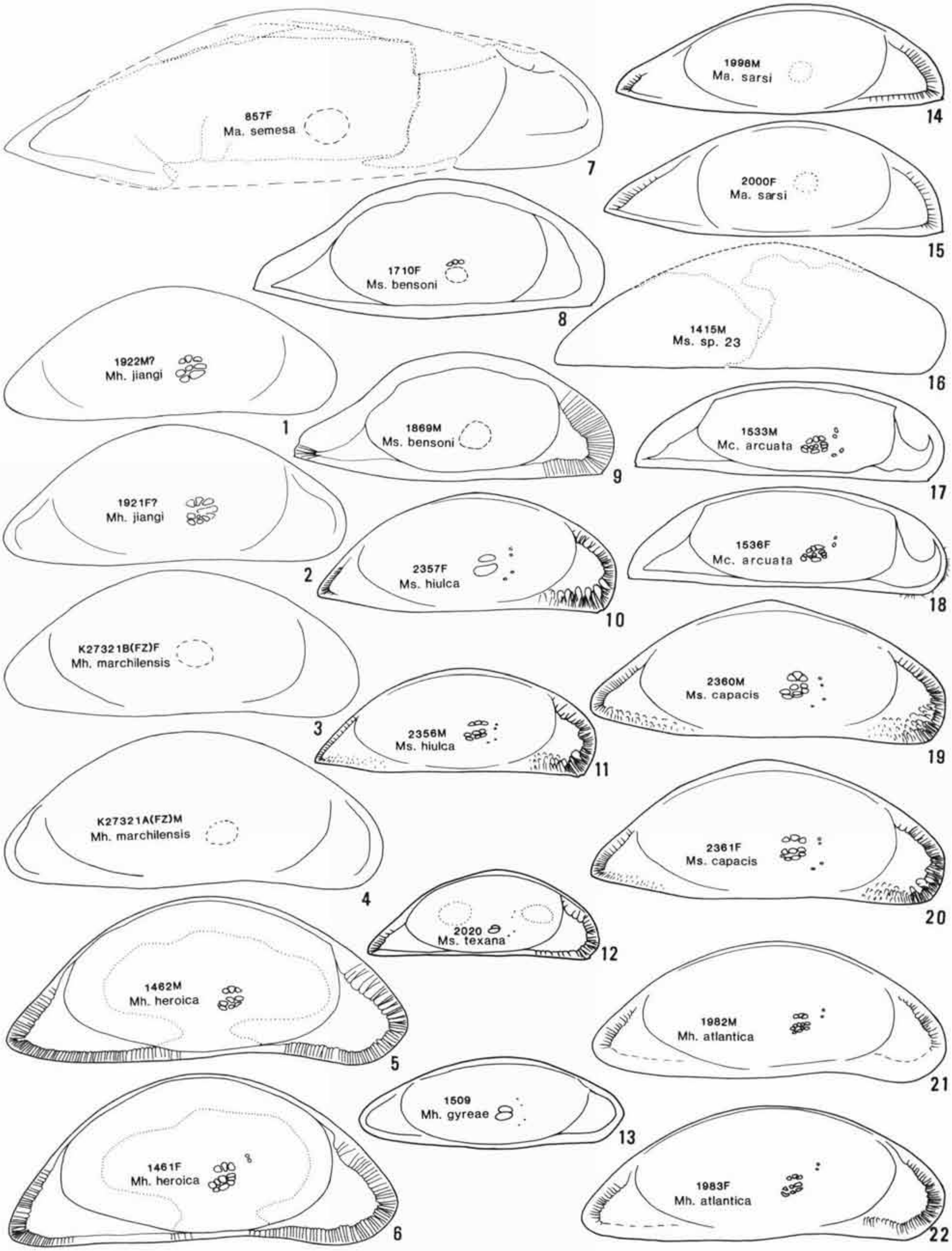
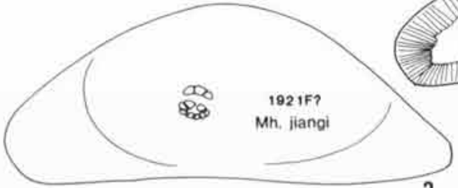

1922M?
Mh. jiangi
1
1921F?
Mh. jiangi
2
K27321B(FZ)F
Mh. marchilensis
3
K27321A(FZ)M
Mh. marchilensis
4
1462M
Mh. heroica
5
1461F
Mh. heroica
6
857F
Ma. semesa
7
1710F
Ms. bensoni
8
1869M
Ms. bensoni
9
2357F
Ms. hiulca
10
2356M
Ms. hiulca
11
2020
Ms. texana
12
1509
Mh. gyreae
13
1998M
Ma. sarsi
14
2000F
Ma. sarsi
15
1415M
Ms. sp. 23
16
1533M
Mc. arcuata
17
1536F
Mc. arcuata
18
2360M
Ms. capacis
19
2361F
Ms. capacis
20
1982M
Mh. atlantica
21
1983F
Mh. atlantica
22

FIGURE 13

1



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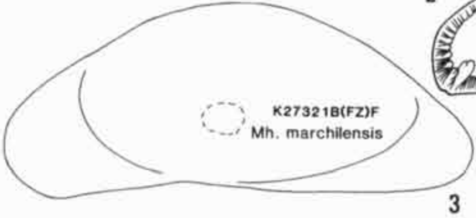

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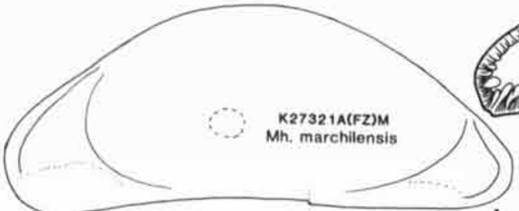
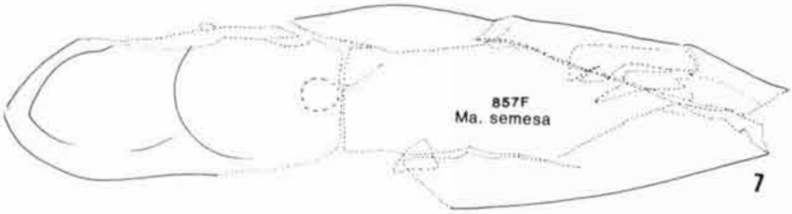


4

5

6



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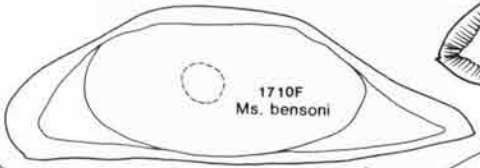

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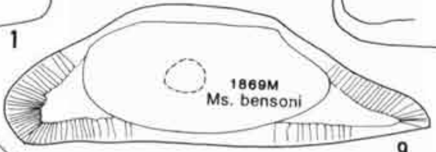
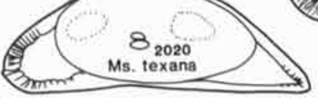


9

10

11



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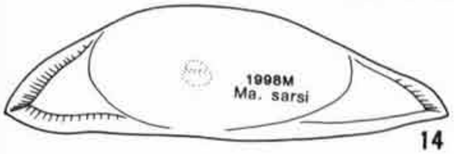
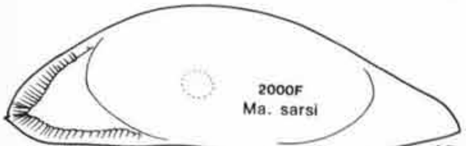
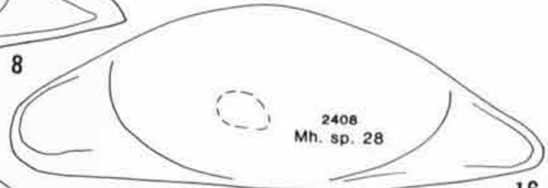
13



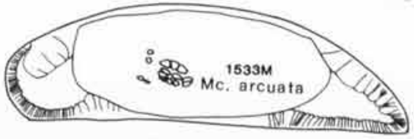
14



15



16



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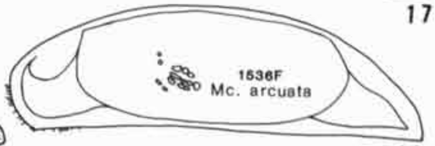

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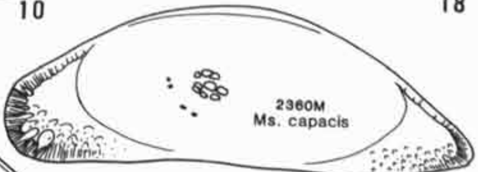
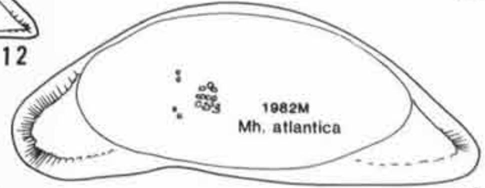


19

20



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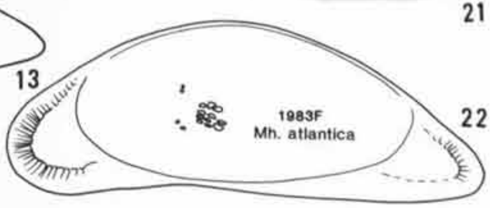


22

FIGURE 14

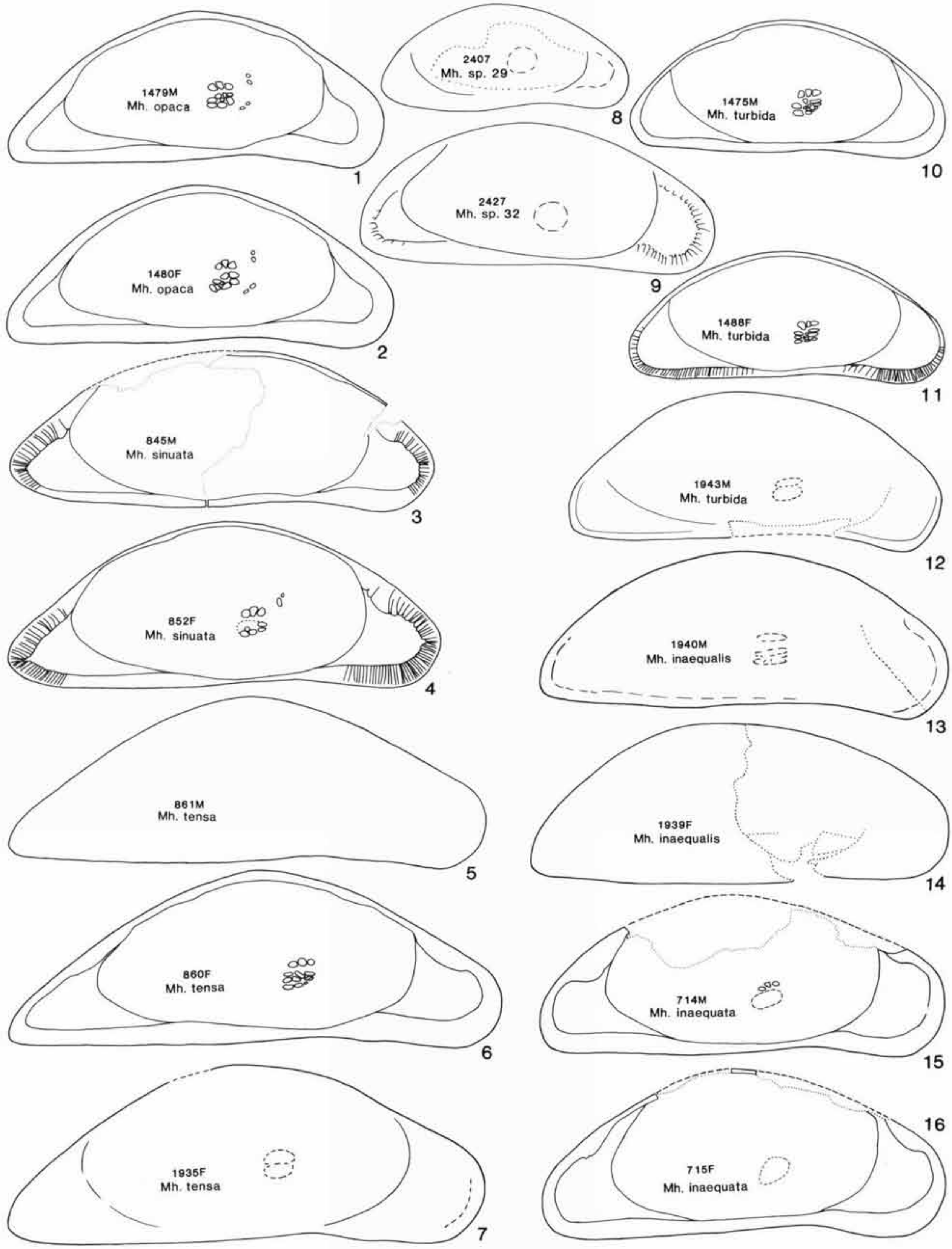
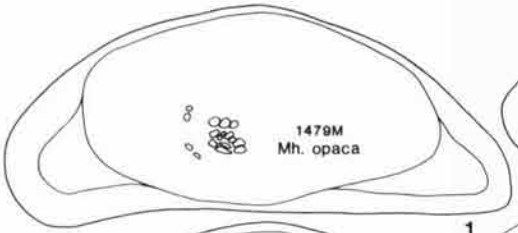
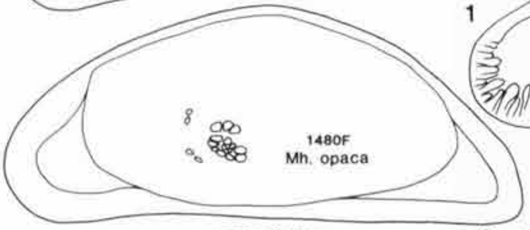

1479M
Mh. opaca
1
1480F
Mh. opaca
2
845M
Mh. sinuata
3
852F
Mh. sinuata
4
861M
Mh. tensa
5
860F
Mh. tensa
6
1935F
Mh. tensa
7
2407
Mh. sp. 29
8
2427
Mh. sp. 32
9
1475M
Mh. turbida
10
1488F
Mh. turbida
11
1943M
Mh. turbida
12
1940M
Mh. inaequalis
13
1939F
Mh. inaequalis
14
714M
Mh. inaequata
15
715F
Mh. inaequata
16

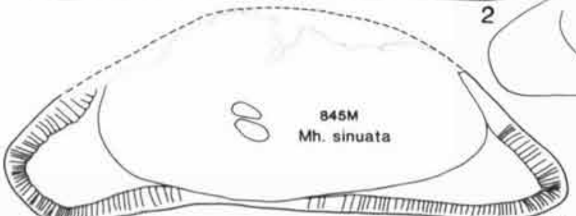
FIGURE 15



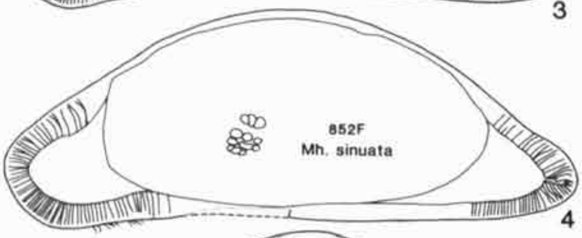
1



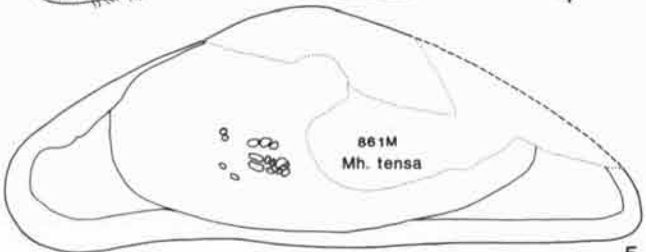
2



3



4



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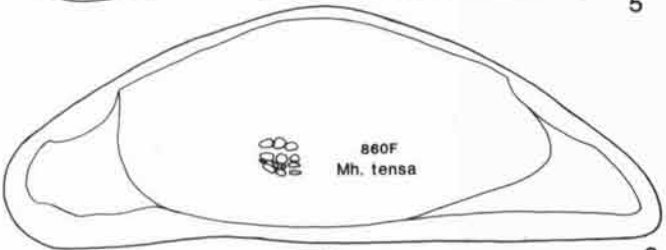
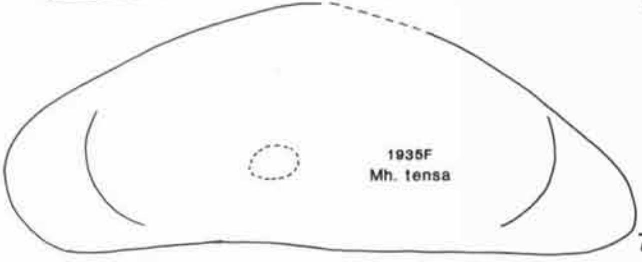
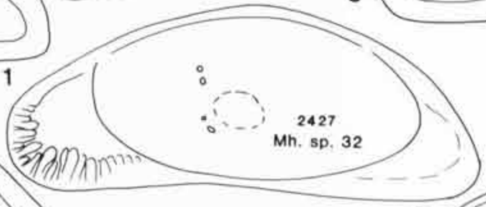


6



7

8



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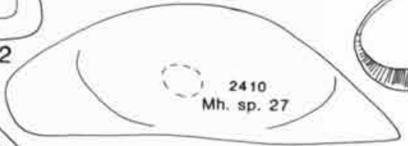

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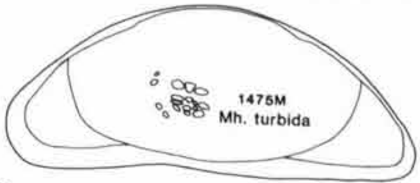

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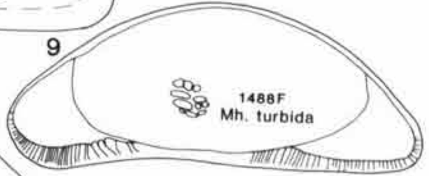

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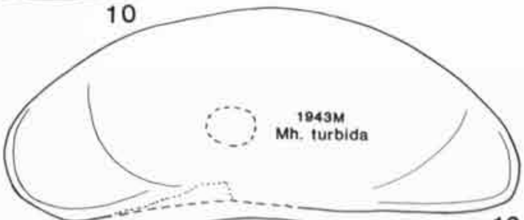

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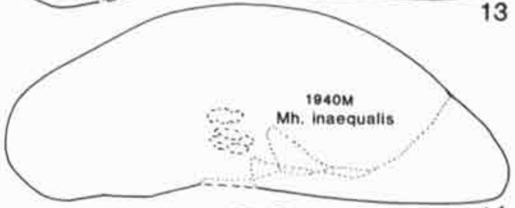

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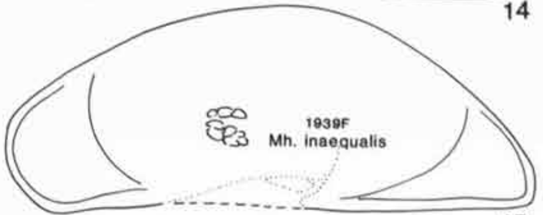

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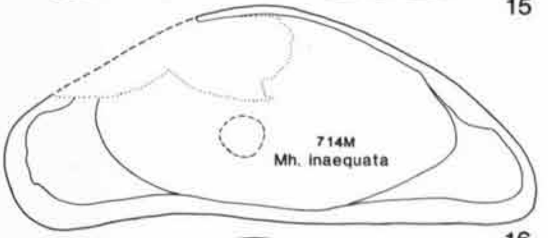

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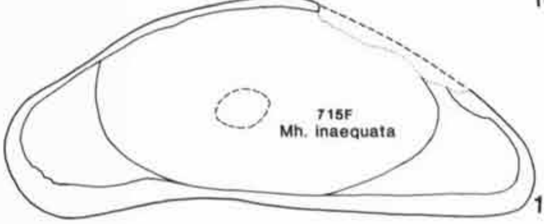
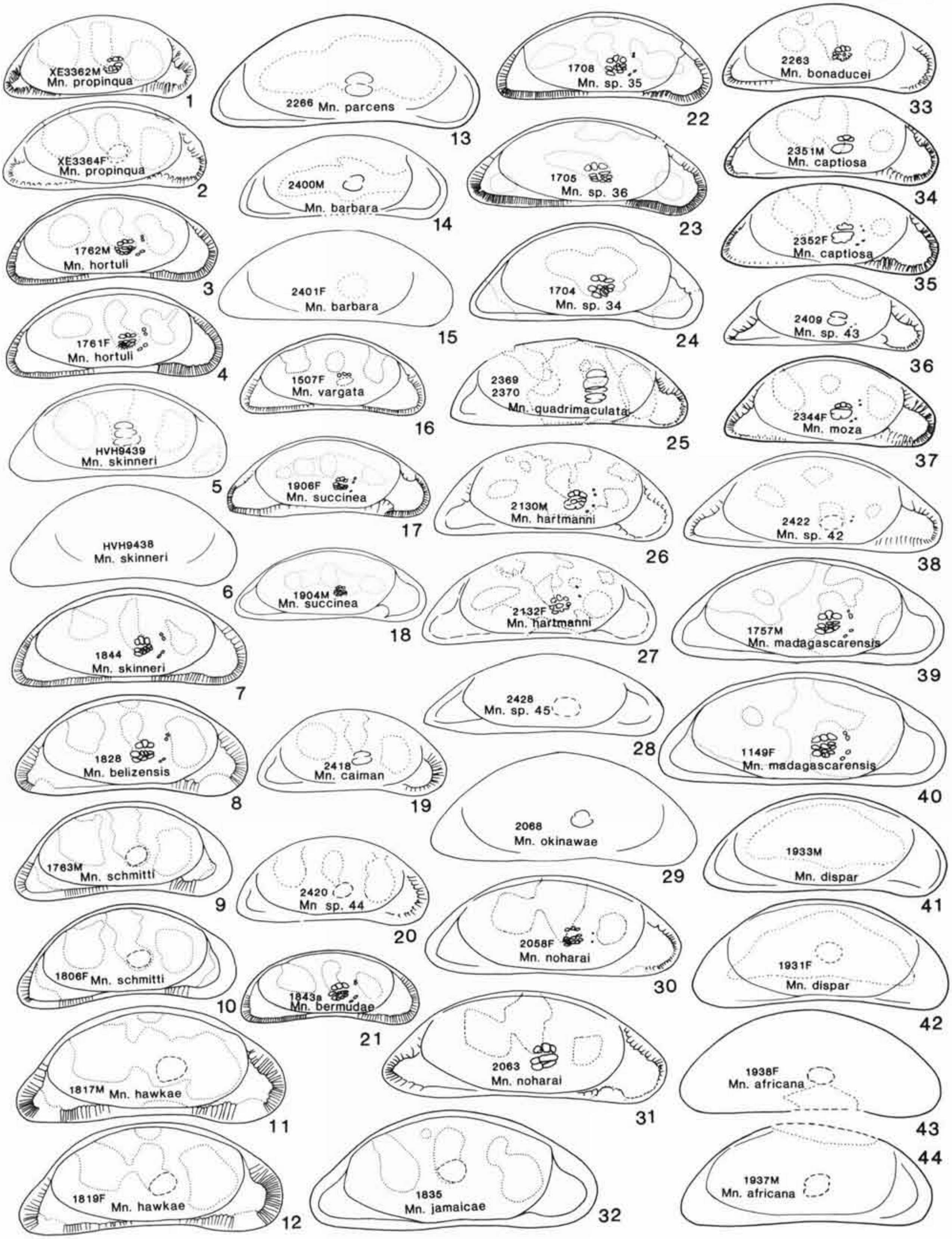


17

FIGURE 16



XE3362M Mn. propinqua
1
XE3364F Mn. propinqua
2
1762M Mn. hortuli
3
1761F Mn. hortuli
4
HVH9439 Mn. skinneri
5
HVH9438 Mn. skinneri
6
1844 Mn. skinneri
7
1828 Mn. belizensis
8
1763M Mn. schmitti
9
1806F Mn. schmitti
10
1817M Mn. hawkae
11
1819F Mn. hawkae
12
2266 Mn. parcens
13
2400M Mn. barbara
14
2401F Mn. barbara
15
1507F Mn. vargata
16
1906F Mn. succinea
17
1904M Mn. succinea
18
2418 Mn. caiman
19
2420 Mn sp. 44
20
1843a Mn. bermudae
21
1708 Mn. sp. 35
22
1705 Mn. sp. 36
23
1704 Mn. sp. 34
24
2369
2370
Mn. quadrimaculata
25
2130M Mn. hartmanni
26
2132F Mn. hartmanni
27
2428 Mn. sp. 45
28
2068 Mn. okinawae
29
2058F Mn. noharai
30
2063 Mn. noharai
31
1835 Mn. jamaicae
32
2263 Mn. bonaducei
33
2351M Mn. captiosa
34
2352F Mn. captiosa
35
2409 Mn. sp. 43
36
2344F Mn. moza
37
2422 Mn. sp. 42
38
1757M Mn. madagascarensis
39
1149F Mn. madagascarensis
40
1933M Mn. dispar
41
1931F Mn. dispar
42
1938F Mn. africana
43
1937M Mn. africana
44

FIGURE 17

XE3362M
Mn. propinqua
1
XE3364E
Mn. propinqua
2
Mn. hortuli 1762M
3
Mn. hortuli 1761F
4
1845
Mn. skinneri
5
HVH9437
Mn. skinneri
6
1829
Mn. belizensis
7
HVH9440
Mn. schmitti
8
1763M
Mn. schmitti
9
Mn. schmitti 1806F
10
1819F
Mn. hawkae
11
1817M
Mn. hawkae
12
2265
Mn. parcens
13
2400M
Mn. barbara
14
2401F
Mn. barbara
15
Mn. swaini 2285
16
1507F
Mn. vargata
17
1906F
Mn. succinea
18
1904M
Mn. succinea
19
2419
Mn. caiman
20
1843
Mn. bermudae
21
2429
Mn. sp. 45
22
1707
Mn. sp. 33
23
1513
Mn. sp. 34
24
2367
2368
Mn. quadrimaculata
25
2130M
Mn. hartmanni
26
2132F
Mn. hartmanni
27
2064
Mn. okinawae
28
2058F
Mn. noharai
29
1836
Mn. jamaicae
30
2421
Mn. sp. 41
31
2261
Mn. bonaducei
32
2351M
Mn. captiosa
33
2352F
Mn. captiosa
34
2409
Mn. sp. 43
35
2344F
Mn. moza
36
2422
Mn. sp. 42
37
1757M
Mn. madagascarensis
38
1149F
Mn. madagascarensis
39
1933M
Mn. dispar
40
1931F
Mn. dispar
41
1936F
Mn. africana
42

FIGURE 18

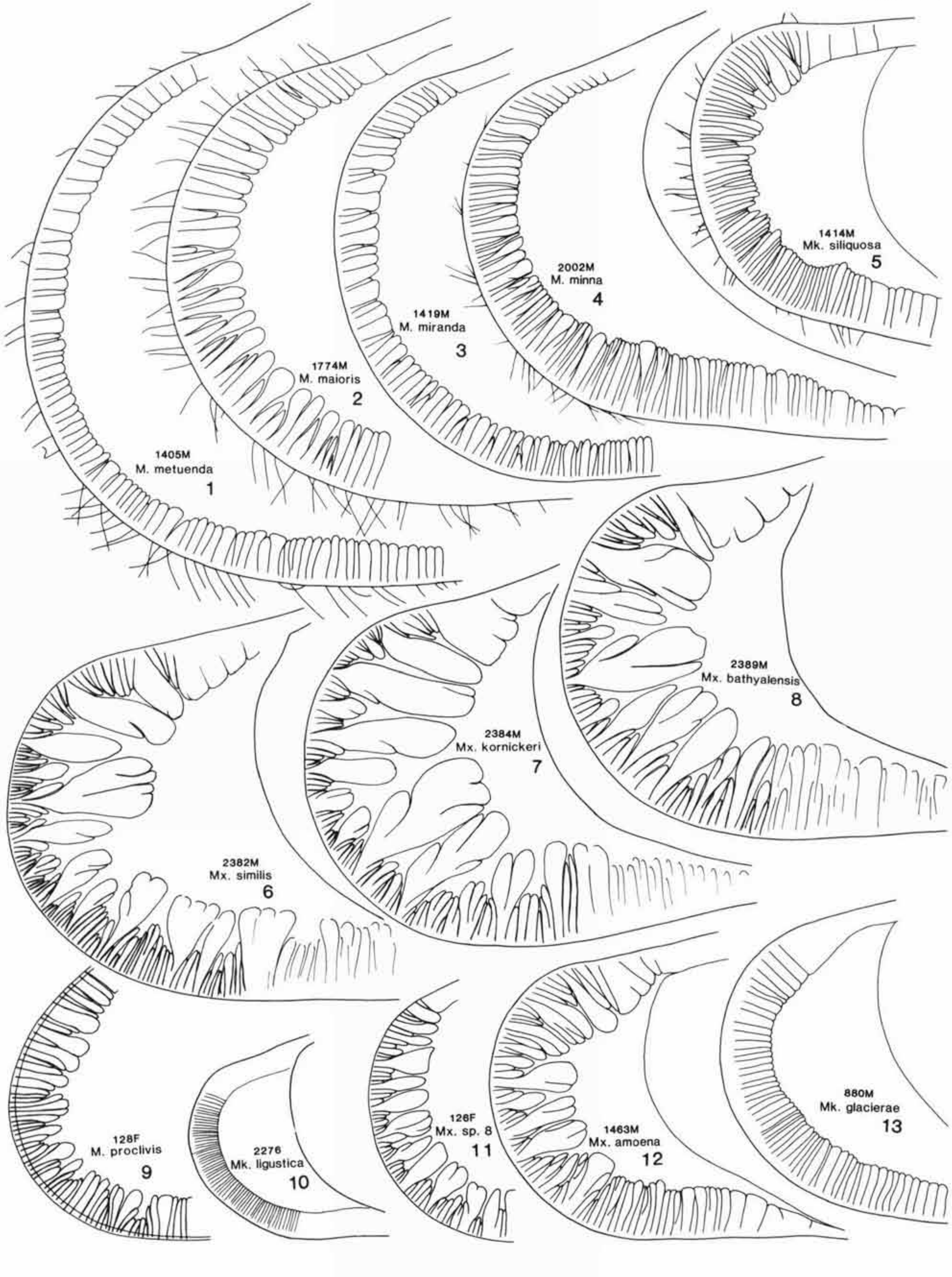

1405M
M. metuenda
1
1774M
M. maioris
2
1419M
M. miranda
3
2002M
M. minna
4
1414M
Mk. siliquosa
5
2382M
Mx. similis
6
2384M
Mx. kornickeri
7
2389M
Mx. bathyalensis
8
128F
M. proclivis
9
2276
Mk. ligustica
10
126F
Mx. sp. 8
11
1463M
Mx. amoena
12
880M
Mk. glacierae
13

FIGURE 19

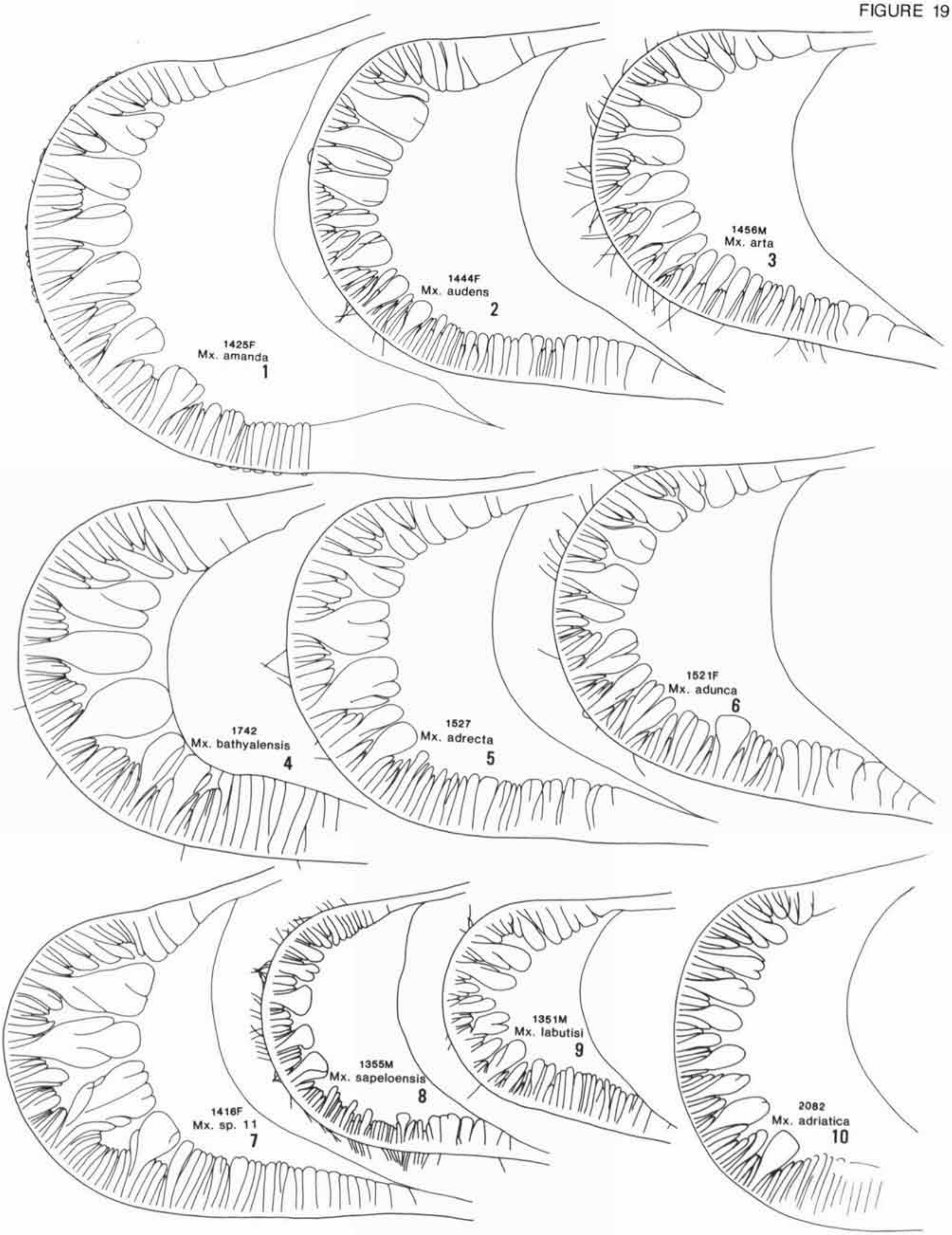

1425F
Mx. amanda
1
1444F
Mx. audens
2
1456M
Mx. arta
3
1742
Mx. bathyalensis
4
1527
Mx. adrecta
5
1521F
Mx. adunca
6
1416F
Mx. sp. 11
7
1355M
Mx. sapeloensis
8
1351M
Mx. labutisi
9
2082
Mx. adriatica
10

FIGURE 20

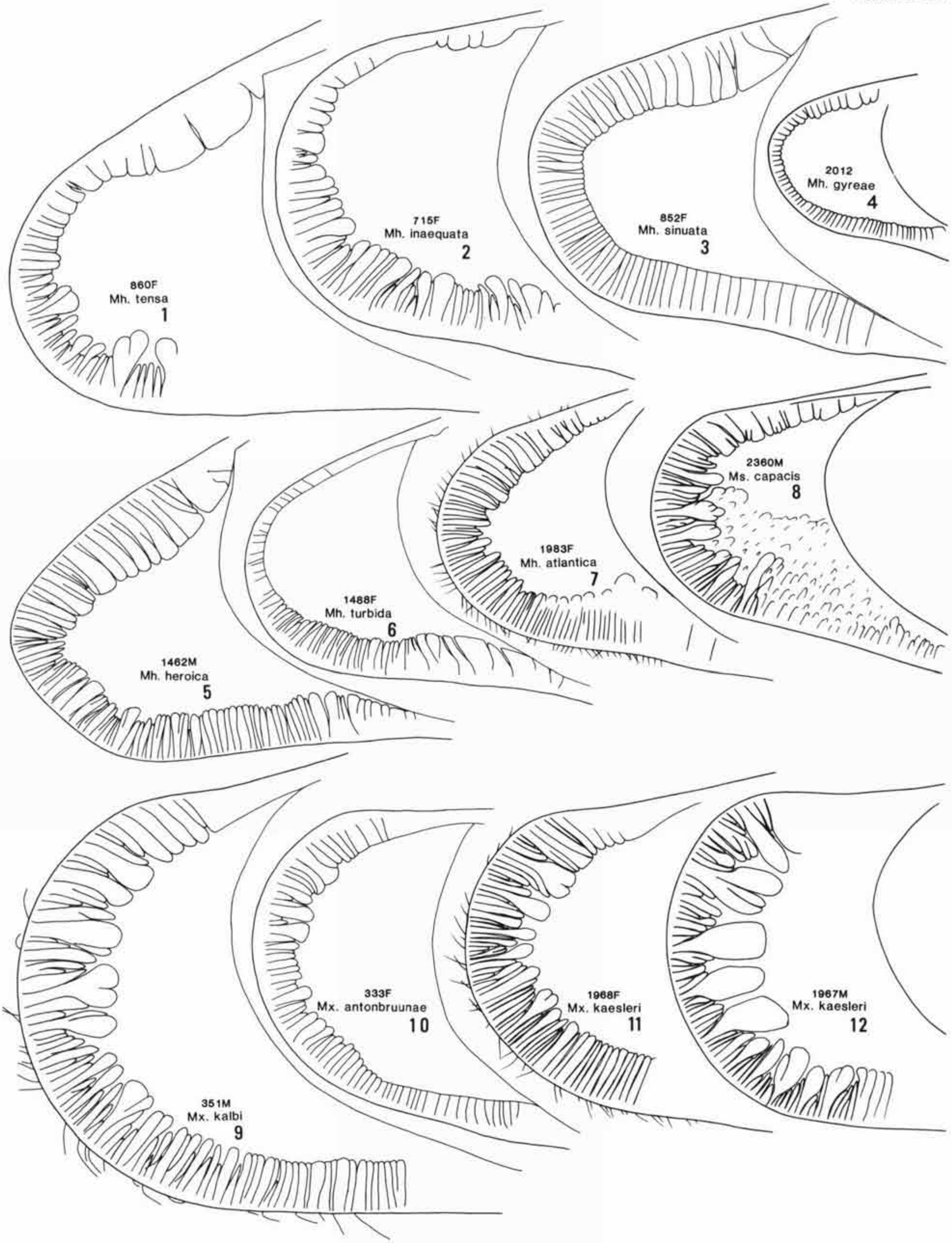

860F
Mh. tensa
1
715F
Mh. inaequata
2
852F
Mh. sinuata
3
2012
Mh. gyreae
4
1462M
Mh. heroica
5
1488F
Mh. turbida
6
1983F
Mh. atlantica
7
2360M
Ms. capacis
8
351M
Mx. kalbi
9
333F
Mx. antonbruunae
10
1968F
Mx. kaesleri
11
1967M
Mx. kaesleri
12

FIGURE 21

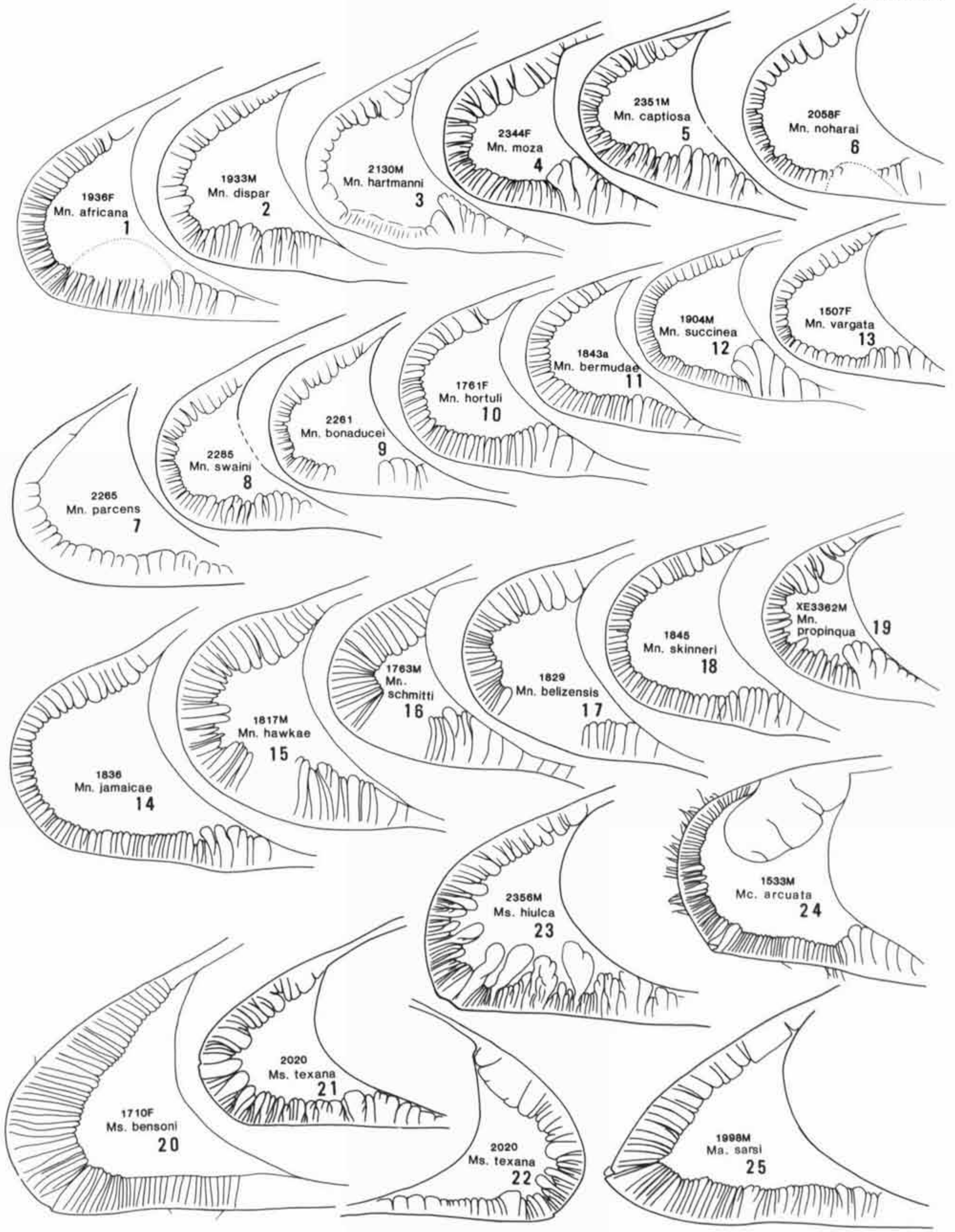

1936F
Mn. africana
1
1933M
Mn. dispar
2
2130M
Mn. hartmanni
3
2344F
Mn. moza
4
2351M
Mn. captiosa
5
2058F
Mn. noharai
6
2265
Mn. parcens
7
2285
Mn. swaini
8
2261
Mn. bonaducei
9
1761F
Mn. hortuli
10
1843a
Mn. bermudae
11
1904M
Mn. succinea
12
1507F
Mn. vargata
13
1836
Mn. jamaicae
14
1817M
Mn. hawkae
15
1763M
Mn.
schmitti
16
1829
Mn. belizensis
17
1845
Mn. skinneri
18
XE3362M
Mn.
propinqua
19
1710F
Ms. bensoni
20
2020
Ms. texana
21
2020
Ms. texana
22
2356M
Ms. hiulca
23
1533M
Mc. arcuata
24
1998M
Ma. sarsi
25

FIGURE 22

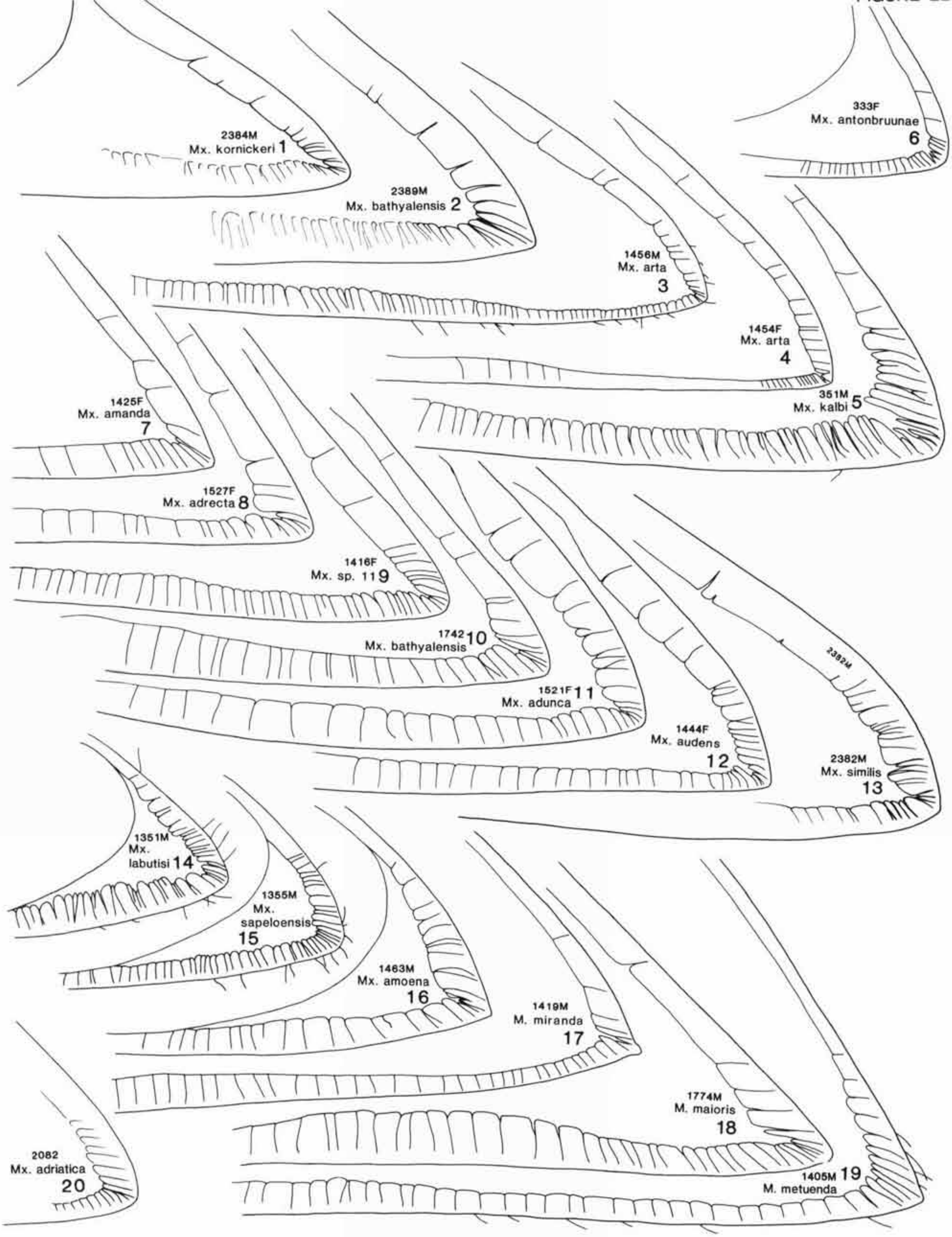

2384M
Mx. kornickeri 1
2389M
Mx. bathyalensis 2
1456M
Mx. arta
3
1454F
Mx. arta
4
351M
Mx. kalbi 5
333F
Mx. antonbruunae
6
1425F
Mx. amanda
7
1527F
Mx. adrecta 8
1416F
Mx. sp. 11 9
1742 10
Mx. bathyalensis
1521F 11
Mx. adunca
1444F
Mx. audens
12
2382M
2382M
Mx. similis
13
1351M
Mx.
labutisi 14
1355M
Mx.
sapeloensis
15
1463M
Mx. amoena
16
1419M
M. miranda
17
1774M
M. maioris
18
1405M 19
M. metuenda
2082
Mx. adriatica
20

FIGURE 23

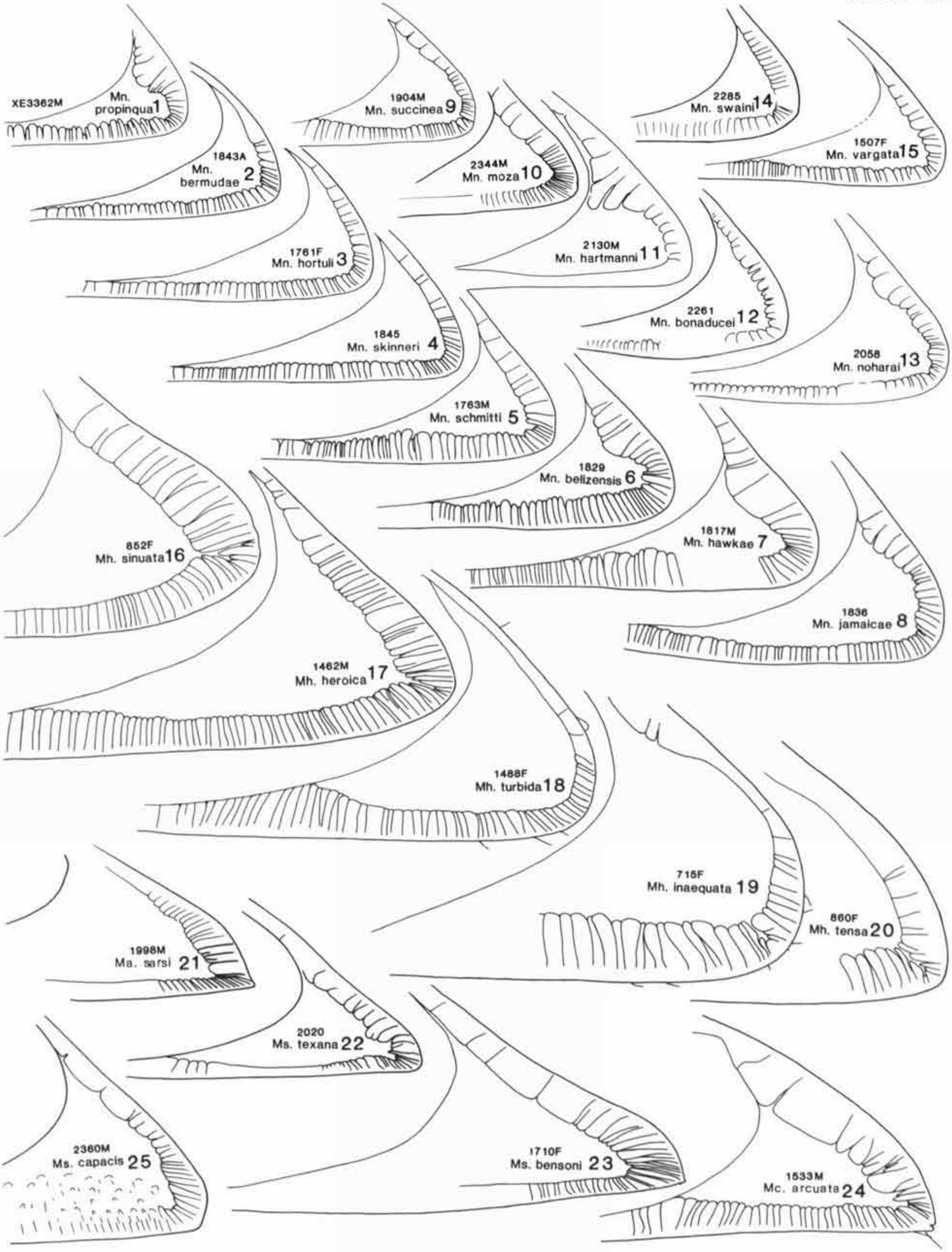

XE3362M
Mn. propinqua 1
1843A
Mn. bermudae 2
1761F
Mn. hortuli 3
1845
Mn. skinneri 4
1763M
Mn. schmitti 5
1829
Mn. belizensis 6
1817M
Mn. hawkae 7
1836
Mn. jamaicae 8
1904M
Mn. succinea 9
2344M
Mn. moza 10
2130M
Mn. hartmanni 11
2261
Mn. bonaducei 12
2058
Mn. noharai 13
2285
Mn. swaini 14
1507F
Mn. vargata 15
852F
Mh. sinuata 16
1462M
Mh. heroica 17
1488F
Mh. turbida 18
715F
Mh. inaequata 19
860F
Mh. tensa 20
1998M
Ma. sarsi 21
2020
Ms. texana 22
1710F
Ms. bensoni 23
1533M
Mc. arcuata 24
2360M
Ms. capacis 25

FIGURE 24

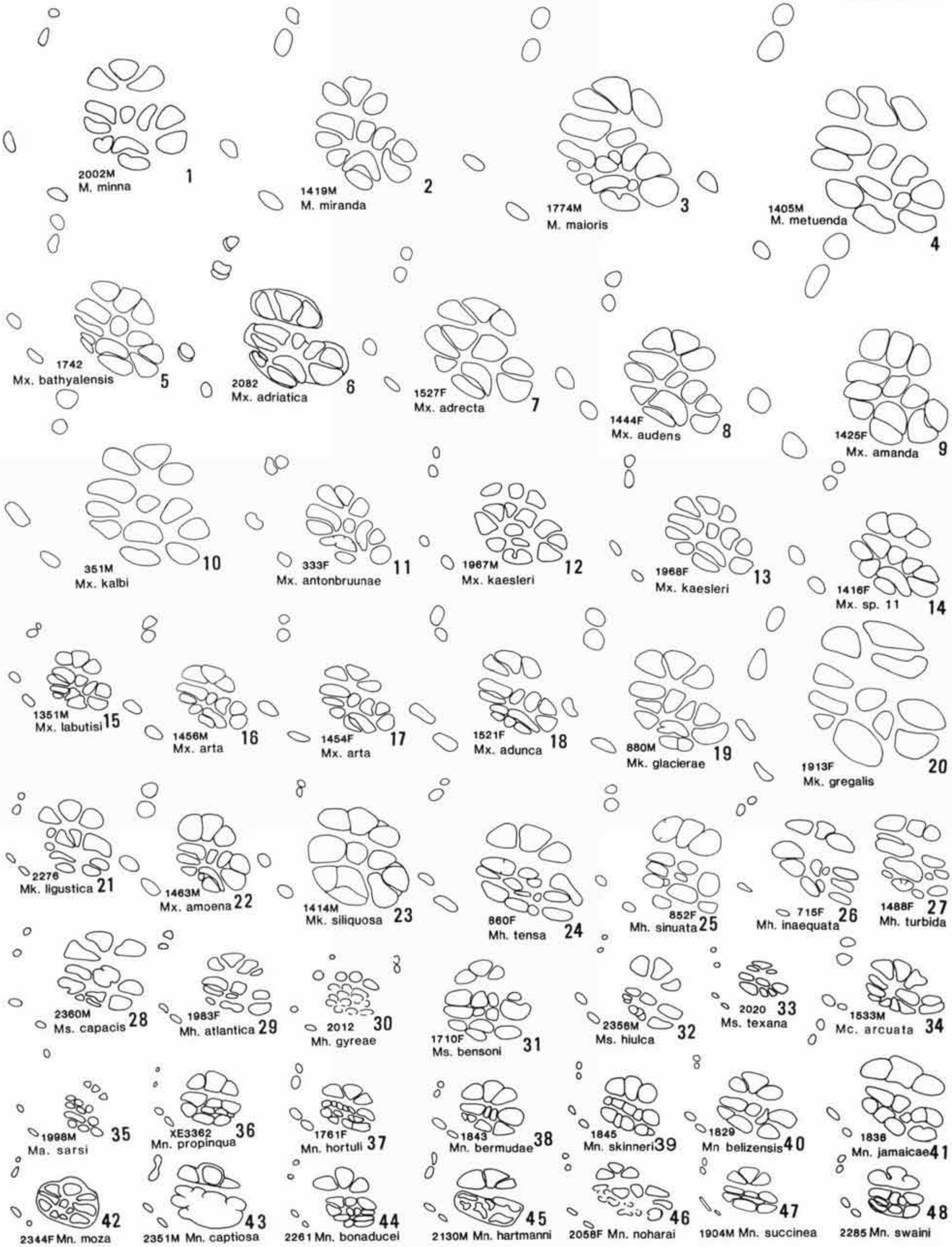

2002M
M. minna
1
1419M
M. miranda
2
1774M
M. maioris
3
1405M
M. metuenda
4
1742
Mx. bathyalensis
5
2082
Mx. adriatica
6
1527F
Mx. adrecta
7
1444F
Mx. audens
8
1425F
Mx. amanda
9
351M
Mx. kalbi
10
333F
Mx. antonbruunae
11
1967M
Mx. kaesleri
12
1968F
Mx. kaesleri
13
1416F
Mx. sp. 11
14
1351M
Mx. labutisi
15
1456M
Mx. arta
16
1454F
Mx. arta
17
1521F
Mx. adunca
18
880M
Mk. glacierae
19
1913F
Mk. gregalis
20
2276
Mk. ligustica
21
1463M
Mx. amoena
22
1414M
Mk. siliquosa
23
860F
Mh. tensa
24
852F
Mh. sinuata
25
715F
Mh. inaequata
26
1488F
27
Mh. turbida
2360M
Ms. capacis
28
1983F
Mh. atlantica
29
2012
30
Mh. gyreae
1710F
Ms. bensoni
31
2356M
Ms. hiulca
32
2020
33
Ms. texana
1533M
Mc. arcuata
34
1998M
35
Ma. sarsi
XE3362
36
Mn. propinqua
1761F
Mn. hortuli
37
1843
Mn. bermudae
38
1845
Mn. skinneri
39
1829
Mn belizensis
40
1836
Mn. jamaicae
41
42
2344F Mn. moza
43
2351M Mn. captiosa
44
2261 Mn. bonaducei
45
2130M Mn. hartmanni
46
2058F Mn. noharai
47
1904M Mn. succinea
48
2285 Mn. swaini

FIGURE 25


1
2002M
M. minna
2
2002M
M. minna
3
1774M
M. maioris
4
1774M
M. maioris
5
1410M
Mk. siliquosa
6
1410M
Mk. siliquosa
7
880M
Mk. glacierae
8
880M
Mk. glacierae
9
1463M
Mx. amoena
10
1463M
Mx. amoena
11
1419M
M. miranda
12
1419M
M. miranda
13
1405M
M. metuenda
14
1405M
M. metuenda

FIGURE 26

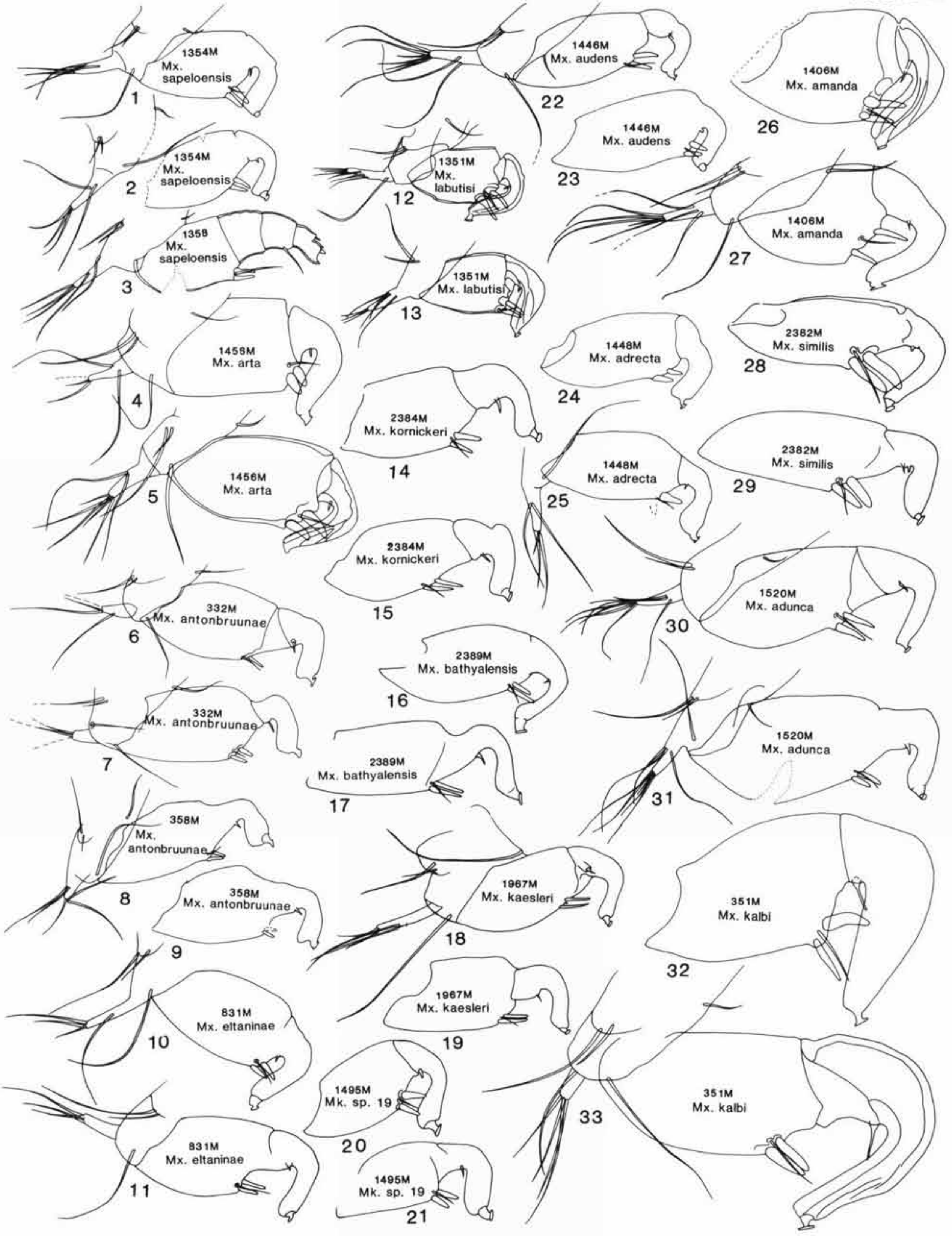

1
1354M
Mx.
sapeloensis
2
1354M
Mx.
sapeloensis
3
1358
Mx.
sapeloensis
4
1456M
Mx. arta
5
1456M
Mx. arta
6
332M
Mx. antonbruunae
7
332M
Mx. antonbruunae
8
358M
Mx.
antonbruunae
9
358M
Mx. antonbruunae
10
831M
Mx. eltaninae
11
831M
Mx. eltaninae
12
1351M
Mx.
labutisi
13
1351M
Mx. labutisi
14
2384M
Mx. kornickeri
15
2384M
Mx. kornickeri
16
2389M
Mx. bathyalensis
17
2389M
Mx. bathyalensis
18
1967M
Mx. kaesleri
19
1967M
Mx. kaesleri
20
1495M
Mk. sp. 19
21
1495M
Mk. sp. 19
22
1446M
Mx. audens
23
1446M
Mx. audens
24
1448M
Mx. adrecta
25
1448M
Mx. adrecta
26
1406M
Mx. amanda
27
1406M
Mx. amanda
28
2382M
Mx. similis
29
2382M
Mx. similis
30
1520M
Mx. adunca
31
1520M
Mx. adunca
32
351M
Mx. kalbi
33
351M
Mx. kalbi

FIGURE 27


1
K27321(GL)M
Mh. marchilensis
2
1462M
Mh. heroica
3
1462M
Mh. heroica
4
845M
Mh. sinuata
5
845M
Mh. sinuata
6
1475M
Mh. turbida
7
1475M
Mh. turbida
8
1943M
Mh. turbida
9
1943M
Mh. turbida
10
714M
Mh. inaequata
11
714M
Mh. inaequata
12
1982M
Mh. atlantica
13
1982M
Mh. atlantica
14
198M
Mh. sp. 25
15
198M
Mh. sp. 25
16
848MF?
Mh. sinuata
17
848MF?
Mh. sinuata
18
1479M
Mh. opaca
19
1479M
Mh. opaca
20
1940M
Mh. inaequalis
21
1940M
Mh. inaequalis
22
861M
Mh. tensa
23
861M
Mh. tensa

FIGURE 28

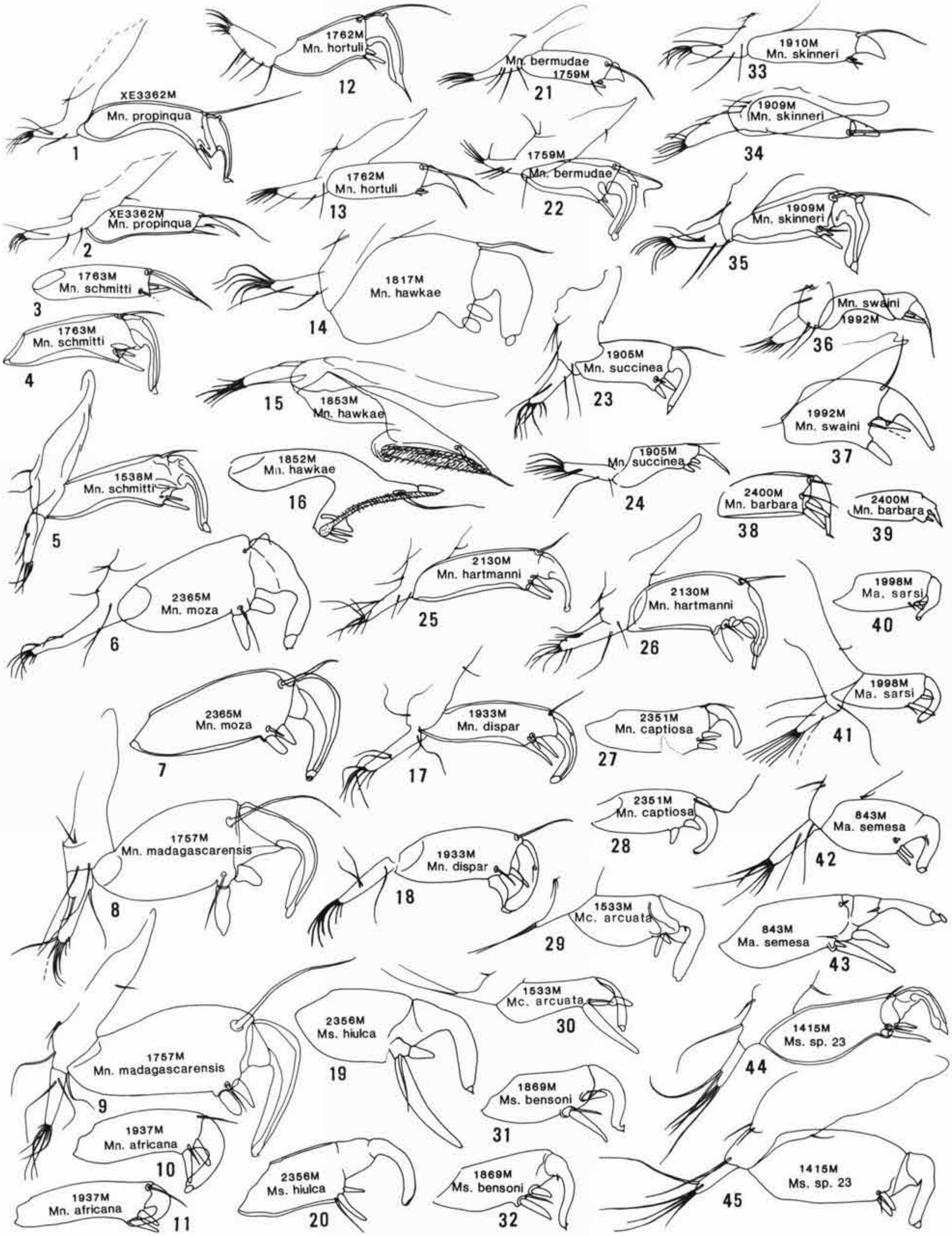
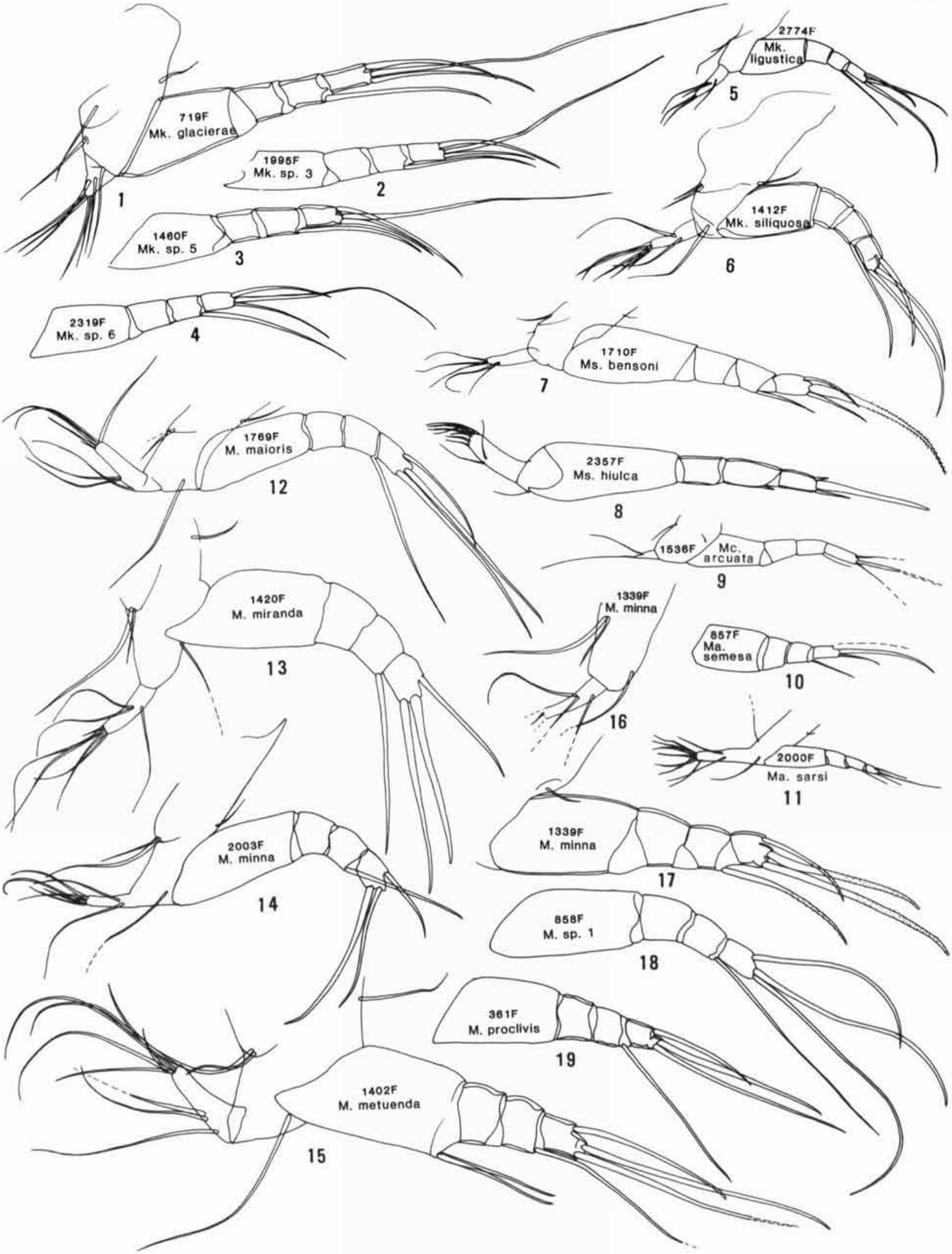
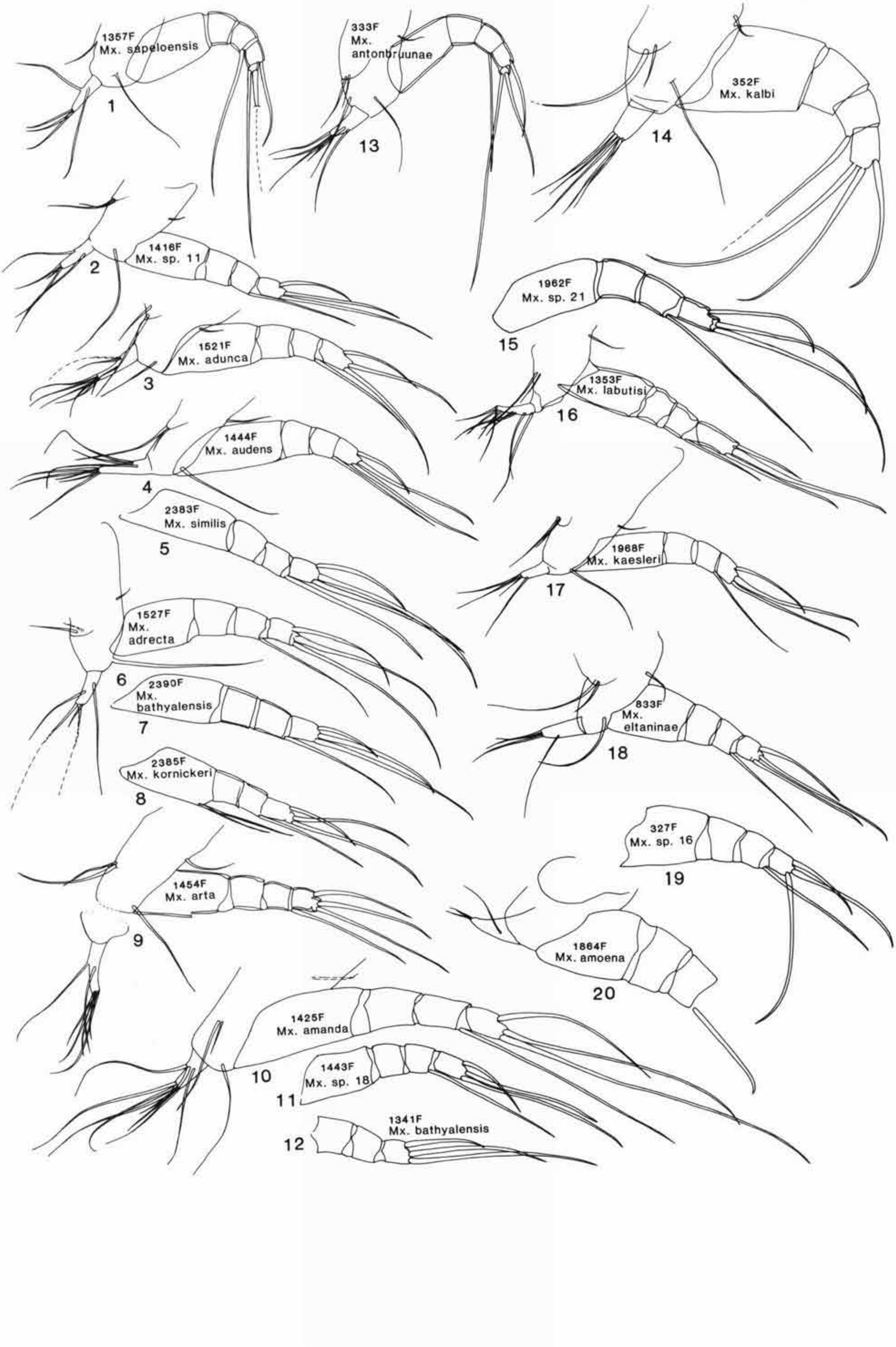

1 XE3362M Mn. propinqua
2 XE3362M Mn. propinqua
3 1763M Mn. schmitti
4 1763M Mn. schmitti
5 1538M Mn. schmitti
6 2365M Mn. moza
7 2365M Mn. moza
8 1757M Mn. madagascarensis
9 1757M Mn. madagascarensis
10 1937M Mn. africana
11 1937M Mn. africana
12 1762M Mn. hortuli
13 1762M Mn. hortuli
14 1817M Mn. hawkae
15 1853M Mn. hawkae
16 1852M Mn. hawkae
17 1933M Mn. dispar
18 1933M Mn. dispar
19 2356M Ms. hiulca
20 2356M Ms. hiulca
21 Mn. bermudae 1759M
22 1759M Mn. bermudae
23 1905M Mn. succinea
24 1905M Mn. succinea
25 2130M Mn. hartmanni
26 2130M Mn. hartmanni
27 2351M Mn. captiosa
28 2351M Mn. captiosa
29 1533M Mc. arcuata
30 1533M Mc. arcuata
31 1869M Ms. bensoni
32 1869M Ms. bensoni
33 1910M Mn. skinneri
34 1909M Mn. skinneri
35 1909M Mn. skinneri
36 Mn. swaini 1992M
37 1992M Mn. swaini
38 2400M Mn. barbara
39 2400M Mn. barbara
40 1998M Ma. sarsi
41 1998M Ma. sarsi
42 843M Ma. semesa
43 843M Ma. semesa
44 1415M Ms. sp. 23
45 1415M Ms. sp. 23

FIGURE 29



719F
Mk. glacierae
1
1995F
Mk. sp. 3
2
1460F
Mk. sp. 5
3
2319F
Mk. sp. 6
4
2774F
Mk. ligustica
5
1412F
Mk. siliquosa
6
1710F
Ms. bensoni
7
2357F
Ms. hiulca
8
1536F
Mc. arcuata
9
857F
Ma. semesa
10
2000F
Ma. sarsi
11
1769F
M. maioris
12
1420F
M. miranda
13
2003F
M. minna
14
1402F
M. metuenda
15
1339F
M. minna
16
1339F
M. minna
17
858F
M. sp. 1
18
361F
M. proclivis
19

FIGURE 30


1357F
Mx. sapeloensis
1
333F
Mx.
antonbruunae
13
352F
Mx. kalbi
14
1416F
Mx. sp. 11
2
1962F
Mx. sp. 21
15
1521F
Mx. adunca
3
1353F
Mx. labutisi
16
1444F
Mx. audens
4
2383F
Mx. similis
5
1968F
Mx. kaesleri
17
1527F
Mx.
adrecta
6
2390F
Mx.
bathyalensis
7
833F
Mx.
eltaninae
18
2385F
Mx. kornickeri
8
327F
Mx. sp. 16
19
1454F
Mx. arta
9
1864F
Mx. amoena
20
1425F
Mx. amanda
10
1443F
Mx. sp. 18
11
1341F
Mx. bathyalensis
12

FIGURE 31

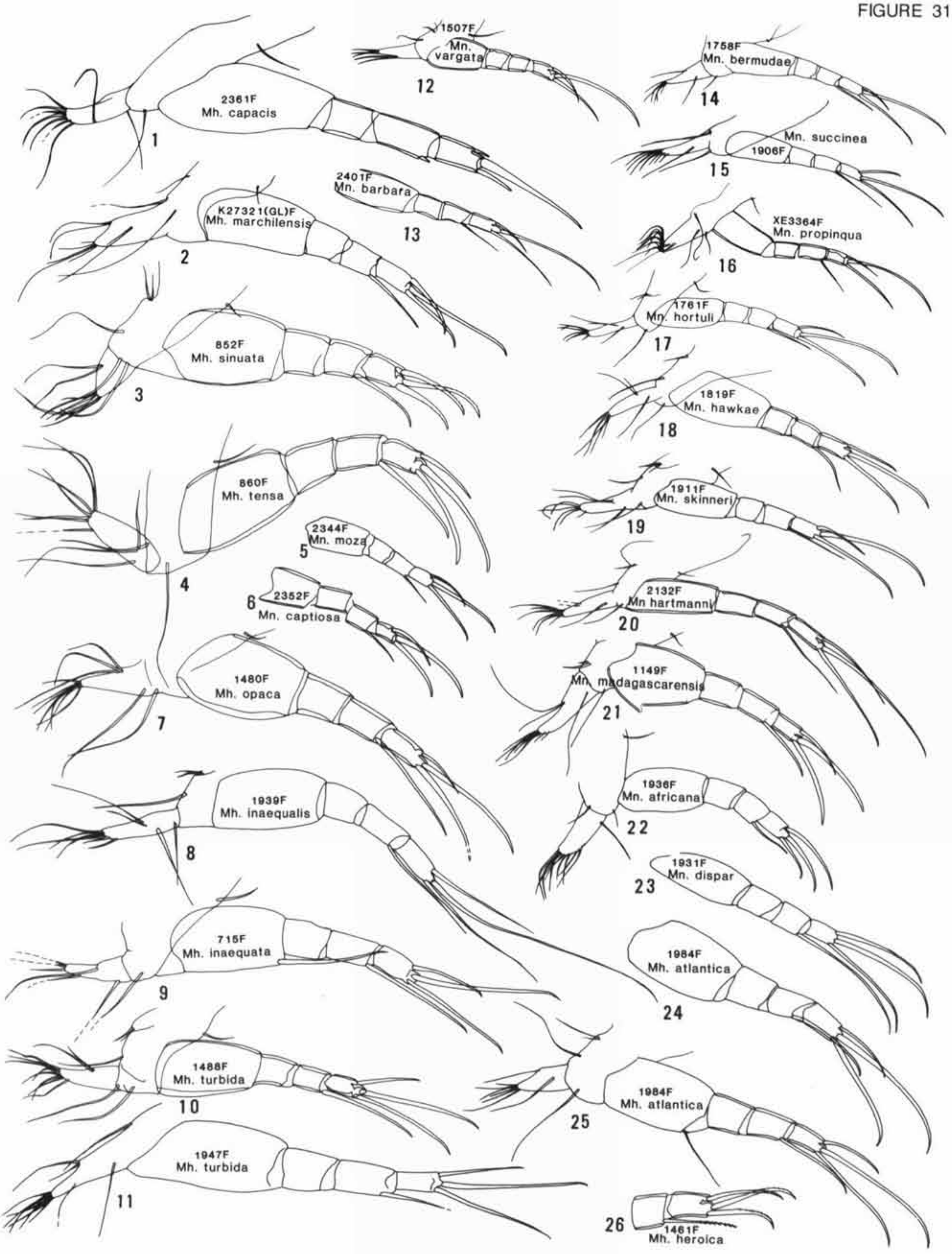
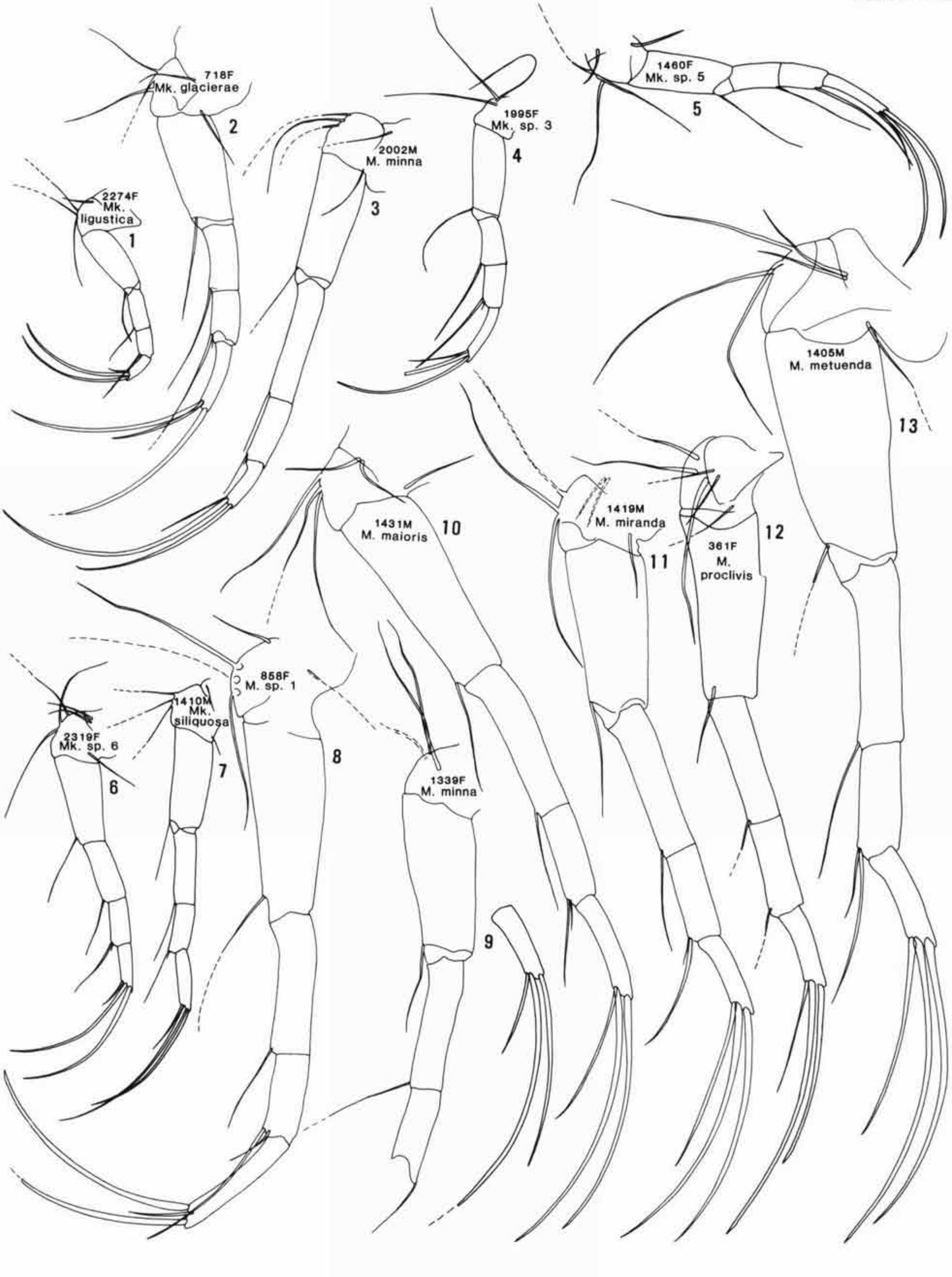

1
2361F
Mh. capacis
2
K27321(GL)F
Mh. marchilensis
3
852F
Mh. sinuata
4
860F
Mh. tensa
5
2344F
Mn. moza
6
2352F
Mn. captiosa
7
1480F
Mh. opaca
8
1939F
Mh. inaequalis
9
715F
Mh. inaequata
10
1488F
Mh. turbida
11
1947F
Mh. turbida
12
1507F
Mn. vargata
13
2401F
Mn. barbara
14
1758F
Mn. bermudae
15
Mn. succinea
1906F
16
XE3364F
Mn. propinqua
17
1761F
Mn. hortuli
18
1819F
Mn. hawkae
19
1911F
Mn. skinneri
20
2132F
Mn hartmanni
21
1149F
Mn. madagascarensis
22
1936F
Mn. africana
23
1931F
Mn. dispar
24
1984F
Mh. atlantica
25
1984F
Mh. atlantica
26
1461F
Mh. heroica

FIGURE 32



718F
Mk. glacierae
2
2274F
Mk.
ligustica
1
2002M
M. minna
3
1995F
Mk. sp. 3
4
1460F
Mk. sp. 5
5
1405M
M. metuenda
13
1431M
M. maioris
10
1419M
M. miranda
11
361F
M.
proclivis
12
858F
M. sp. 1
8
1410M
Mk.
siliquosa
7
2319F
Mk. sp. 6
6
1339F
M. minna
9

FIGURE 33

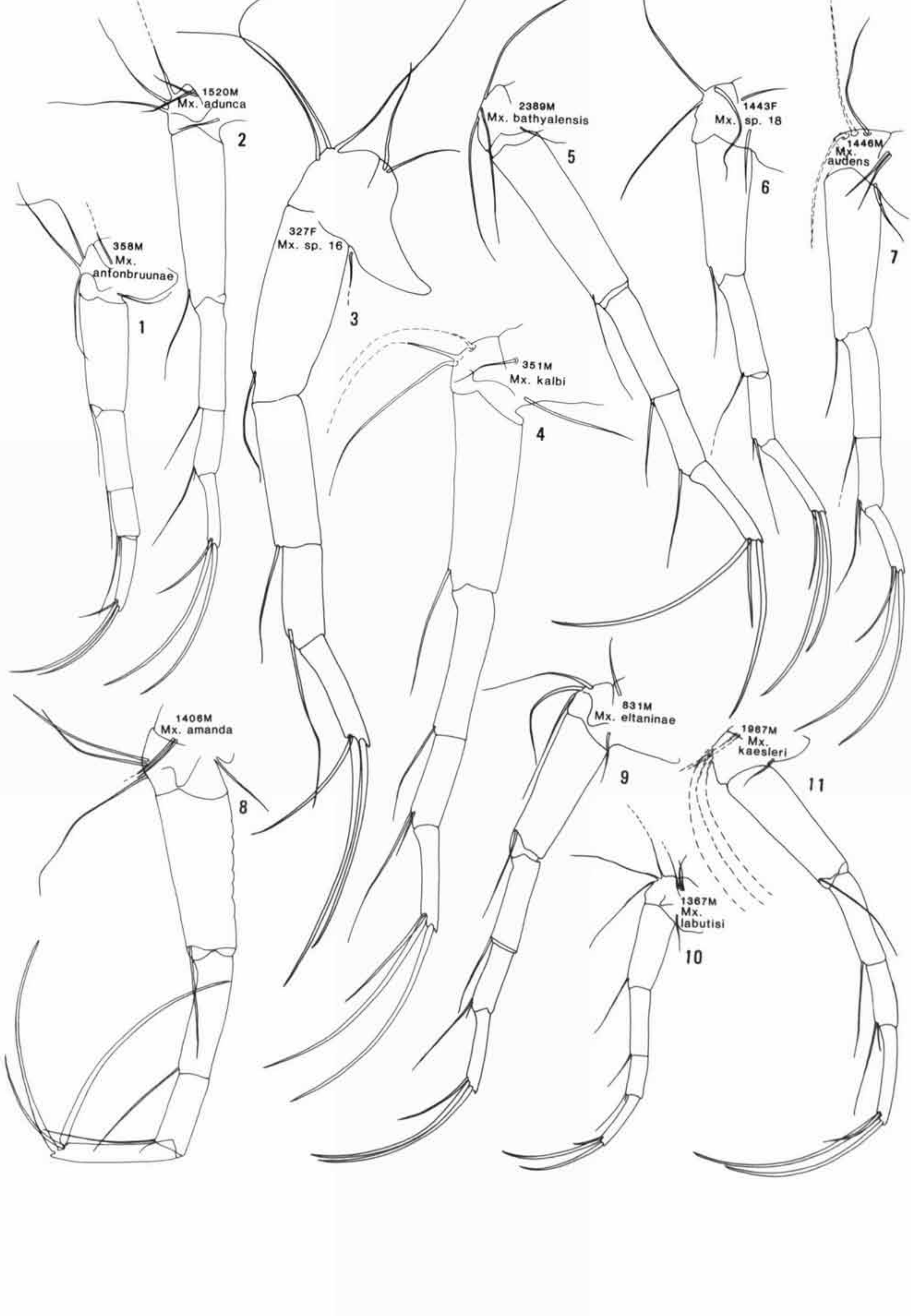

1520M
Mx. adunca
2
358M
Mx.
antonbruunae
1
327F
Mx. sp. 16
3
351M
Mx. kalbi
4
2389M
Mx. bathyalensis
5
1443F
Mx. sp. 18
6
1446M
Mx.
audens
7
1406M
Mx. amanda
8
831M
Mx. eltaninae
9
1367M
Mx.
labutisi
10
1987M
Mx.
kaesleri
11

FIGURE 34

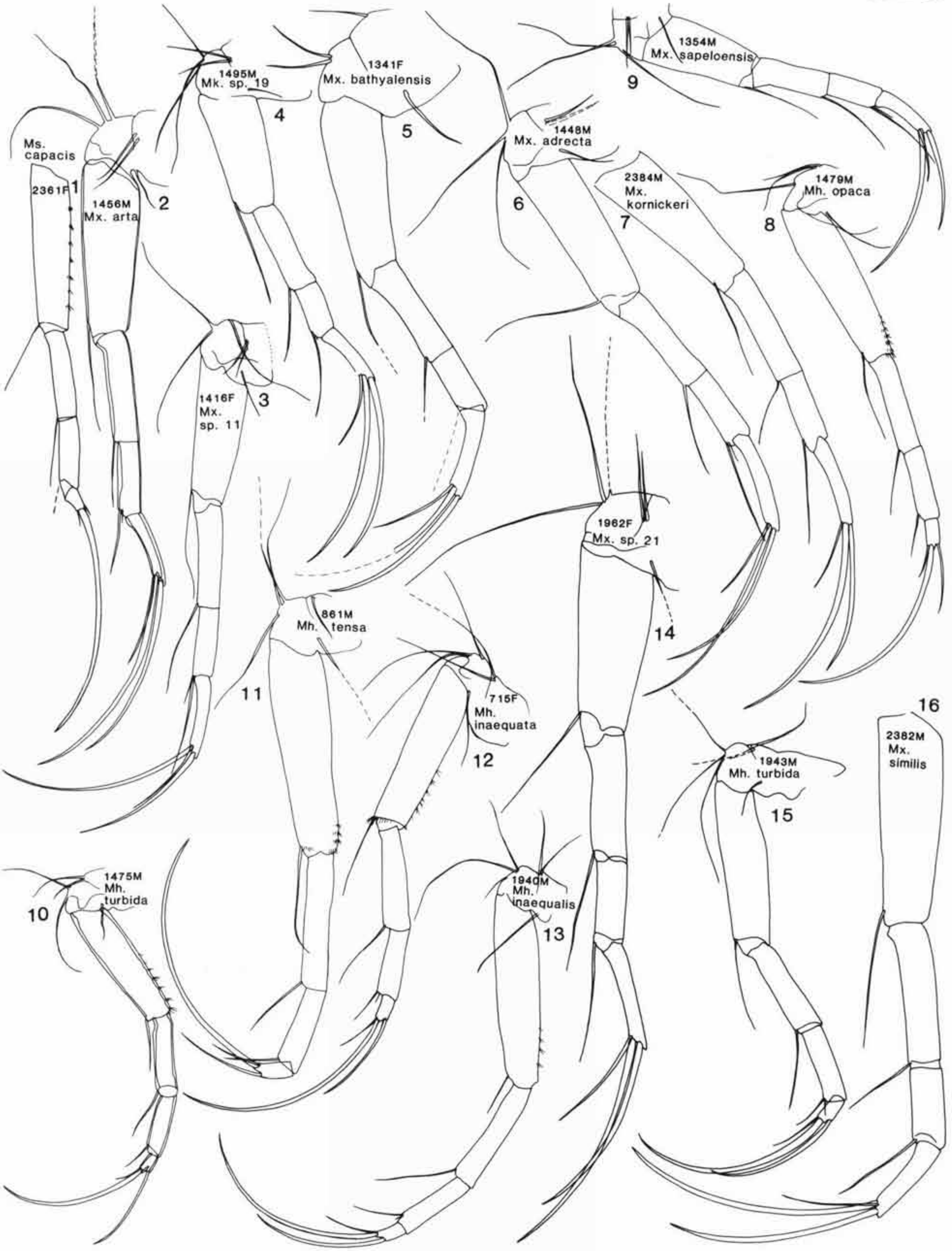

Ms. capacis
2361F
1
1456M
Mx. arta
2
1416F
Mx. sp. 11
3
1495M
Mk. sp. 19
4
1341F
Mx. bathyalensis
5
1448M
Mx. adrecta
6
2384M
Mx. kornickeri
7
1479M
Mh. opaca
8
1354M
Mx. sapeloensis
9
9
1475M
Mh. turbida
10
861M
Mh. tensa
11
715F
Mh. inaequata
12
1940M
Mh. inaequalis
13
1962F
Mx. sp. 21
14
1943M
Mh. turbida
15
16
2382M
Mx. similis

FIGURE 35

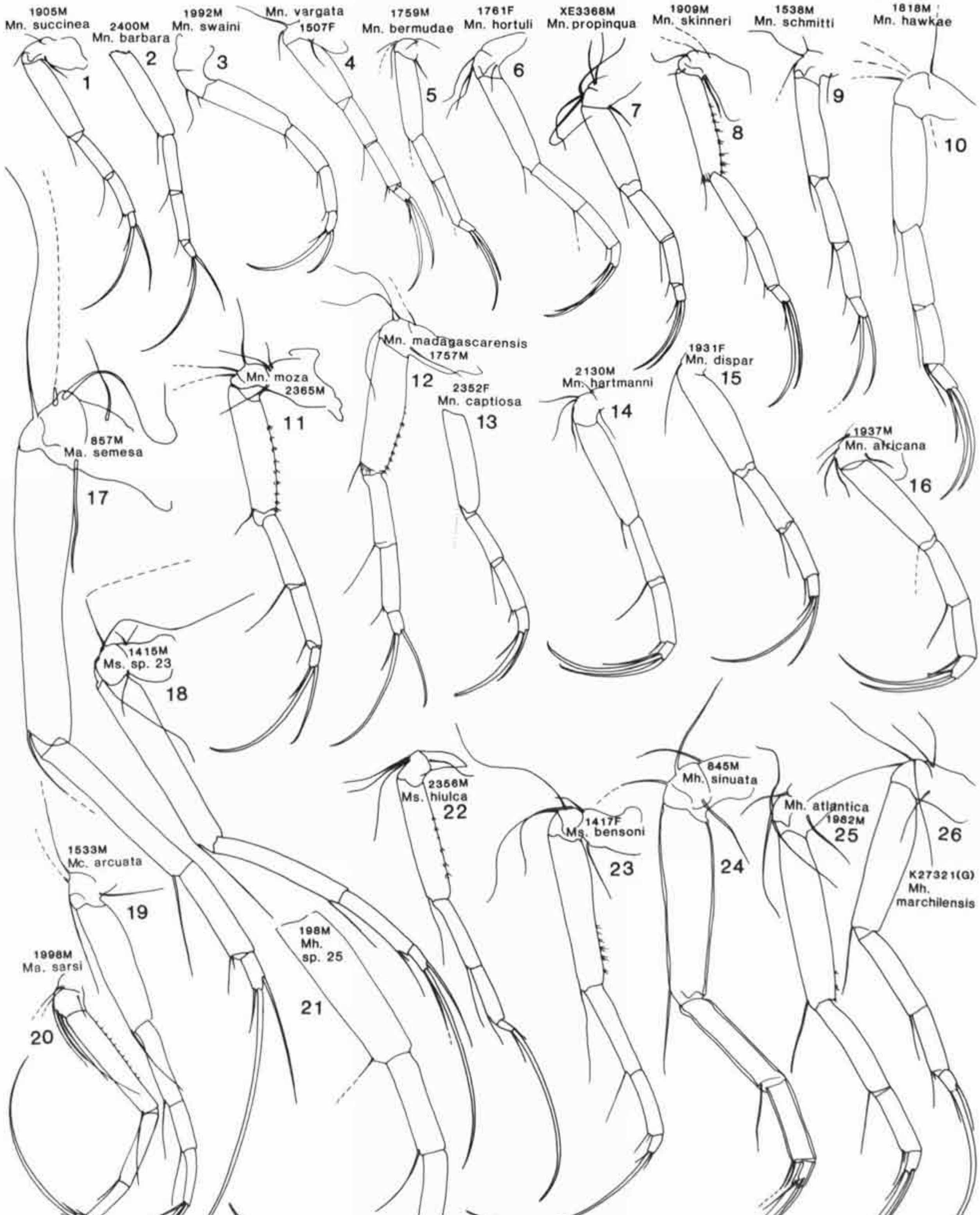

1905M
Mn. succinea
1
2400M
Mn. barbara
2
1992M
Mn. swaini
3
Mn. vargata
1507F
4
1759M
Mn. bermudae
5
1761F
Mn. hortuli
6
XE3368M
Mn. propinqua
7
1909M
Mn. skinneri
8
1538M
Mn. schmitti
9
1818M
Mn. hawkae
10
Mn. moza
2365M
11
Mn. madagascarensis
1757M
12
2352F
Mn. captiosa
13
2130M
Mn. hartmanni
14
1931F
Mn. dispar
15
1937M
Mn. africana
16
857M
Ma. semesa
17
1415M
Ms. sp. 23
18
1533M
Mc. arcuata
19
1998M
Ma. sarsi
20
198M
Mh.
sp. 25
21
2356M
Ms. hiulca
22
1417F
Ms. bensoni
23
845M
Mh. sinuata
24
Mh. atlantica
1982M
25
26
K27321(G)
Mh.
marchilensis

FIGURE 36


327F
Mx. sp. 16
1
1414M
Mk. siliquosa
5
858F
M. sp. 1
2
1995F
Mk. sp. 3
6
1339F
M. minna
3
3
1405M
M. metuenda
4

FIGURE 37


2274F
Mk. ligustica
7
880M
Mk. glacierae
8
1774M
M. maioris
9
1463M
Mx. amoena
10
1
4

FIGURE 38

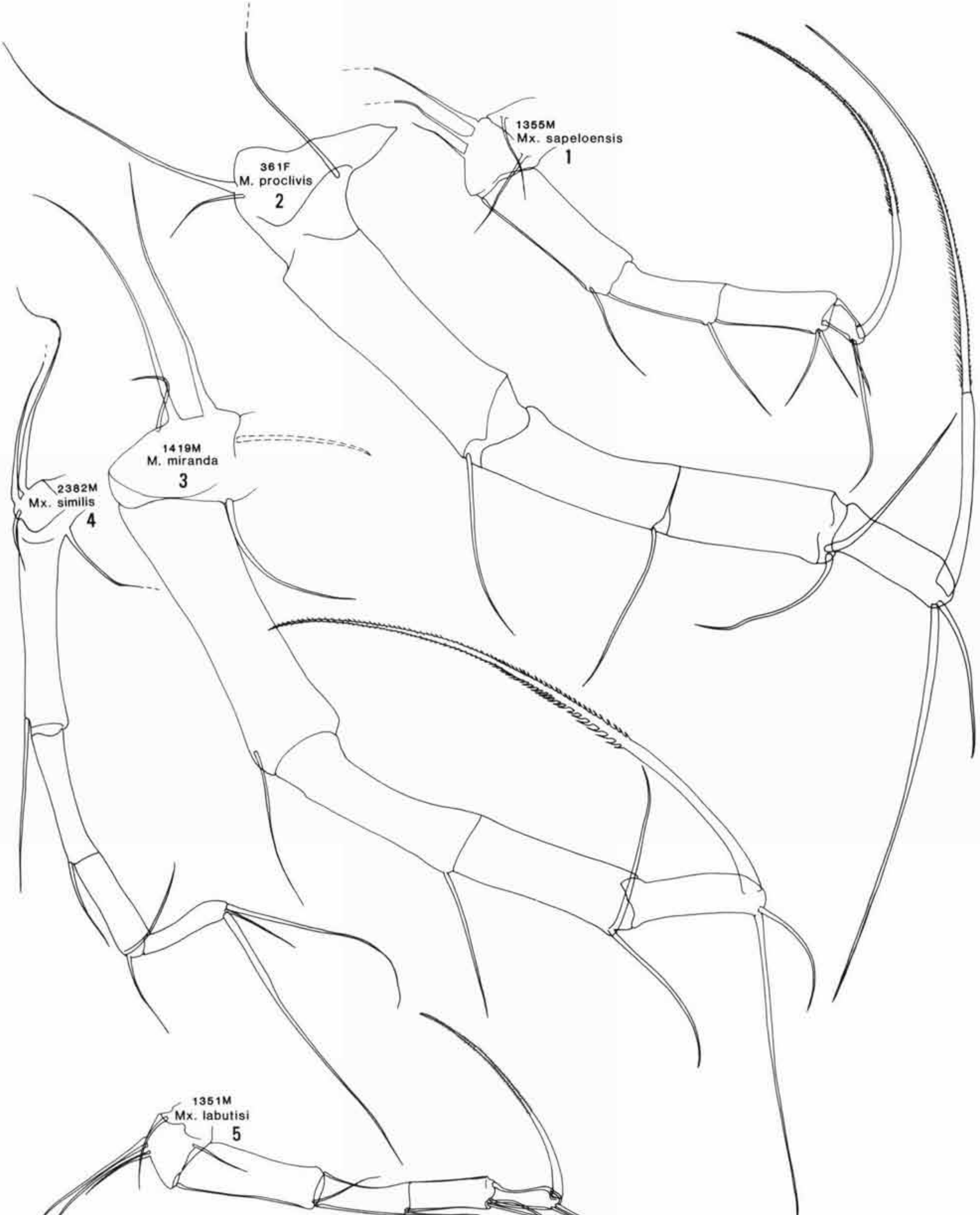

1355M
Mx. sapeloensis
1
361F
M. proclivis
2
1419M
M. miranda
3
2382M
Mx. similis
4
1351M
Mx. labutisi
5

FIGURE 39

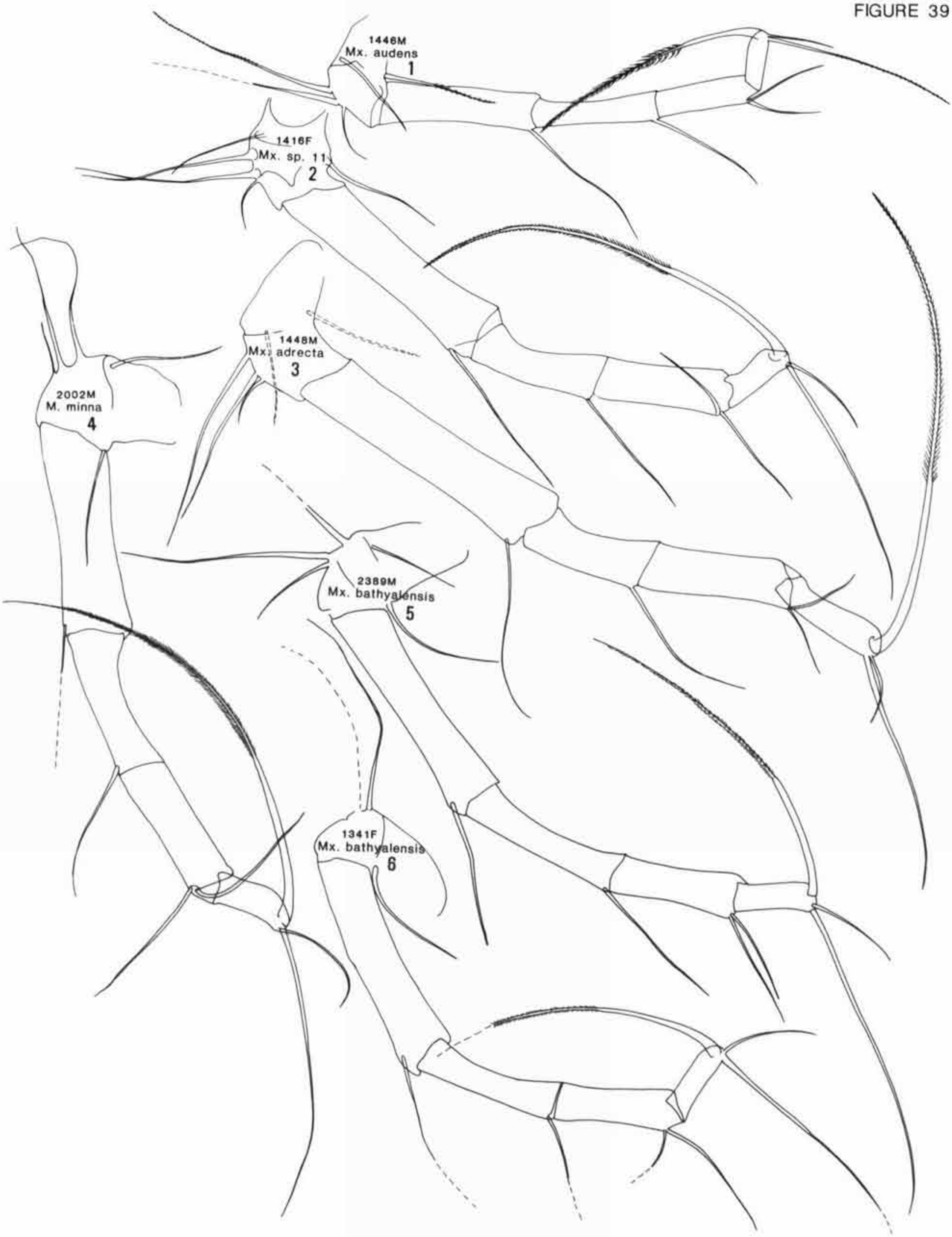

1446M
Mx. audens
1
1416F
Mx. sp. 11
2
1448M
Mx. adrecta
3
2002M
M. minna
4
2389M
Mx. bathyalensis
5
1341F
Mx. bathyalensis
6

FIGURE 40


1456M
Mx. arta
1
831M
Mx. eltaninae
2
332M
Mx. antonbruunae
3
1495M
Mk. sp. 19
4
1967M
Mx. kaesleri
5
351M
Mx. kalbi
6
1460F
Mk. sp. 5
7

FIGURE 41


1443F
Mx. sp. 18
1
2384M
Mx. kornickeri
2
1962F
Mx. sp. 21
3
2319F
Mk. sp. 6
4
1406M
Mx. amanda
5
1520M
Mx. adunca
6

FIGURE 42

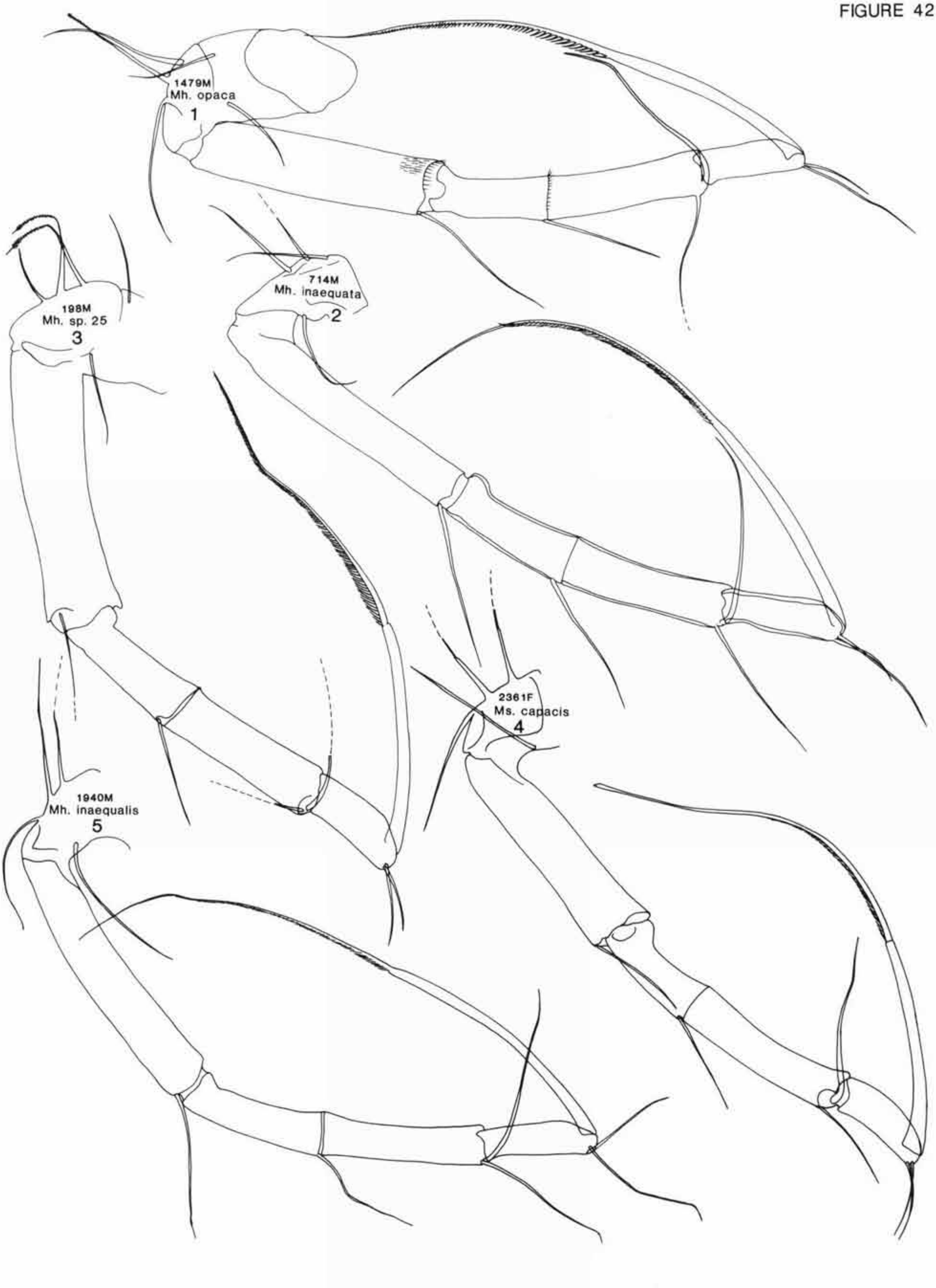

1479M
Mh. opaca
1
714M
Mh. inaequata
2
198M
Mh. sp. 25
3
2361F
Ms. capacis
4
1940M
Mh. inaequalis
5

FIGURE 43


845M
Mh. sinuata
1
1475M
Mh. turbida
2
1943M
Mh. turbida
3
861M
Mh. tensa
4
1982M
Mh. atlantica
5

FIGURE 44

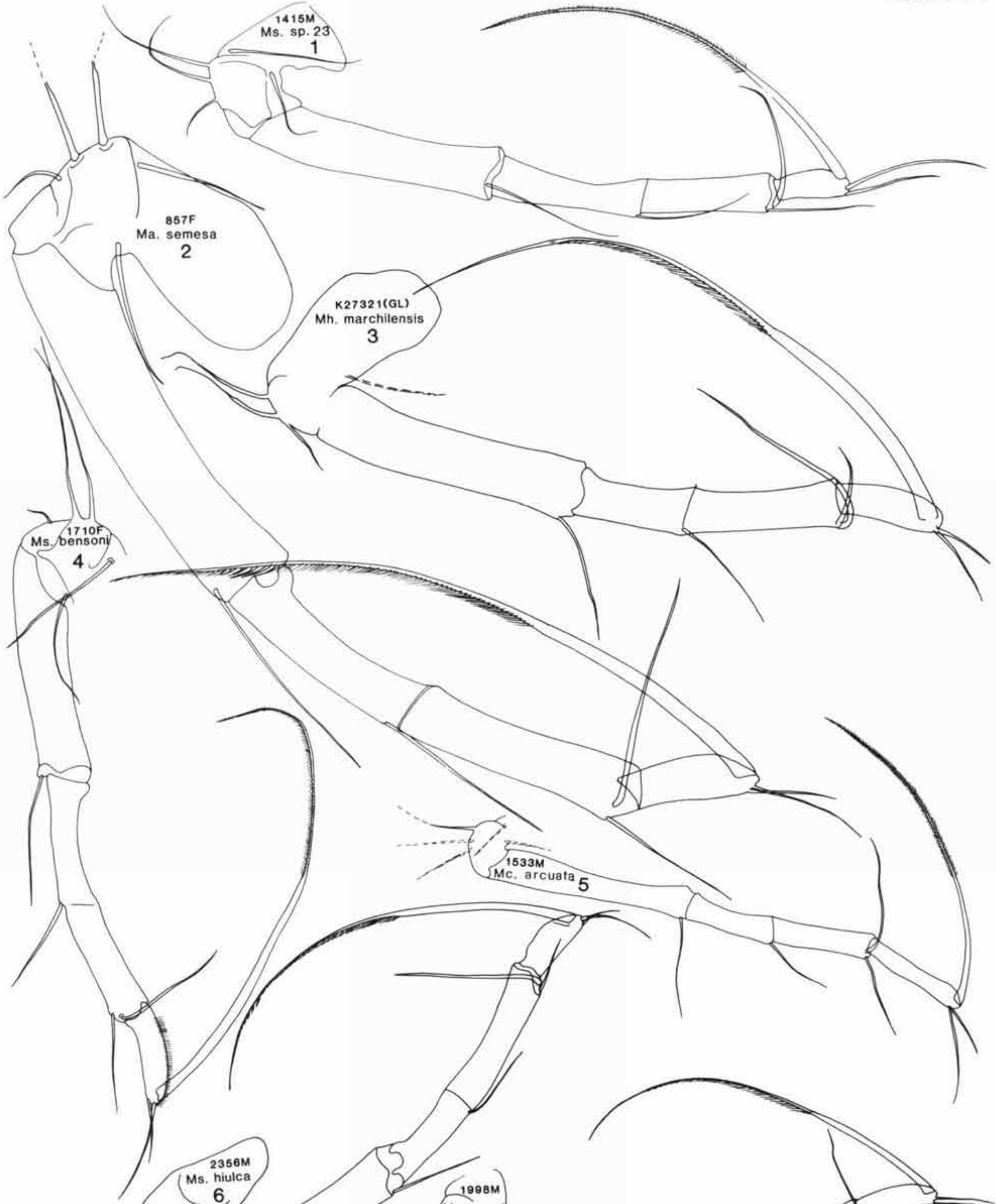

1415M
Ms. sp. 23
1
857F
Ma. semesa
2
K27321(GL)
Mh. marchilensis
3
1710F
Ms. bensoni
4
1533M
Mc. arcuata
5
2356M
Ms. hiulca
6
1998M
Ma. sarsi
7

FIGURE 45

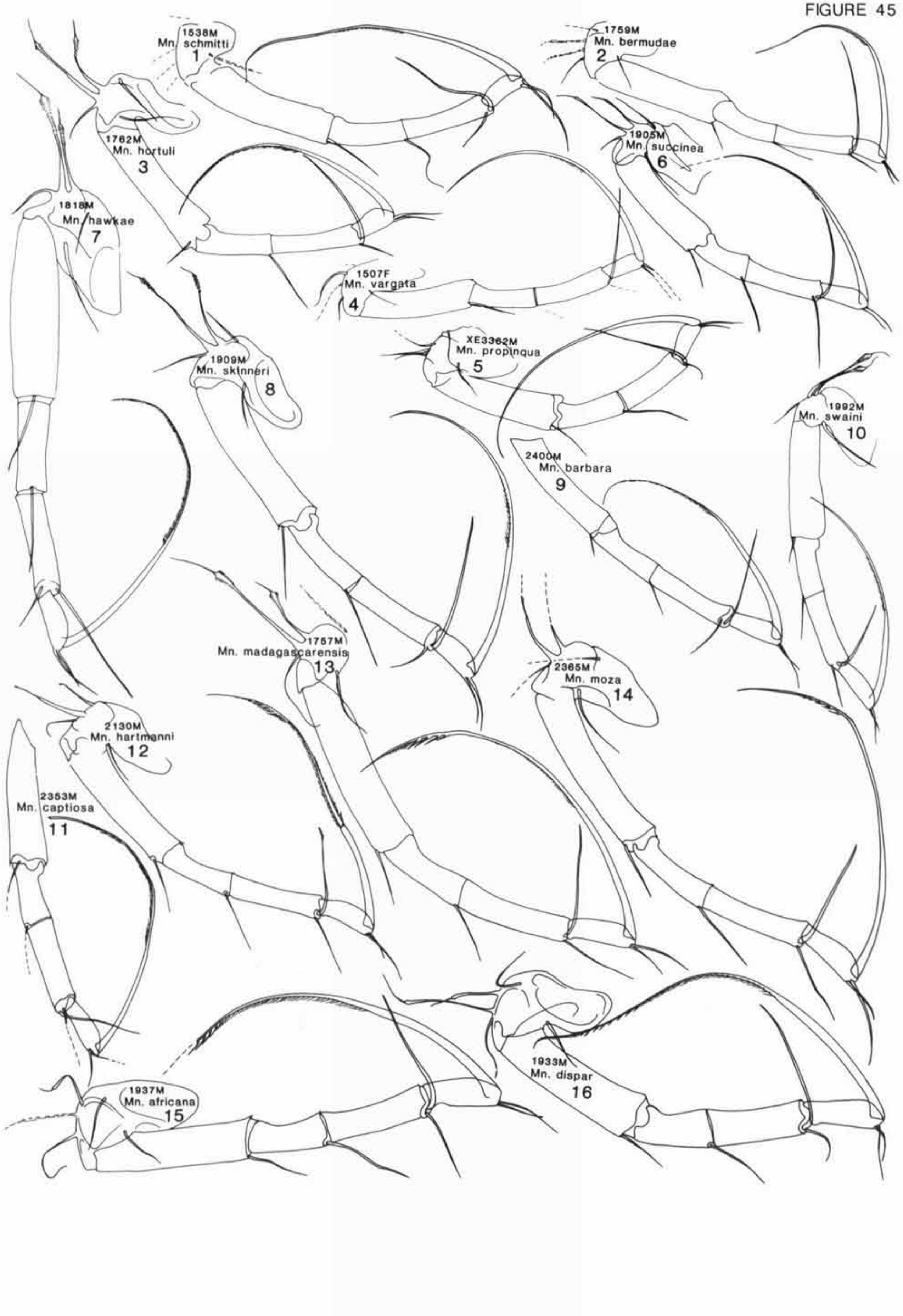

1538M
Mn. schmitti
1
1759M
Mn. bermudae
2
1762M
Mn. hortuli
3
1905M
Mn. succinea
6
1818M
Mn. hawkae
7
1507F
Mn. vargata
4
XE3362M
Mn. propinqua
5
1909M
Mn. skinneri
8
1992M
Mn. swaini
10
2400M
Mn. barbara
9
1757M
Mn. madagascarensis
13
2365M
Mn. moza
14
2130M
Mn. hartmanni
12
2353M
Mn. captiosa
11
1933M
Mn. dispar
16
1937M
Mn. africana
15

FIGURE 46

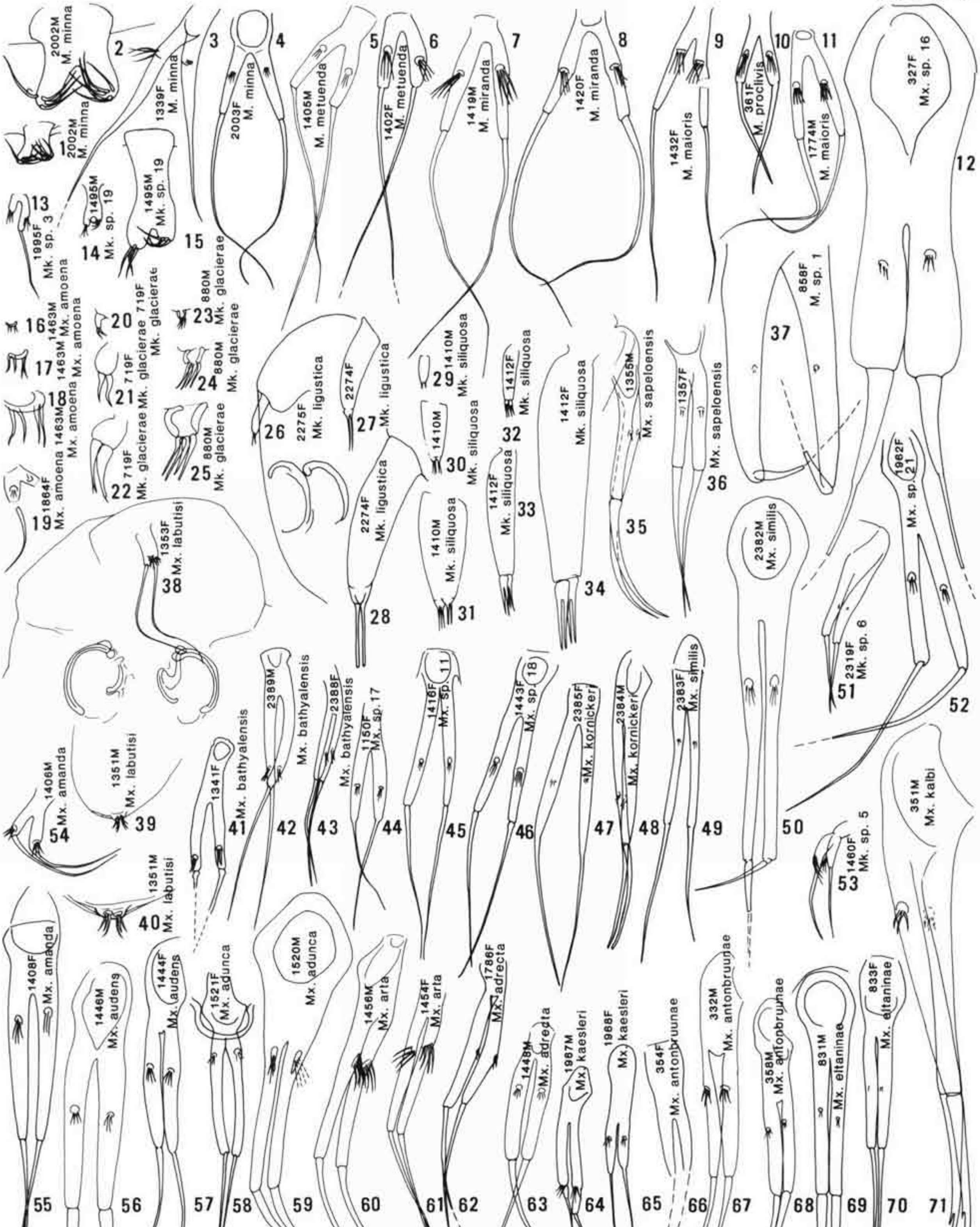

1 2002M M. minna
2 2002M M. minna
3 1339F M. minna
4 2003F M. minna
5 1405M M. metuenda
6 1402F M. metuenda
7 1419M M. miranda
8 1420F M. miranda
9 1432F M. maioris
10 361F M. proclivis
11 1774M M. maioris
12 327F Mx. sp. 16
13 1995F Mk. sp. 3
14 1495M Mk. sp. 19
15 1495M Mk. sp. 19
16 1463M Mx. amoena
17 1463M Mx. amoena
18 1463M Mx. amoena
19 1864F Mx. amoena
20 719F Mk. glacierae
21 719F Mk. glacierae
22 719F Mk. glacierae
23 880M Mk. glacierae
24 880M Mk. glacierae
25 880M Mk. glacierae
26 2275F Mk. ligustica
27 2274F Mk. ligustica
28 2274F Mk. ligustica
29 1410M Mk. siliquosa
30 1410M Mk. siliquosa
31 1410M Mk. siliquosa
32 1412F Mk. siliquosa
33 1412F Mk. siliquosa
34 1412F Mk. siliquosa
35 1355M Mx. sapeloensis
36 1357F Mx. sapeloensis
37 858F M. sp. 1
38 1353F Mx. labutisi
39 1351M Mx. labutisi
40 1351M Mx. labutisi
41 1341F Mx. bathyalensis
42 2389M Mx. bathyalensis
43 2388F Mx. bathyalensis
44 1150F Mx. sp. 17
45 1416F Mx. sp. 11
46 1443F Mx. sp. 18
47 2385F Mx. kornickeri
48 2384M Mx. kornickeri
49 2383F Mx. similis
50 2382M Mx. similis
51 2319F Mk. sp. 6
52 1962F Mx. sp. 21
53 1460F Mk. sp. 5
54 1406M Mx. amanda
55 1408F Mx. amanda
56 1446M Mx. audens
57 1444F Mx. audens
58 1521F Mx. adunca
59 1520M Mx. adunca
60 1456M Mx. arta
61 1454F Mx. arta
62 1786F Mx. adrecta
63 1448M Mx. adrecta
64 1967M Mx. kaesleri
65 1968F Mx. kaesleri
66 354F Mx. antonbruunae
67 332M Mx. antonbruunae
68 358M Mx. antonbruunae
69 831M Mx. eltaninae
70 833F Mx. eltaninae
71 351M Mx. kalbi

FIGURE 47

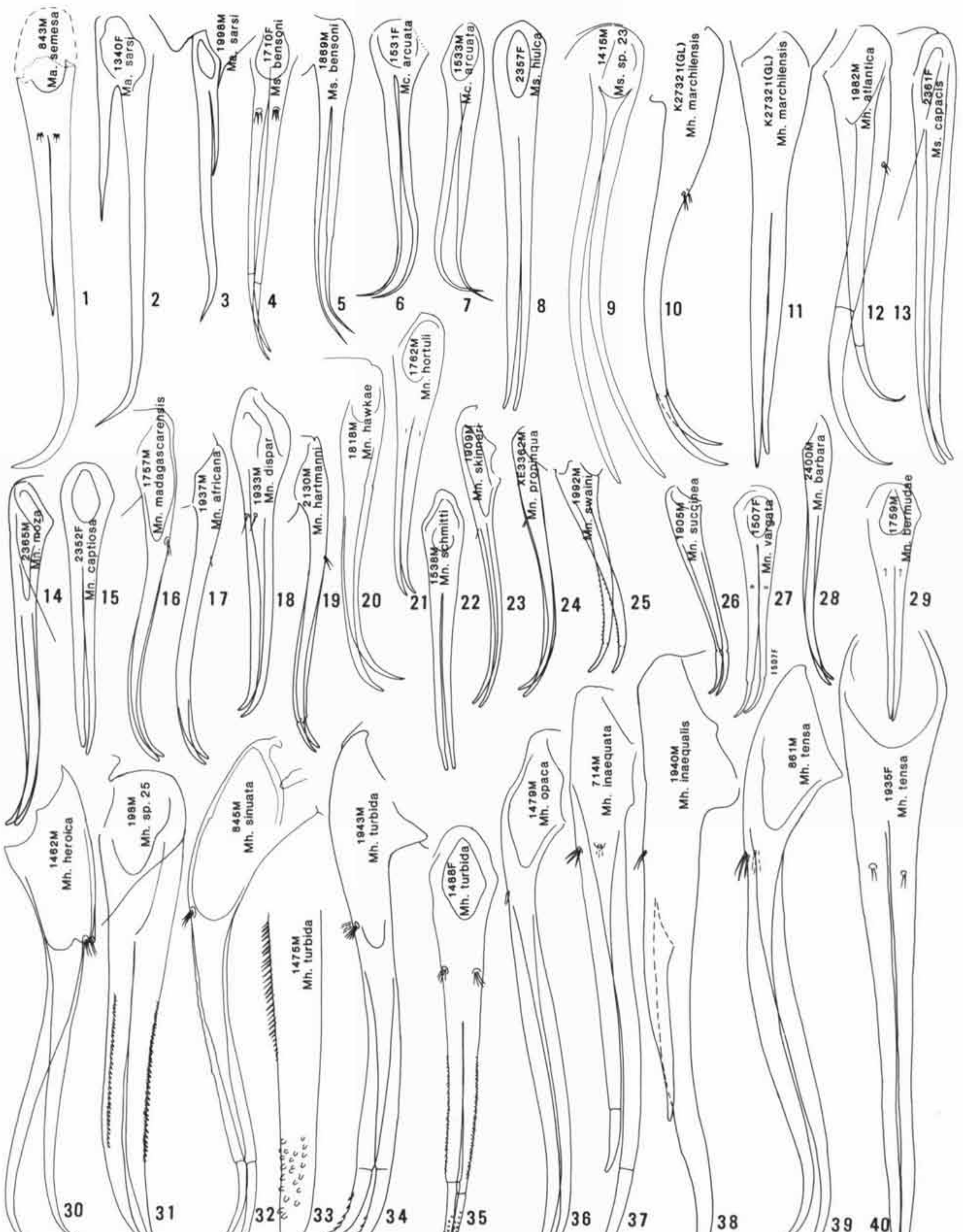

843M Ma. semesa
1
1340F Ma. sarsi
2
1998M Ma. sarsi
3
1710F Ms. bensoni
4
1869M Ms. bensoni
5
1531F Mc. arcuata
6
1533M Mc. arcuata
7
2357F Ms. hiulca
8
1415M Ms. sp. 23
9
K27321(GL) Mh. marchilensis
10
K27321(GL) Mh. marchilensis
11
1982M Mh. atlantica
12
2361F Ms. capacis
13
2365M Mn. moza
14
2352F Mn. captiosa
15
1757M Mn. madagascarensis
16
1937M Mn. africana
17
1933M Mn. dispar
18
2130M Mn. hartmanni
19
1818M Mn. hawkae
20
1762M Mn. hortuli
21
1538M Mn. schmitti
22
1909M Mn. skinneri
23
XE3362M Mn. propinqua
24
1992M Mn. swaini
25
1905M Mn. succinea
26
1507F Mn. vargata
1507F
27
2400M Mn. barbara
28
1759M Mn. bermudae
29
1462M Mh. heroica
30
198M Mh. sp. 25
31
845M Mh. sinuata
32
1475M Mh. turbida
33
1943M Mh. turbida
34
1468F Mh. turbida
35
1479M Mh. opaca
36
714M Mh. inaequata
37
1940M Mh. inaequalis
38
861M Mh. tensa
39
1935F Mh. tensa
40

FIGURE 48

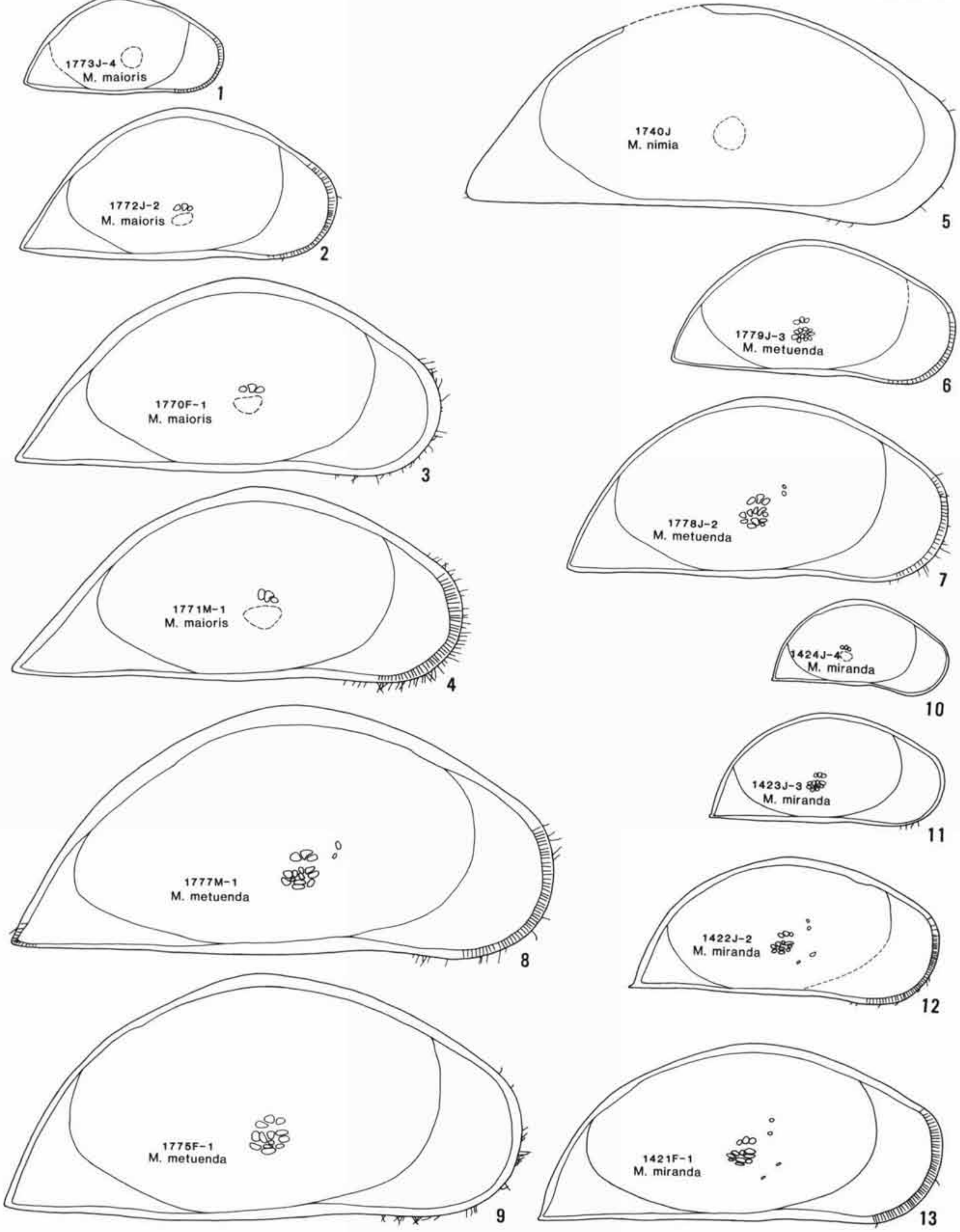

1773J-4
M. maioris
1
1772J-2
M. maioris
2
1770F-1
M. maioris
3
1771M-1
M. maioris
4
1777M-1
M. metuenda
8
1775F-1
M. metuenda
9
1740J
M. nimia
5
1779J-3
M. metuenda
6
1778J-2
M. metuenda
7
1424J-4
M. miranda
10
1423J-3
M. miranda
11
1422J-2
M. miranda
12
1421F-1
M. miranda
13

FIGURE 49

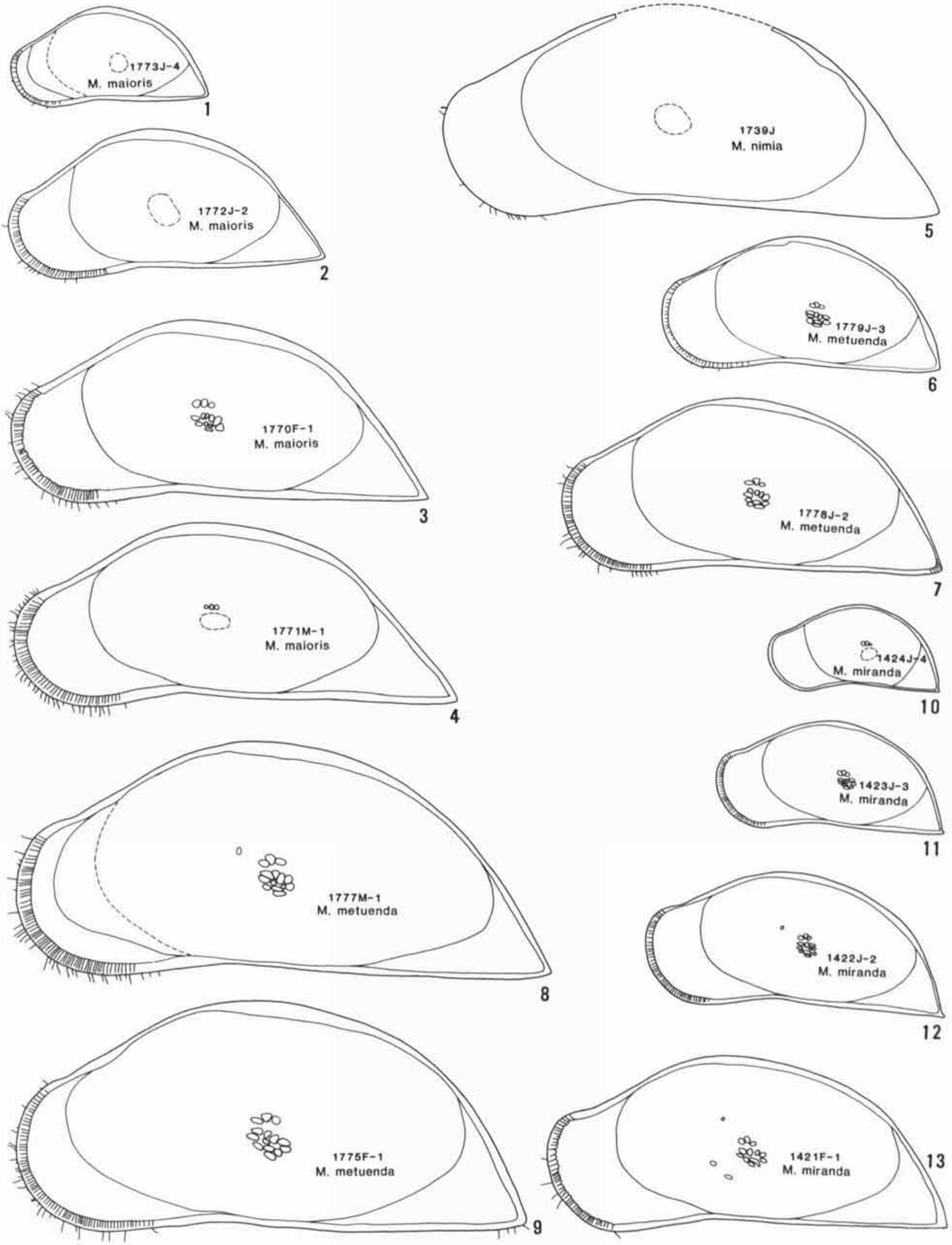

1773J-4
M. maioris
1
1772J-2
M. maioris
2
1770F-1
M. maioris
3
1771M-1
M. maioris
4
1739J
M. nimia
5
1779J-3
M. metuenda
6
1778J-2
M. metuenda
7
1777M-1
M. metuenda
8
1775F-1
M. metuenda
9
1424J-4
M. miranda
10
1423J-3
M. miranda
11
1422J-2
M. miranda
12
1421F-1
M. miranda
13

FIGURE 50

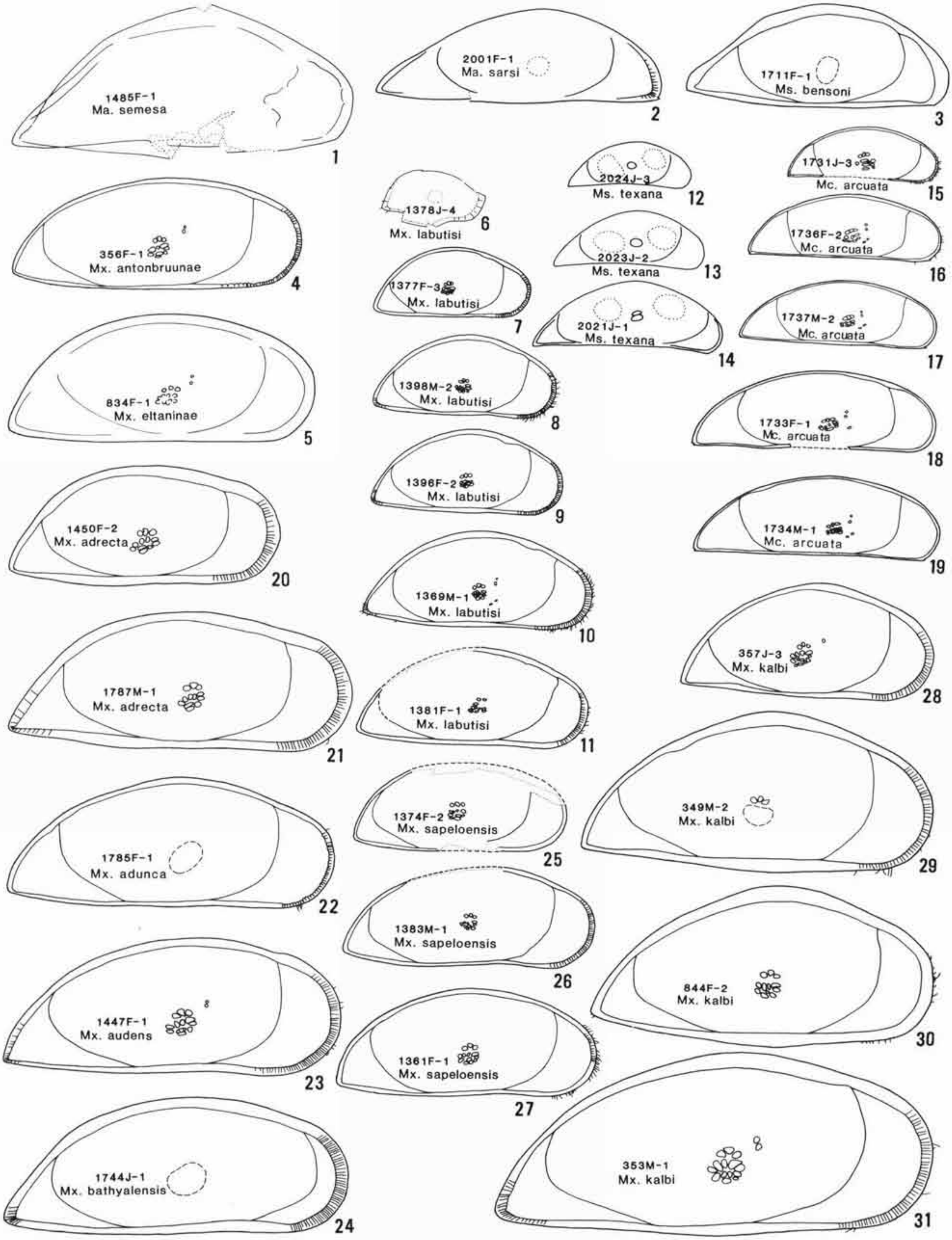

1485F-1
Ma. semesa
1
2001F-1
Ma. sarsi
2
1711F-1
Ms. bensoni
3
356F-1
Mx. antonbruunae
4
834F-1
Mx. eltaninae
5
1378J-4
Mx. labutisi
6
1377F-3
Mx. labutisi
7
1398M-2
Mx. labutisi
8
1396F-2
Mx. labutisi
9
1369M-1
Mx. labutisi
10
1381F-1
Mx. labutisi
11
2024J-3
Ms. texana
12
2023J-2
Ms. texana
13
2021J-1
Ms. texana
14
1731J-3
Mc. arcuata
15
1736F-2
Mc. arcuata
16
1737M-2
Mc. arcuata
17
1733F-1
Mc. arcuata
18
1734M-1
Mc. arcuata
19
1450F-2
Mx. adrecta
20
1787M-1
Mx. adrecta
21
1785F-1
Mx. adunca
22
1447F-1
Mx. audens
23
1744J-1
Mx. bathyalensis
24
1374F-2
Mx. sapeloensis
25
1383M-1
Mx. sapeloensis
26
1361F-1
Mx. sapeloensis
27
357J-3
Mx. kalbi
28
349M-2
Mx. kalbi
29
844F-2
Mx. kalbi
30
353M-1
Mx. kalbi
31

FIGURE 51

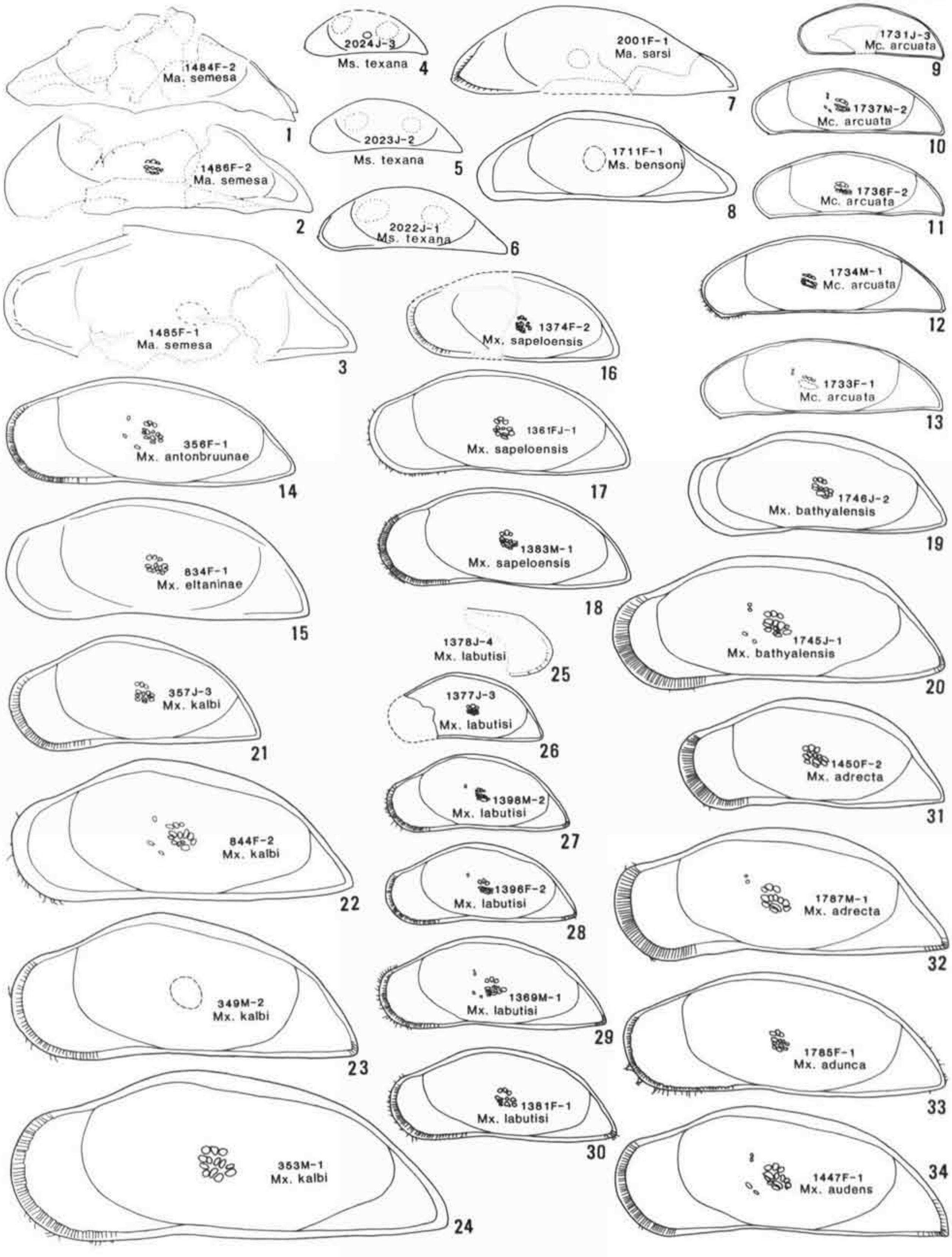

1484F-2 Ma. semesa
1
1486F-2 Ma. semesa
2
1485F-1 Ma. semesa
3
2024J-3 Ms. texana
4
2023J-2 Ms. texana
5
2022J-1 Ms. texana
6
2001F-1 Ma. sarsi
7
1711F-1 Ms. bensoni
8
1731J-3 Mc. arcuata
9
1737M-2 Mc. arcuata
10
1736F-2 Mc. arcuata
11
1734M-1 Mc. arcuata
12
1733F-1 Mc. arcuata
13
356F-1 Mx. antonbruunae
14
834F-1 Mx. eltaninae
15
1374F-2 Mx. sapeloensis
16
1361FJ-1 Mx. sapeloensis
17
1383M-1 Mx. sapeloensis
18
1746J-2 Mx. bathyalensis
19
1745J-1 Mx. bathyalensis
20
357J-3 Mx. kalbi
21
844F-2 Mx. kalbi
22
349M-2 Mx. kalbi
23
353M-1 Mx. kalbi
24
1378J-4 Mx. labutisi
25
1377J-3 Mx. labutisi
26
1398M-2 Mx. labutisi
27
1396F-2 Mx. labutisi
28
1369M-1 Mx. labutisi
29
1381F-1 Mx. labutisi
30
1450F-2 Mx. adrecta
31
1787M-1 Mx. adrecta
32
1785F-1 Mx. adunca
33
1447F-1 Mx. audens
34

FIGURE 52

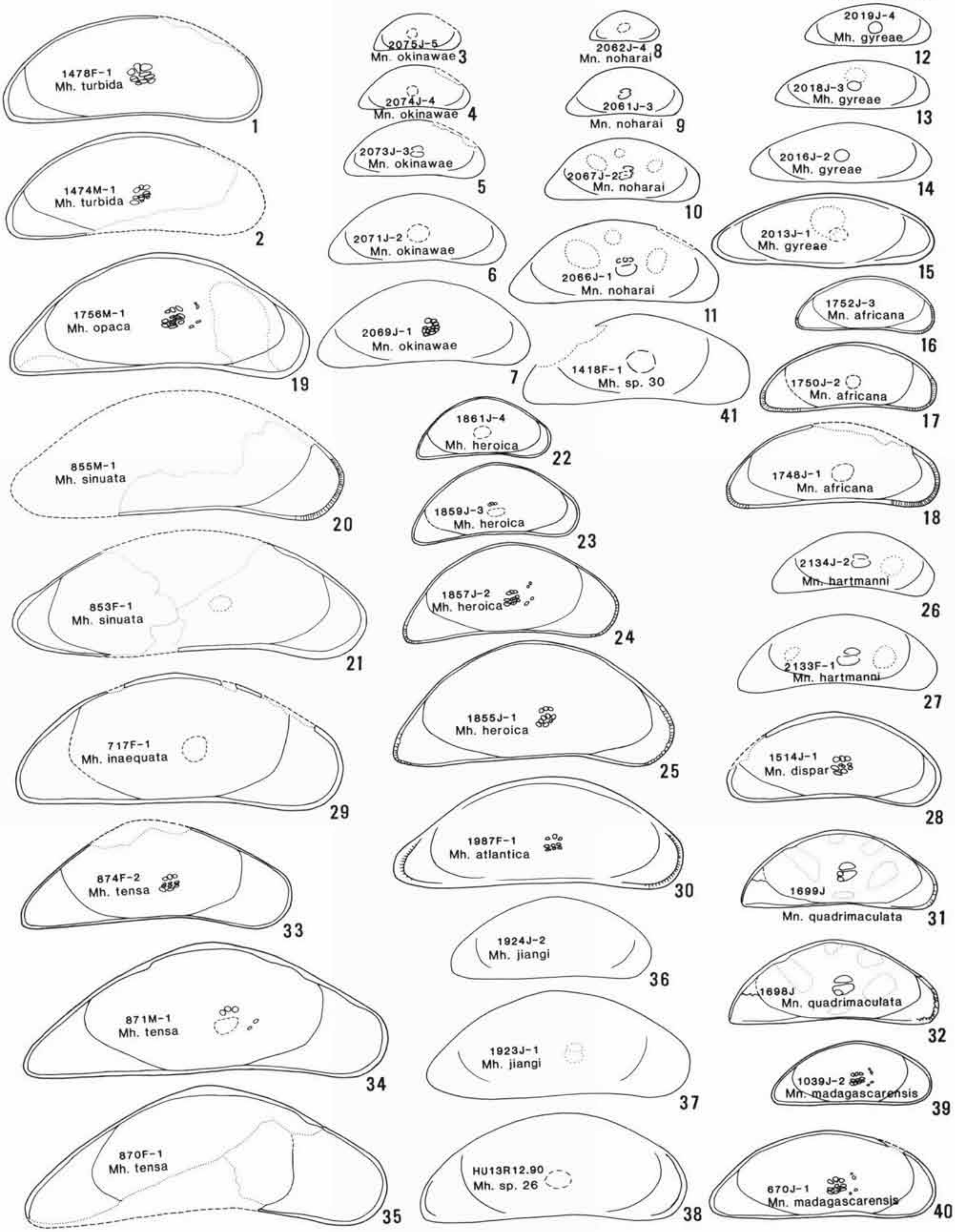

1478F-1
Mh. turbida
1
1474M-1
Mh. turbida
2
2075J-5
Mn. okinawae
3
2074J-4
Mn. okinawae
4
2073J-3
Mn. okinawae
5
2071J-2
Mn. okinawae
6
2069J-1
Mn. okinawae
7
2062J-4
Mn. noharai
8
2061J-3
Mn. noharai
9
2067J-2
Mn. noharai
10
2066J-1
Mn. noharai
11
2019J-4
Mh. gyreae
12
2018J-3
Mh. gyreae
13
2016J-2
Mh. gyreae
14
2013J-1
Mh. gyreae
15
1752J-3
Mn. africana
16
1750J-2
Mn. africana
17
1748J-1
Mn. africana
18
1756M-1
Mh. opaca
19
855M-1
Mh. sinuata
20
853F-1
Mh. sinuata
21
1861J-4
Mh. heroica
22
1859J-3
Mh. heroica
23
1857J-2
Mh. heroica
24
1855J-1
Mh. heroica
25
2134J-2
Mn. hartmanni
26
2133F-1
Mn. hartmanni
27
1514J-1
Mn. dispar
28
717F-1
Mh. inaequata
29
1987F-1
Mh. atlantica
30
1699J
Mn. quadrimaculata
31
1698J
Mn. quadrimaculata
32
874F-2
Mh. tensa
33
871M-1
Mh. tensa
34
870F-1
Mh. tensa
35
1924J-2
Mh. jiangi
36
1923J-1
Mh. jiangi
37
HU13R12.90
Mh. sp. 26
38
1039J-2
Mn. madagascarensis
39
670J-1
Mn. madagascarensis
40
1418F-1
Mh. sp. 30
41

FIGURE 53

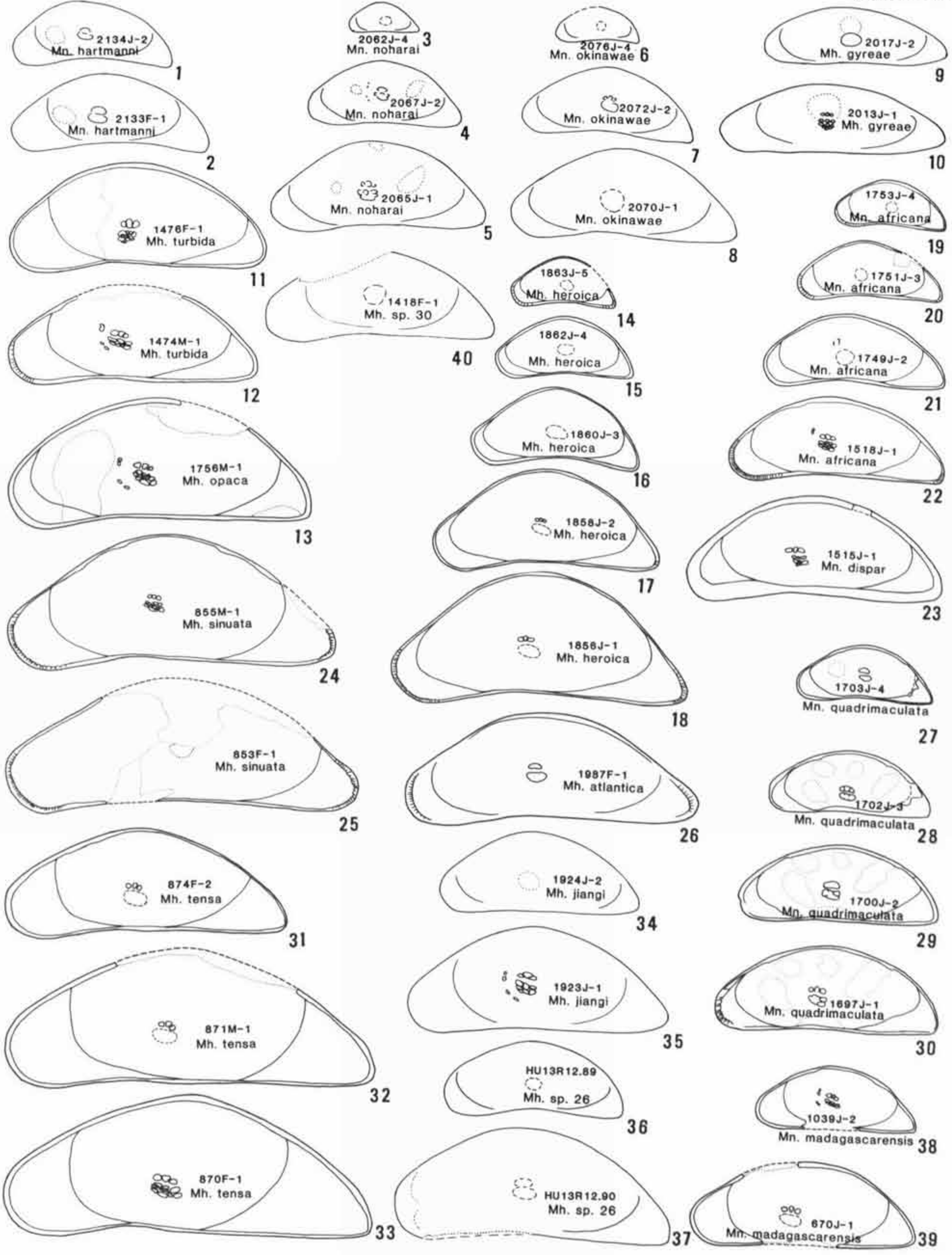

2134J-2
Mn. hartmanni
1
2133F-1
Mn. hartmanni
2
2062J-4
Mn. noharai
3
2067J-2
Mn. noharai
4
2065J-1
Mn. noharai
5
2076J-4
Mn. okinawae
6
2072J-2
Mn. okinawae
7
2070J-1
Mn. okinawae
8
2017J-2
Mh. gyreae
9
2013J-1
Mh. gyreae
10
1476F-1
Mh. turbida
11
1474M-1
Mh. turbida
12
1756M-1
Mh. opaca
13
1863J-5
Mh. heroica
14
1862J-4
Mh. heroica
15
1860J-3
Mh. heroica
16
1858J-2
Mh. heroica
17
1856J-1
Mh. heroica
18
1753J-4
Mn. africana
19
1751J-3
Mn. africana
20
1749J-2
Mn. africana
21
1518J-1
Mn. africana
22
1515J-1
Mn. dispar
23
855M-1
Mh. sinuata
24
853F-1
Mh. sinuata
25
1987F-1
Mh. atlantica
26
1703J-4
Mn. quadrimaculata
27
1702J-3
Mn. quadrimaculata
28
1700J-2
Mn. quadrimaculata
29
1697J-1
Mn. quadrimaculata
30
874F-2
Mh. tensa
31
871M-1
Mh. tensa
32
870F-1
Mh. tensa
33
1924J-2
Mh. jiangi
34
1923J-1
Mh. jiangi
35
HU13R12.89
Mh. sp. 26
36
HU13R12.90
Mh. sp. 26
37
1039J-2
Mn. madagascarensis
38
670J-1
Mn. madagascarensis
39
1418F-1
Mh. sp. 30
40

FIGURE 54

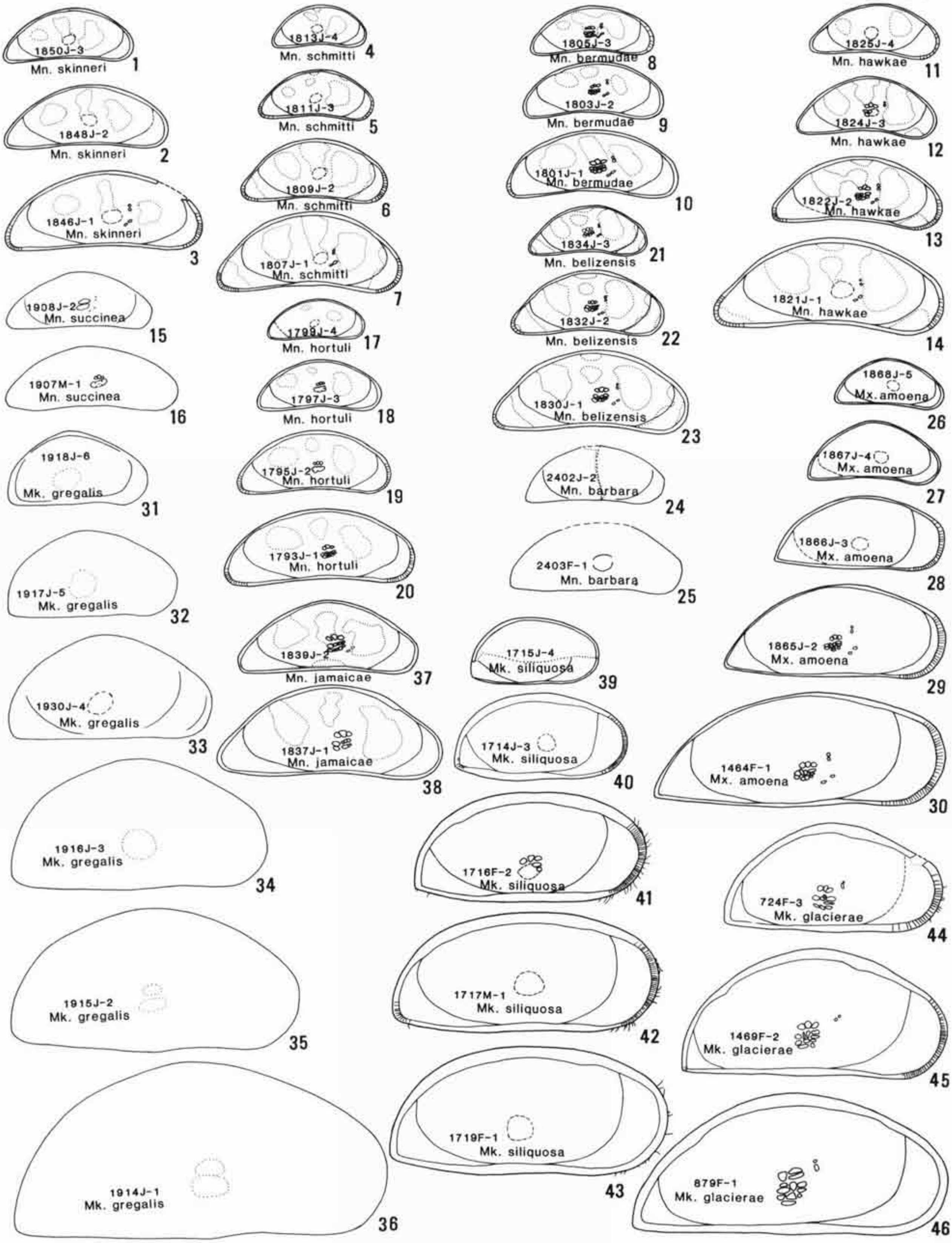

1850J-3
Mn. skinneri
1
1848J-2
Mn. skinneri
2
1846J-1
Mn. skinneri
3
1813J-4
Mn. schmitti
4
1811J-3
Mn. schmitti
5
1809J-2
Mn. schmitti
6
1807J-1
Mn. schmitti
7
1805J-3
Mn. bermudae
8
1803J-2
Mn. bermudae
9
1801J-1
Mn. bermudae
10
1825J-4
Mn. hawkae
11
1824J-3
Mn. hawkae
12
1822J-2
Mn. hawkae
13
1821J-1
Mn. hawkae
14
1908J-2
Mn. succinea
15
1907M-1
Mn. succinea
16
1799J-4
Mn. hortuli
17
1797J-3
Mn. hortuli
18
1795J-2
Mn. hortuli
19
1793J-1
Mn. hortuli
20
1834J-3
Mn. belizensis
21
1832J-2
Mn. belizensis
22
1830J-1
Mn. belizensis
23
2402J-2
Mn. barbara
24
2403F-1
Mn. barbara
25
1868J-5
Mx. amoena
26
1867J-4
Mx. amoena
27
1866J-3
Mx. amoena
28
1865J-2
Mx. amoena
29
1464F-1
Mx. amoena
30
1918J-6
Mk. gregalis
31
1917J-5
Mk. gregalis
32
1930J-4
Mk. gregalis
33
1916J-3
Mk. gregalis
34
1915J-2
Mk. gregalis
35
1914J-1
Mk. gregalis
36
1839J-2
Mn. jamaicae
37
1837J-1
Mn. jamaicae
38
1715J-4
Mk. siliquosa
39
1714J-3
Mk. siliquosa
40
1716F-2
Mk. siliquosa
41
1717M-1
Mk. siliquosa
42
1719F-1
Mk. siliquosa
43
724F-3
Mk. glacierae
44
1469F-2
Mk. glacierae
45
879F-1
Mk. glacierae
46

FIGURE 55

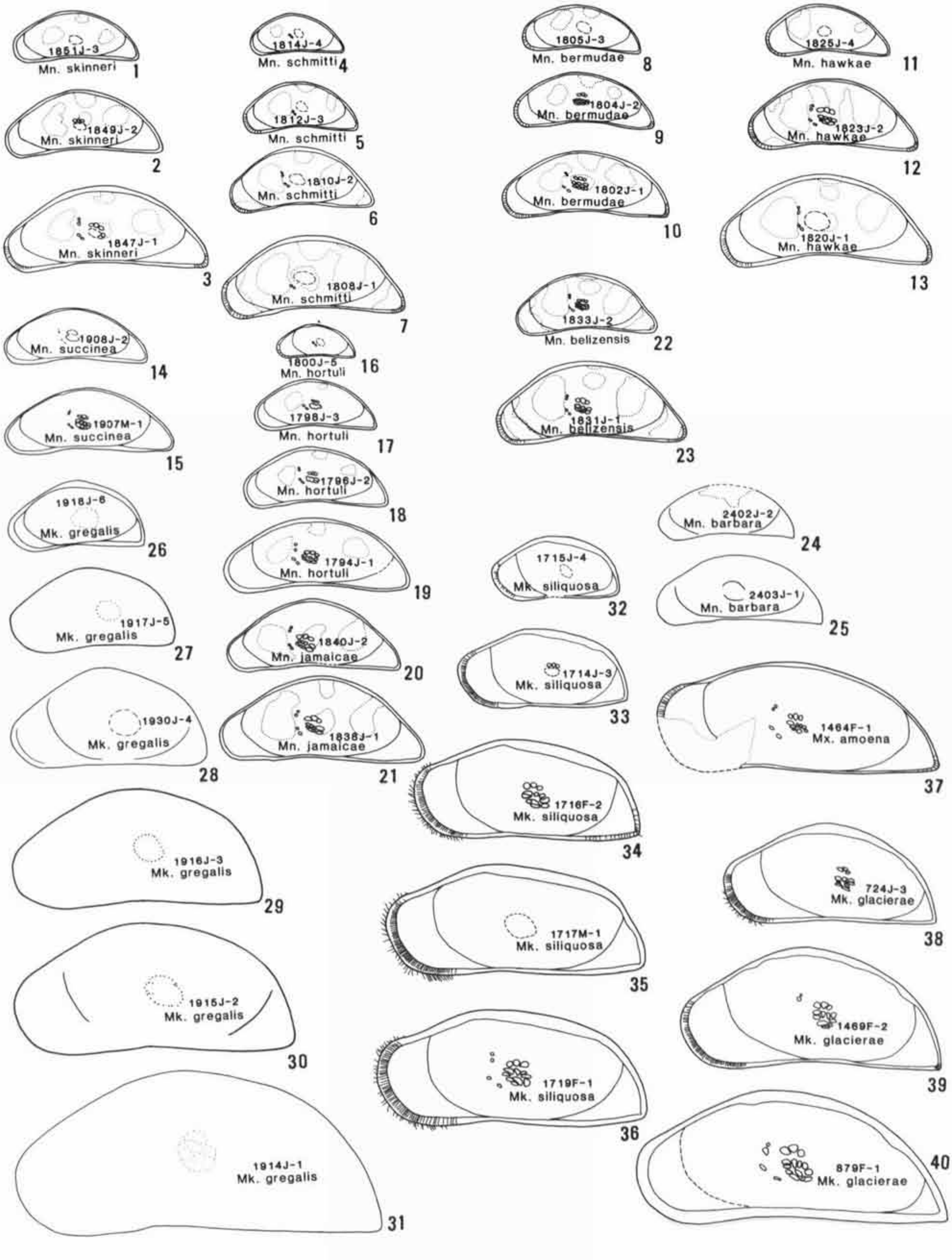

1851J-3
Mn. skinneri
1
1849J-2
Mn. skinneri
2
1847J-1
Mn. skinneri
3
1814J-4
Mn. schmitti
4
1812J-3
Mn. schmitti
5
1810J-2
Mn. schmitti
6
1808J-1
Mn. schmitti
7
1805J-3
Mn. bermudae
8
1804J-2
Mn. bermudae
9
1802J-1
Mn. bermudae
10
1825J-4
Mn. hawkae
11
1823J-2
Mn. hawkae
12
1820J-1
Mn. hawkae
13
1908J-2
Mn. succinea
14
1907M-1
Mn. succinea
15
1800J-5
Mn. hortuli
16
1798J-3
Mn. hortuli
17
1796J-2
Mn. hortuli
18
1794J-1
Mn. hortuli
19
1840J-2
Mn. jamaicae
20
1838J-1
Mn. jamaicae
21
1833J-2
Mn. belizensis
22
1831J-1
Mn. belizensis
23
2402J-2
Mn. barbara
24
2403J-1
Mn. barbara
25
1918J-6
Mk. gregalis
26
1917J-5
Mk. gregalis
27
1930J-4
Mk. gregalis
28
1916J-3
Mk. gregalis
29
1915J-2
Mk. gregalis
30
1914J-1
Mk. gregalis
31
1715J-4
Mk. siliquosa
32
1714J-3
Mk. siliquosa
33
1716F-2
Mk. siliquosa
34
1717M-1
Mk. siliquosa
35
1719F-1
Mk. siliquosa
36
1464F-1
Mx. amoena
37
724J-3
Mk. glacierae
38
1469F-2
Mk. glacierae
39
879F-1
Mk. glacierae
40

FIGURE 56

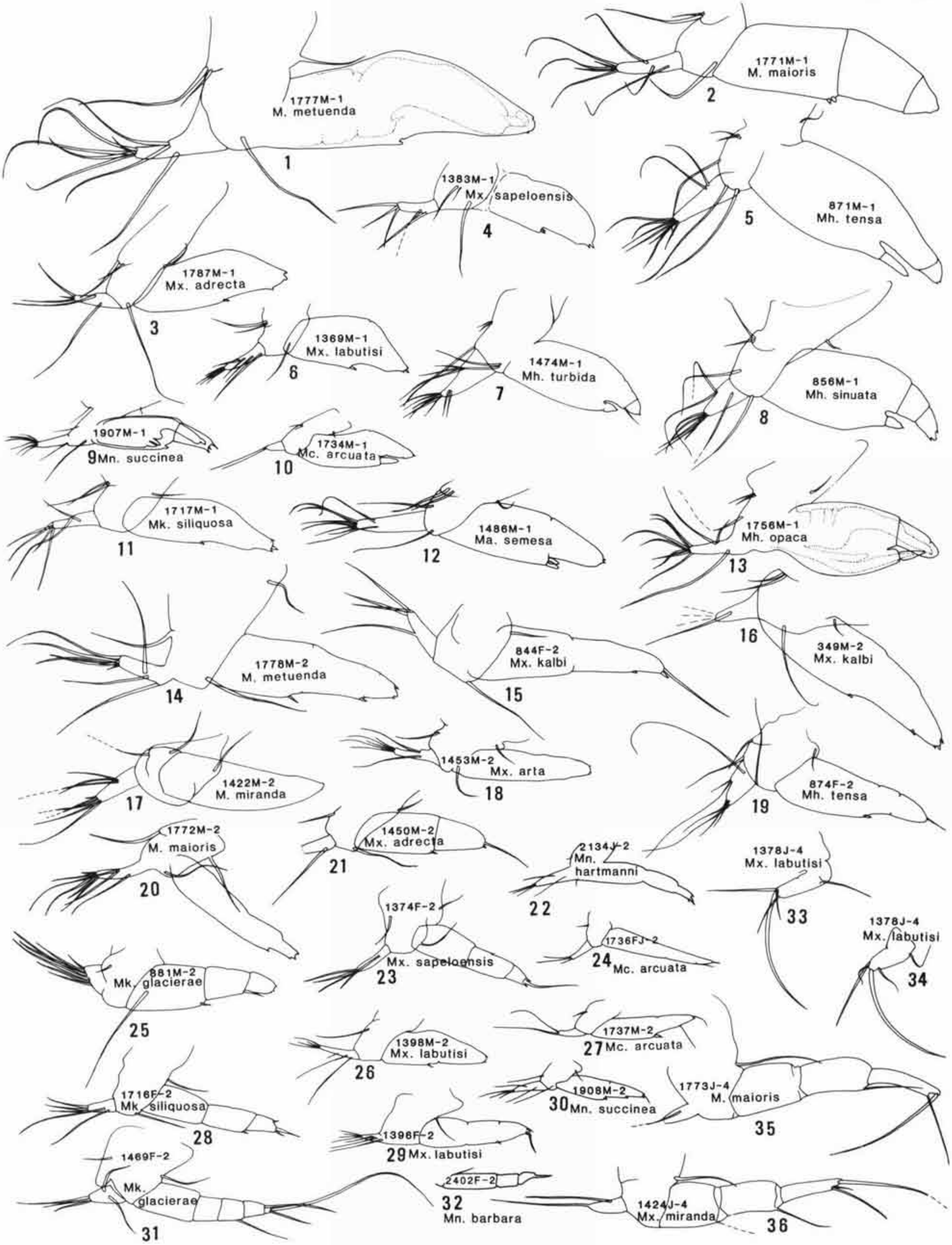

1777M-1
M. metuenda
1
1771M-1
M. maioris
2
1787M-1
Mx. adrecta
3
1383M-1
Mx. sapeloensis
4
871M-1
Mh. tensa
5
1369M-1
Mx. labutisi
6
1474M-1
Mh. turbida
7
856M-1
Mh. sinuata
8
1907M-1
9 Mn. succinea
1734M-1
Mc. arcuata
10
1717M-1
Mk. siliquosa
11
1486M-1
Ma. semesa
12
1756M-1
Mh. opaca
13
1778M-2
M. metuenda
14
844F-2
Mx. kalbi
15
16
349M-2
Mx. kalbi
1422M-2
M. miranda
17
1453M-2
Mx. arta
18
874F-2
Mh. tensa
19
1772M-2
M. maioris
20
1450M-2
Mx. adrecta
21
2134J-2
Mn.
hartmanni
22
1378J-4
Mx. labutisi
33
1374F-2
Mx. sapeloensis
23
1736FJ-2
24 Mc. arcuata
1378J-4
Mx. labutisi
34
881M-2
Mk. glacierae
25
1398M-2
Mx. labutisi
26
1737M-2
27 Mc. arcuata
1716F-2
Mk. siliquosa
28
1908M-2
30 Mn. succinea
1773J-4
M. maioris
35
1396F-2
29 Mx. labutisi
1469F-2
Mk.
glacierae
31
2402F-2
32
Mn. barbara
1424J-4
Mx. miranda
36

FIGURE 57

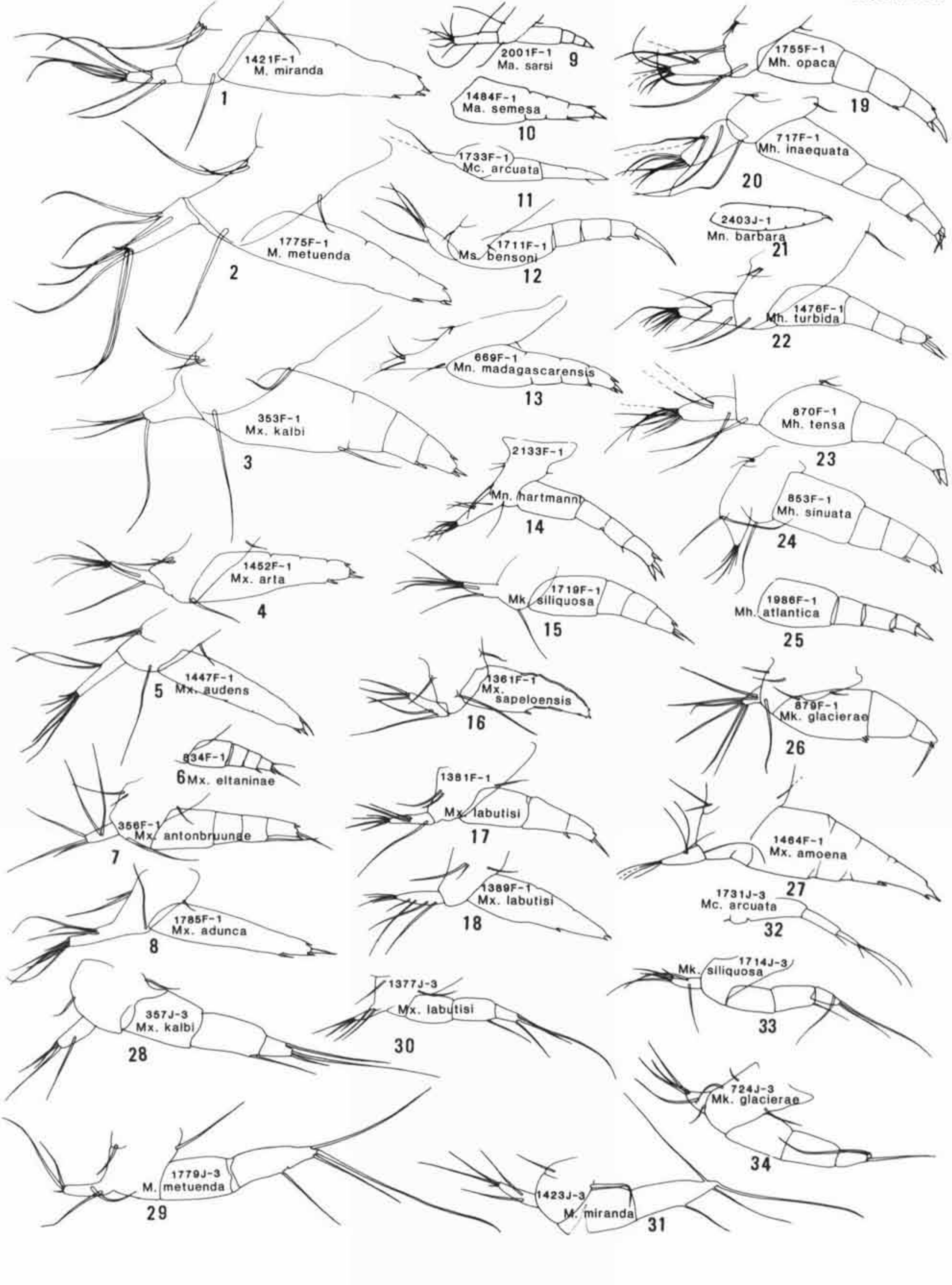

1
1421F-1
M. miranda
2
1775F-1
M. metuenda
3
353F-1
Mx. kalbi
4
1452F-1
Mx. arta
5
1447F-1
Mx. audens
6
834F-1
Mx. eltaninae
7
356F-1
Mx. antonbruunae
8
1785F-1
Mx. adunca
9
2001F-1
Ma. sarsi
10
1484F-1
Ma. semesa
11
1733F-1
Mc. arcuata
12
1711F-1
Ms. bensoni
13
669F-1
Mn. madagascarensis
14
2133F-1
Mn. hartmanni
15
1719F-1
Mk. siliquosa
16
1361F-1
Mx. sapeloensis
17
1381F-1
Mx. labutisi
18
1389F-1
Mx. labutisi
19
1755F-1
Mh. opaca
20
717F-1
Mh. inaequata
21
2403J-1
Mn. barbara
22
1476F-1
Mh. turbida
23
870F-1
Mh. tensa
24
853F-1
Mh. sinuata
25
1986F-1
Mh. atlantica
26
879F-1
Mk. glacierae
27
1464F-1
Mx. amoena
28
357J-3
Mx. kalbi
29
1779J-3
M. metuenda
30
1377J-3
Mx. labutisi
31
1423J-3
M. miranda
32
1731J-3
Mc. arcuata
33
1714J-3
Mk. siliquosa
34
724J-3
Mk. glacierae

FIGURE 58

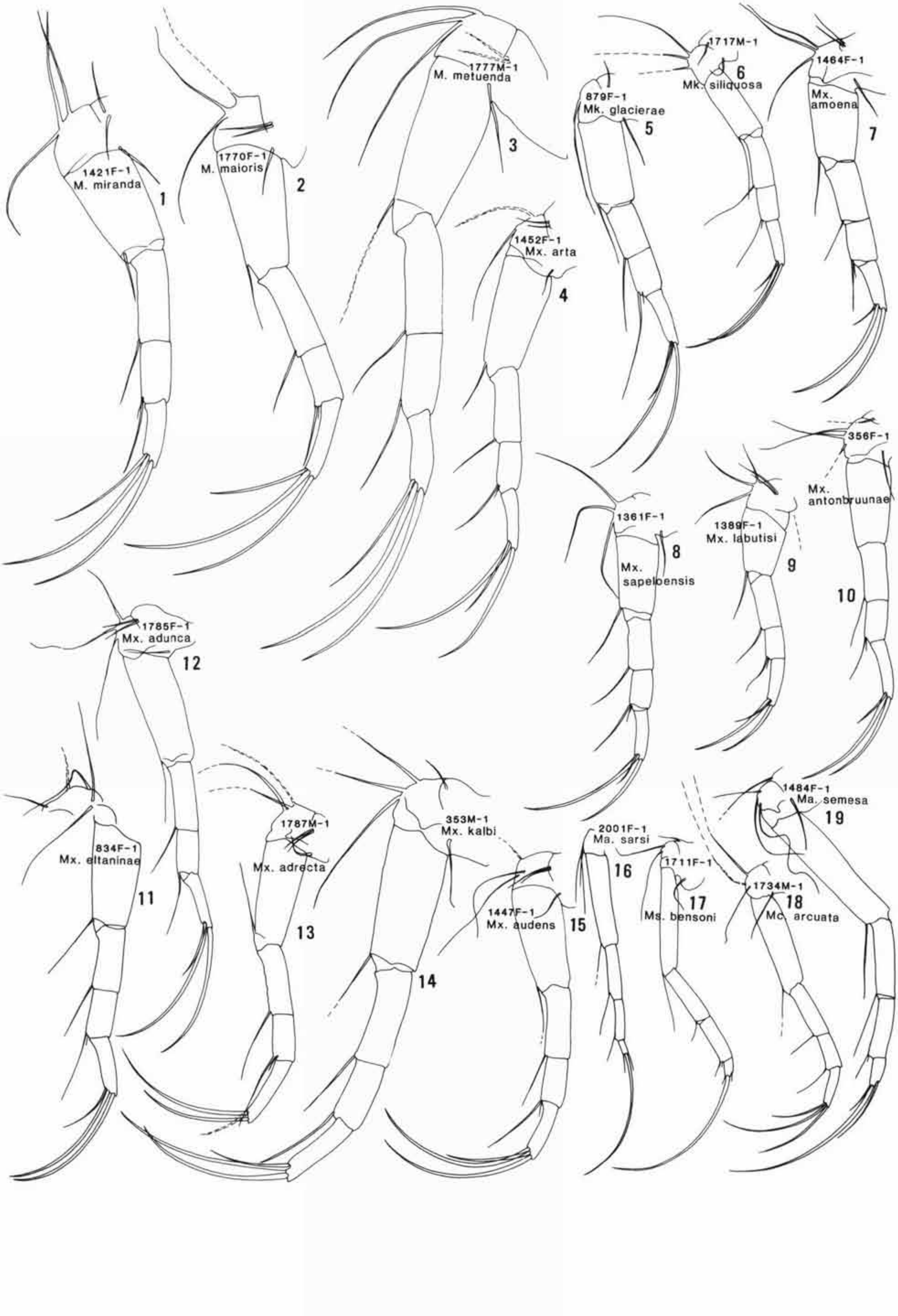
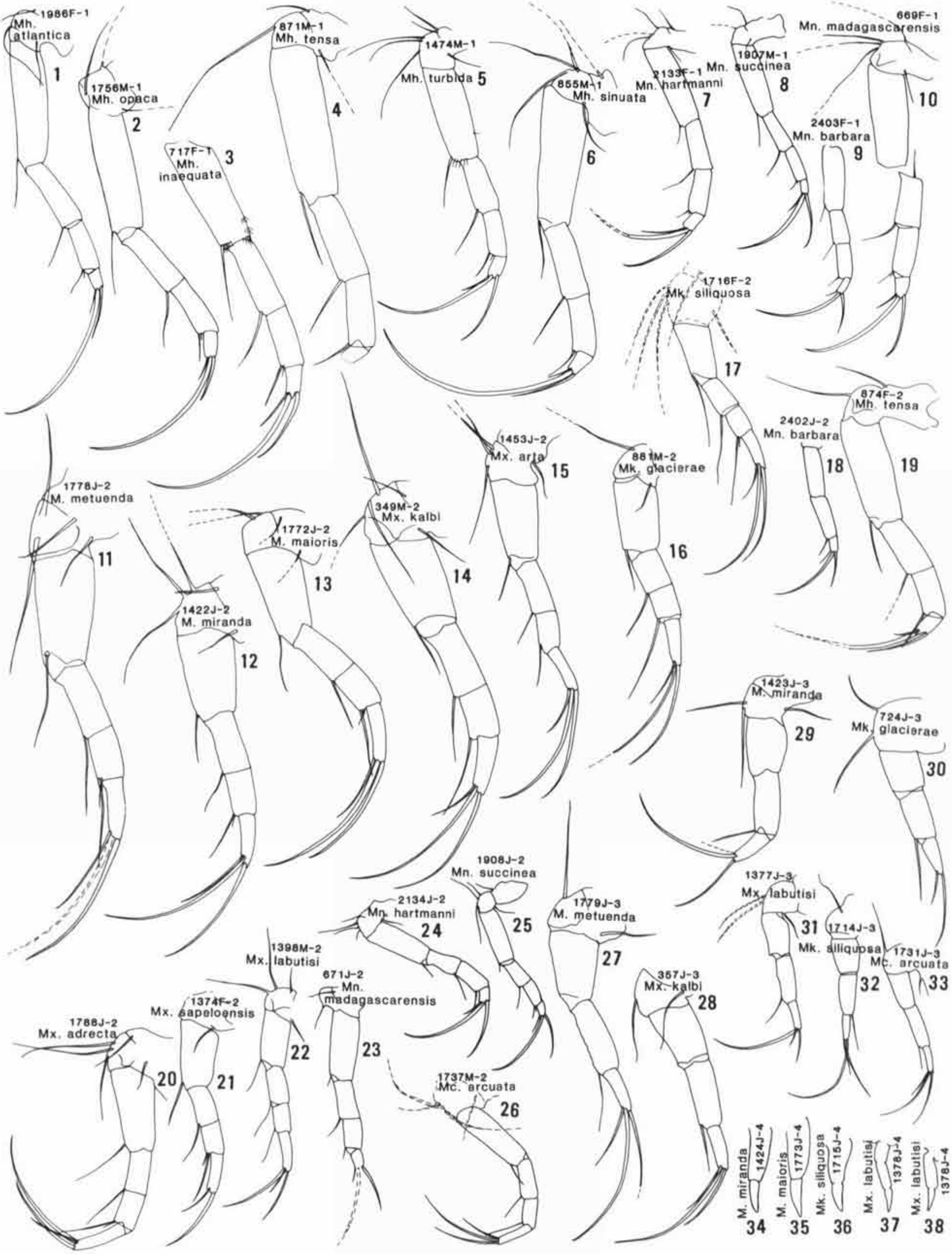

1421F-1
M. miranda
1
1770F-1
M. maioris
2
1777M-1
M. metuenda
3
1452F-1
Mx. arta
4
879F-1
Mk. glacierae
5
1717M-1
Mk. siliquosa
6
1464F-1
Mx.
amoena
7
1361F-1
Mx.
sapeloensis
8
1389F-1
Mx. labutisi
9
356F-1
Mx.
antonbruunae
10
834F-1
Mx. eltaninae
11
1785F-1
Mx. adunca
12
1787M-1
Mx. adrecta
13
353M-1
Mx. kalbi
14
1447F-1
Mx. audens
15
2001F-1
Ma. sarsi
16
1711F-1
Ms. bensoni
17
1734M-1
Mc. arcuata
18
1484F-1
Ma. semesa
19

FIGURE 59


1986F-1
Mh. atlantica
1
1756M-1
Mh. opaca
2
717F-1
Mh. inaequata
3
871M-1
Mh. tensa
4
1474M-1
Mh. turbida
5
855M-1
Mh. sinuata
6
2133F-1
Mn. hartmanni
7
1907M-1
Mn. succinea
8
2403F-1
Mn. barbara
9
669F-1
Mn. madagascarensis
10
1778J-2
M. metuenda
11
1422J-2
M. miranda
12
1772J-2
M. maioris
13
349M-2
Mx. kalbi
14
1453J-2
Mx. arta
15
881M-2
Mk. glacierae
16
1716F-2
Mk. siliquosa
17
2402J-2
Mn. barbara
18
874F-2
Mh. tensa
19
1788J-2
Mx. adrecta
20
1374F-2
Mx. sapeloensis
21
1398M-2
Mx. labutisi
22
671J-2
Mn. madagascarensis
23
2134J-2
Mn. hartmanni
24
1908J-2
Mn. succinea
25
1737M-2
Mc. arcuata
26
1779J-3
M. metuenda
27
357J-3
Mx. kalbi
28
1423J-3
M. miranda
29
724J-3
Mk. glacierae
30
1377J-3
Mx. labutisi
31
1714J-3
Mk. siliquosa
32
1731J-3
Mc. arcuata
33
M. miranda
1424J-4
34
M. maioris
1773J-4
35
Mk. siliquosa
1715J-4
36
Mx. labutisi
1378J-4
37
Mx. labutisi
1378J-4
38

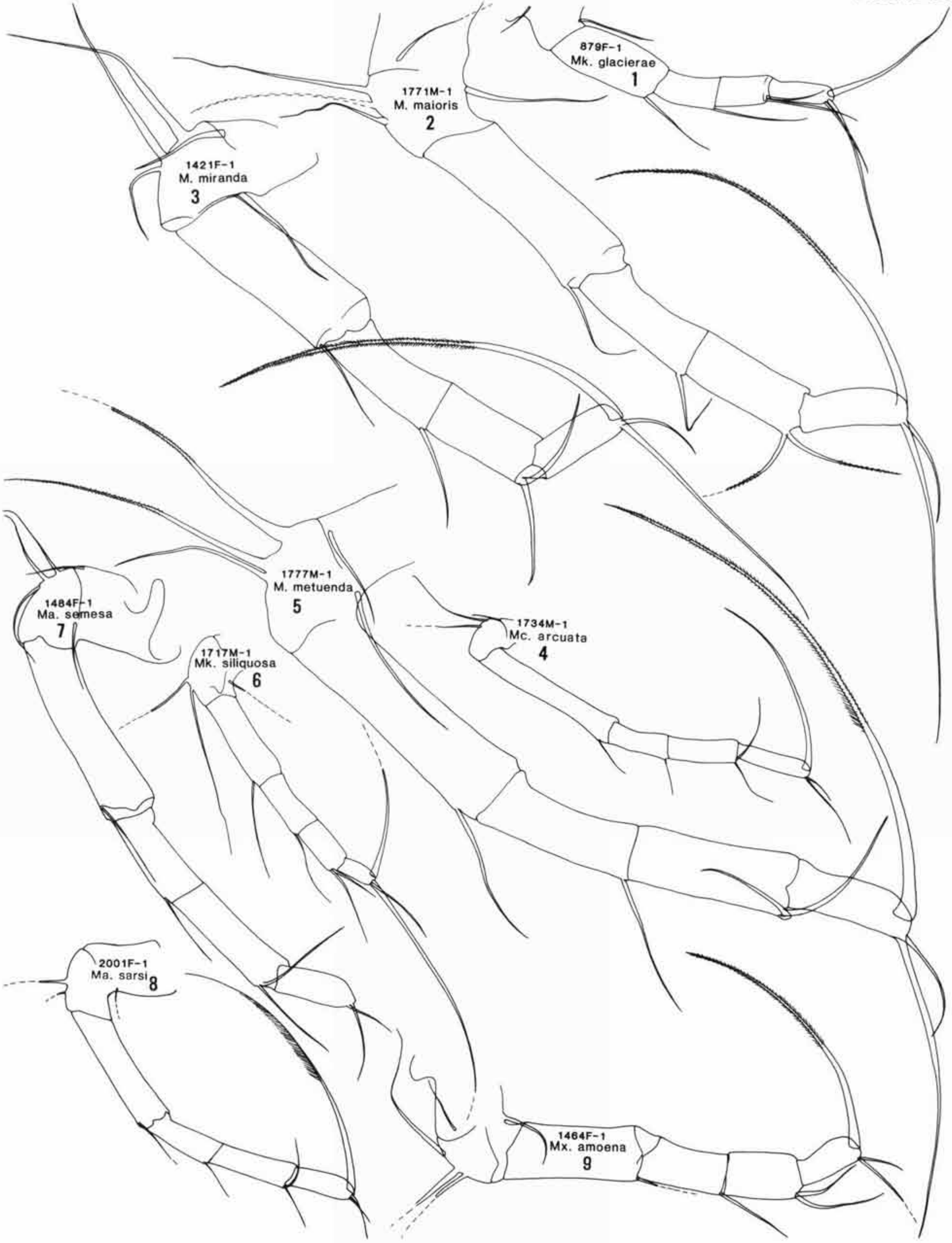

879F-1
Mk. glacierae
1
1771M-1
M. maioris
2
1421F-1
M. miranda
3
1734M-1
Mc. arcuata
4
1777M-1
M. metuenda
5
1717M-1
Mk. siliquosa
6
1484F-1
Ma. semesa
7
2001F-1
Ma. sarsi
8
1464F-1
Mx. amoena
9

FIGURE 61


353M-1
Mx. kalbi
2
356F-1
Mx.
antonbruunae
1
835F-1
Mx. eltaninae
3
1785F-1
Mx. adunca
5
1369M-1
Mx. labutisi
4
1447F-1
Mx. audens
7
1383M-1
Mx. sapeloensis
6
1787M-1
Mx. adrecta
8
1452F-1
Mx. arta
9

FIGURE 62

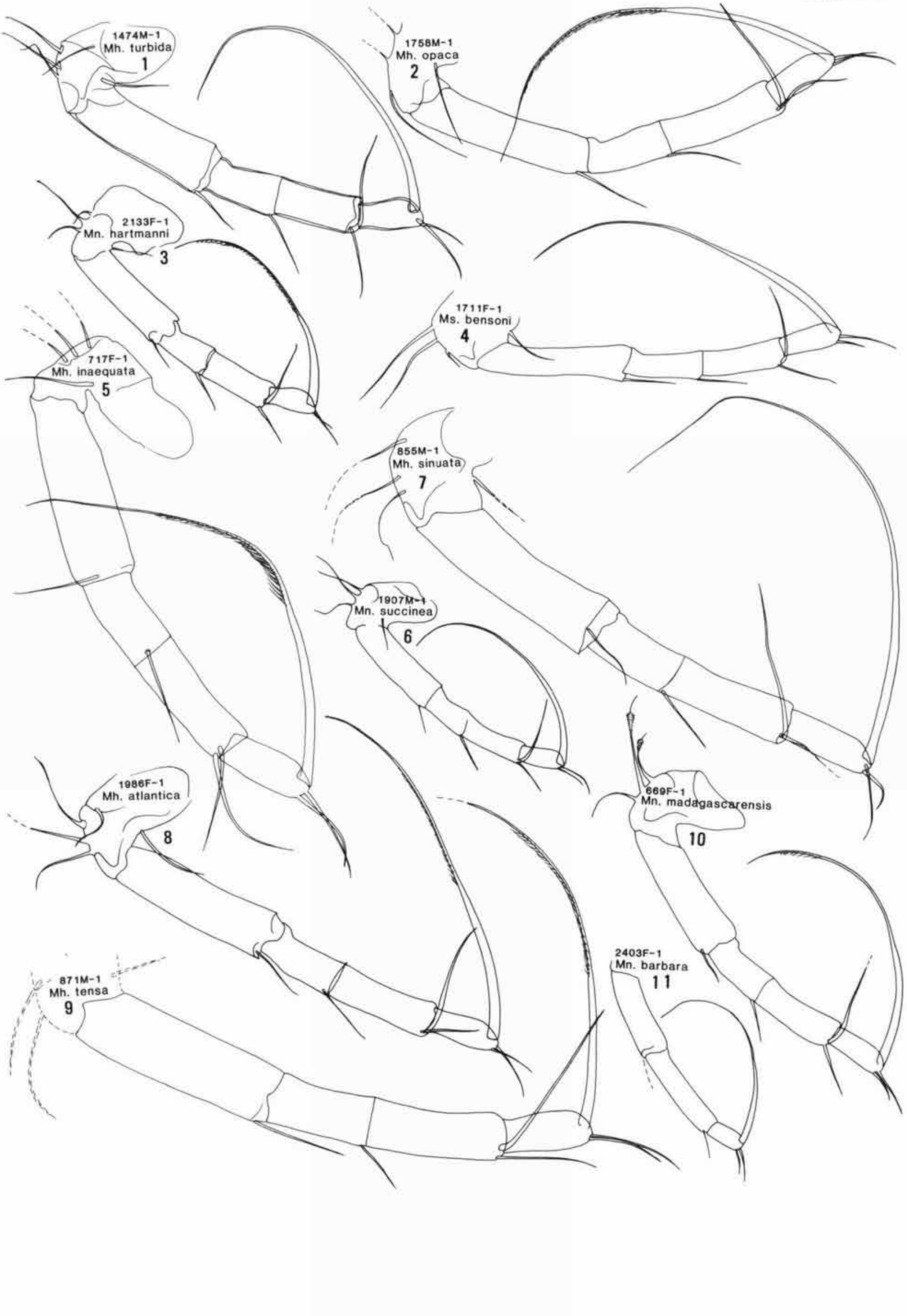

1474M-1
Mh. turbida
1
1758M-1
Mh. opaca
2
2133F-1
Mn. hartmanni
3
1711F-1
Ms. bensoni
4
717F-1
Mh. inaequata
5
855M-1
Mh. sinuata
7
1907M-1
Mn. succinea
6
1986F-1
Mh. atlantica
8
669F-1
Mn. madagascarensis
10
2403F-1
Mn. barbara
11
871M-1
Mh. tensa
9

FIGURE 63

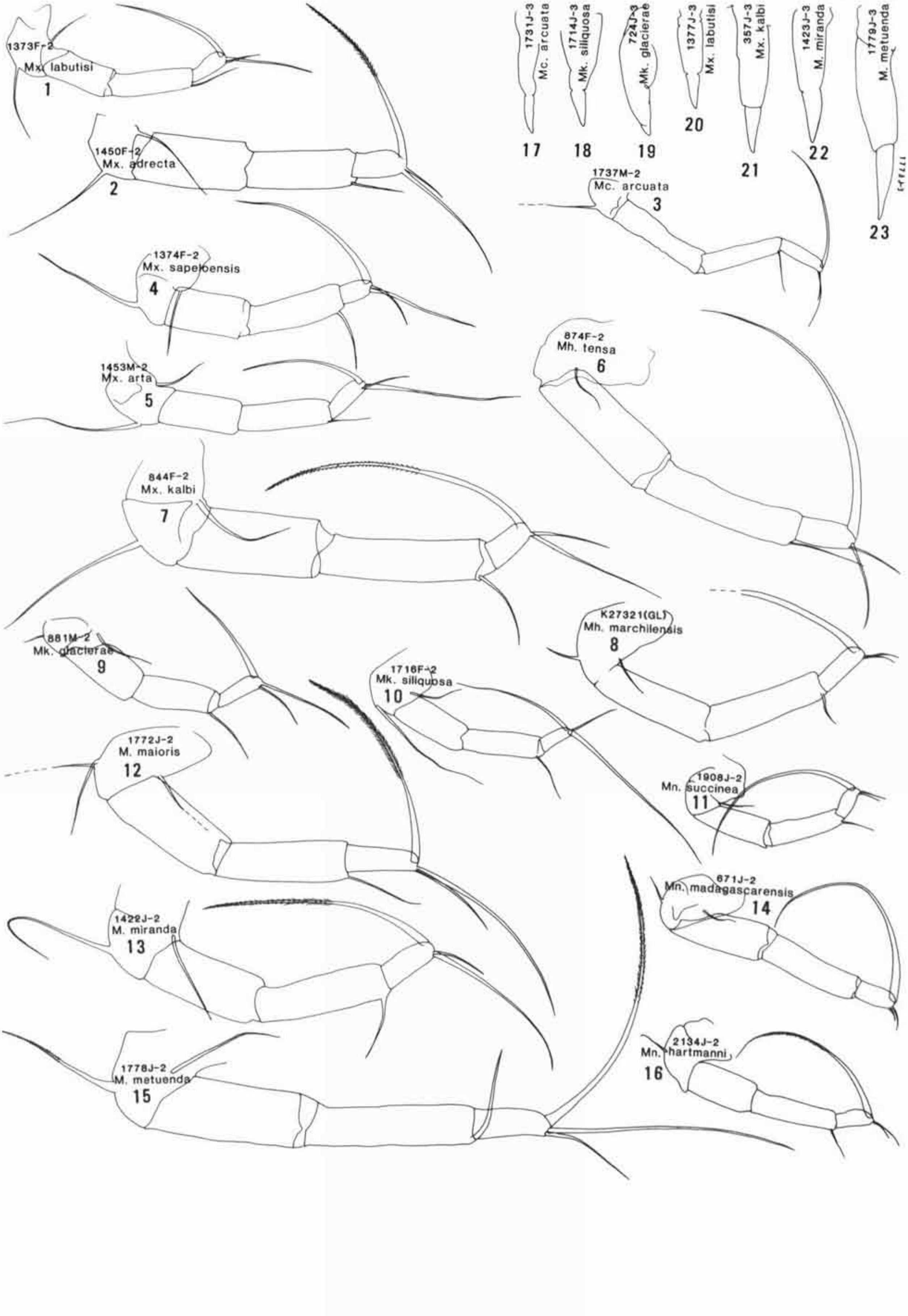

1373F-2
Mx. labutisi
1
1450F-2
Mx. adrecta
2
1737M-2
Mc. arcuata
3
1374F-2
Mx. sapeloensis
4
1453M-2
Mx. arta
5
874F-2
Mh. tensa
6
844F-2
Mx. kalbi
7
K27321(GL)
Mh. marchilensis
8
881M-2
Mk. glacierae
9
1716F-2
Mk. siliquosa
10
1908J-2
Mn. succinea
11
1772J-2
M. maioris
12
1422J-2
M. miranda
13
671J-2
Mn. madagascarensis
14
1778J-2
M. metuenda
15
2134J-2
Mn. hartmanni
16
1731J-3
Mc. arcuata
17
1714J-3
Mk. siliquosa
18
724J-3
Mk. glacierae
19
1377J-3
Mx. labutisi
20
357J-3
Mx. kalbi
21
1423J-3
M. miranda
22
1779J-3
M. metuenda
23

FIGURE 64

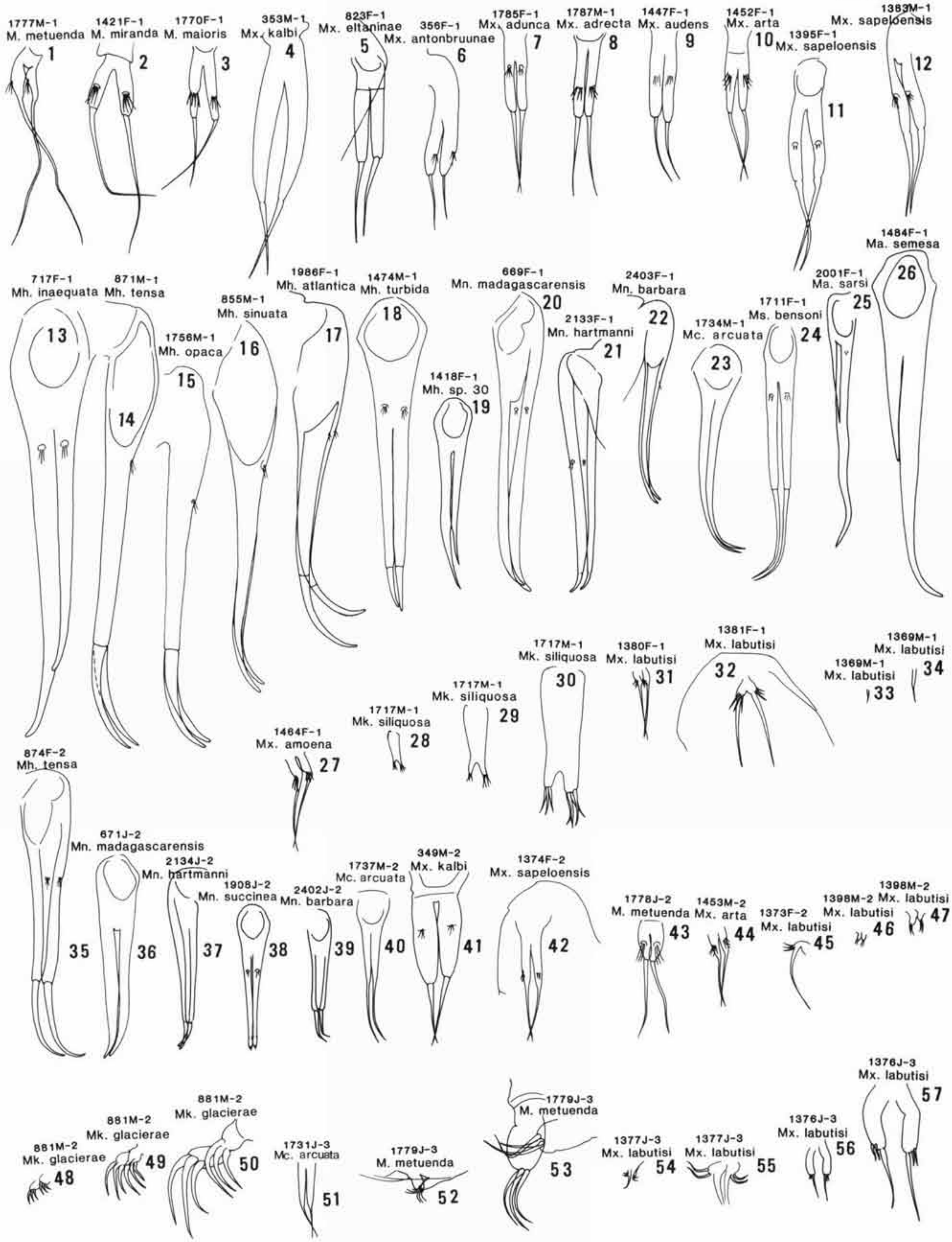

1777M-1
M. metuenda
1
1421F-1
M. miranda
2
1770F-1
M. maioris
3
353M-1
Mx. kalbi
4
823F-1
Mx. eltaninae
5
356F-1
Mx. antonbruunae
6
1785F-1
Mx. adunca
7
1787M-1
Mx. adrecta
8
1447F-1
Mx. audens
9
1452F-1
Mx. arta
10
1395F-1
Mx. sapeloensis
11
1383M-1
Mx. sapeloensis
12
717F-1
Mh. inaequata
13
871M-1
Mh. tensa
14
1756M-1
Mh. opaca
15
855M-1
Mh. sinuata
16
1986F-1
Mh. atlantica
17
1474M-1
Mh. turbida
18
1418F-1
Mh. sp. 30
19
669F-1
Mn. madagascarensis
20
2133F-1
Mn. hartmanni
21
2403F-1
Mn. barbara
22
1734M-1
Mc. arcuata
23
1711F-1
Ms. bensoni
24
2001F-1
Ma. sarsi
25
1484F-1
Ma. semesa
26
1464F-1
Mx. amoena
27
1717M-1
Mk. siliquosa
28
1717M-1
Mk. siliquosa
29
1717M-1
Mk. siliquosa
30
1380F-1
Mx. labutisi
31
1381F-1
Mx. labutisi
32
1369M-1
Mx. labutisi
33
1369M-1
Mx. labutisi
34
874F-2
Mh. tensa
35
671J-2
Mn. madagascarensis
36
2134J-2
Mn. hartmanni
37
1908J-2
Mn. succinea
38
2402J-2
Mn. barbara
39
1737M-2
Mc. arcuata
40
349M-2
Mx. kalbi
41
1374F-2
Mx. sapeloensis
42
1778J-2
M. metuenda
43
1453M-2
Mx. arta
44
1373F-2
Mx. labutisi
45
1398M-2
Mx. labutisi
46
1398M-2
Mx. labutisi
47
881M-2
Mk. glacierae
48
881M-2
Mk. glacierae
49
881M-2
Mk. glacierae
50
1731J-3
Mc. arcuata
51
1779J-3
M. metuenda
52
1779J-3
M. metuenda
53
1377J-3
Mx. labutisi
54
1377J-3
Mx. labutisi
55
1376J-3
Mx. labutisi
56
1376J-3
Mx. labutisi
57
]

FIGURE 65

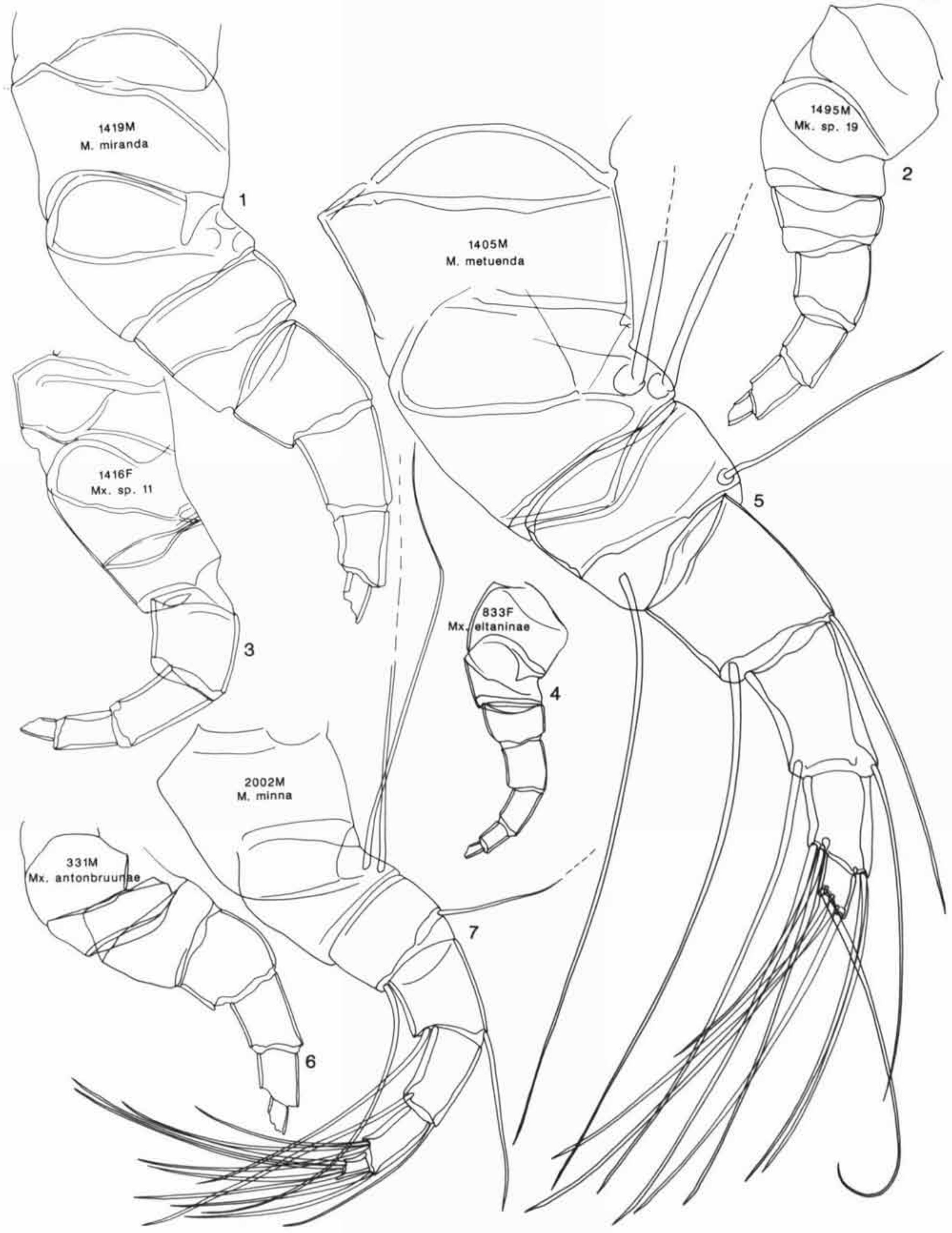

1419M
M. miranda
1
1495M
Mk. sp. 19
2
1405M
M. metuenda
1416F
Mx. sp. 11
5
833F
Mx. eltaninae
3
4
2002M
M. minna
331M
Mx. antonbruunae
7
6

FIGURE 66

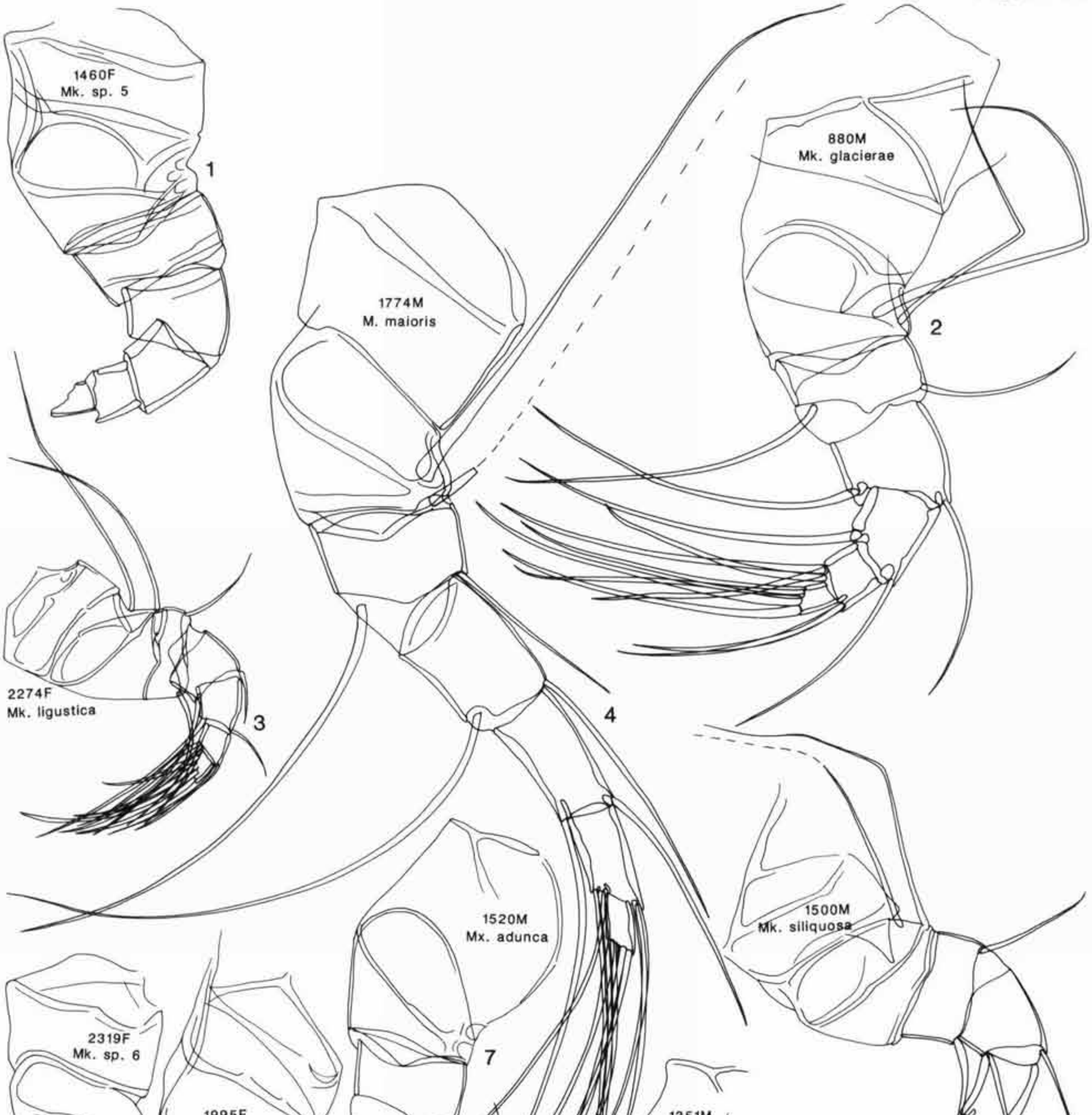

1460F
Mk. sp. 5
1
880M
Mk. glacierae
2
1774M
M. maioris
2274F
Mk. ligustica
3
4
1520M
Mx. adunca
1500M
Mk. siliquosa
2319F
Mk. sp. 6
1995F
Mk. sp. 3
7
6
1351M
Mx. labutisi
5
8
9

FIGURE 67

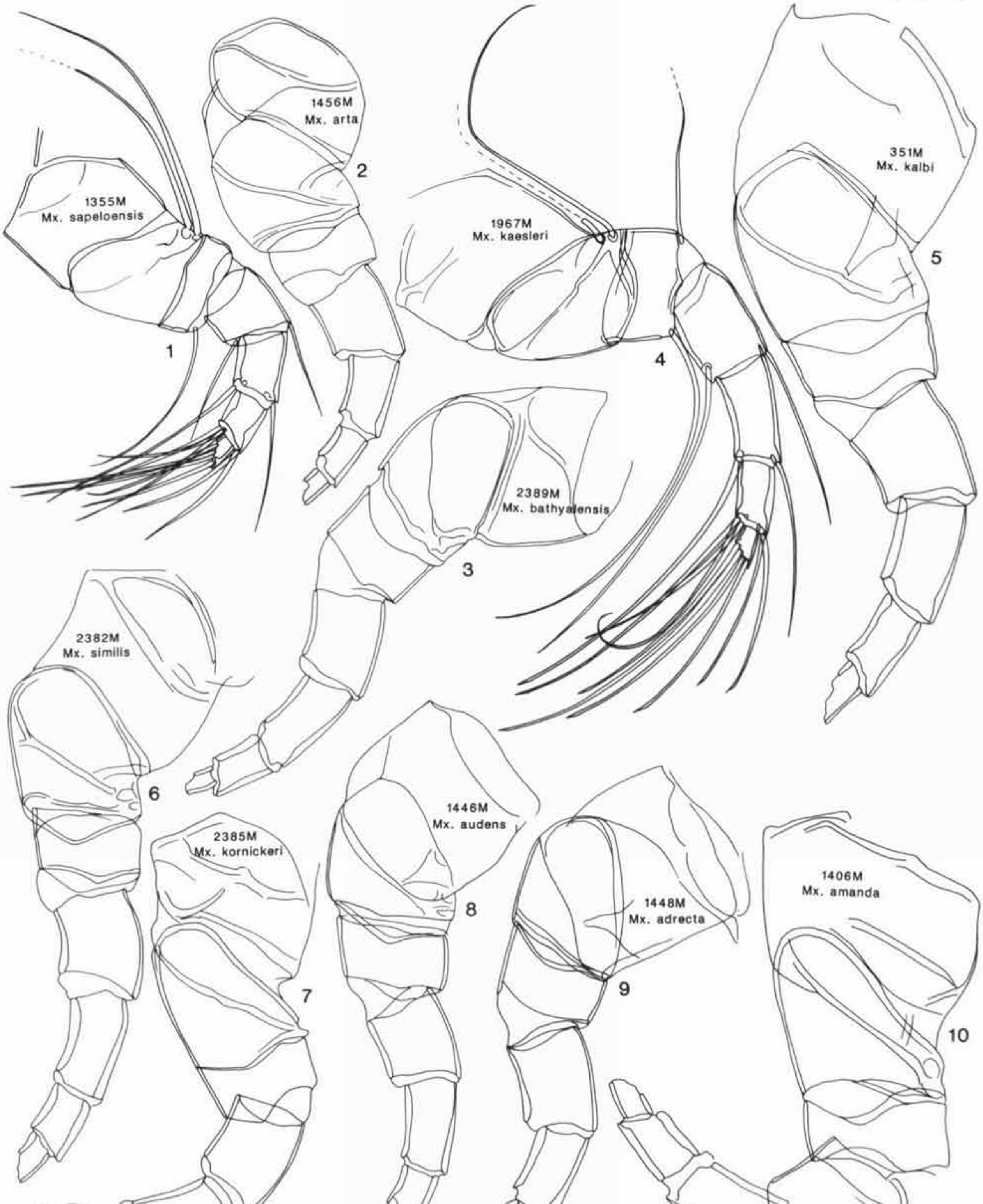

1
1355M
Mx. sapeloensis
2
1456M
Mx. arta
3
2389M
Mx. bathyalensis
4
1967M
Mx. kaesleri
5
351M
Mx. kalbi
6
2382M
Mx. similis
7
2385M
Mx. kornickeri
8
1446M
Mx. audens
9
1448M
Mx. adrecta
10
1406M
Mx. amanda

FIGURE 68

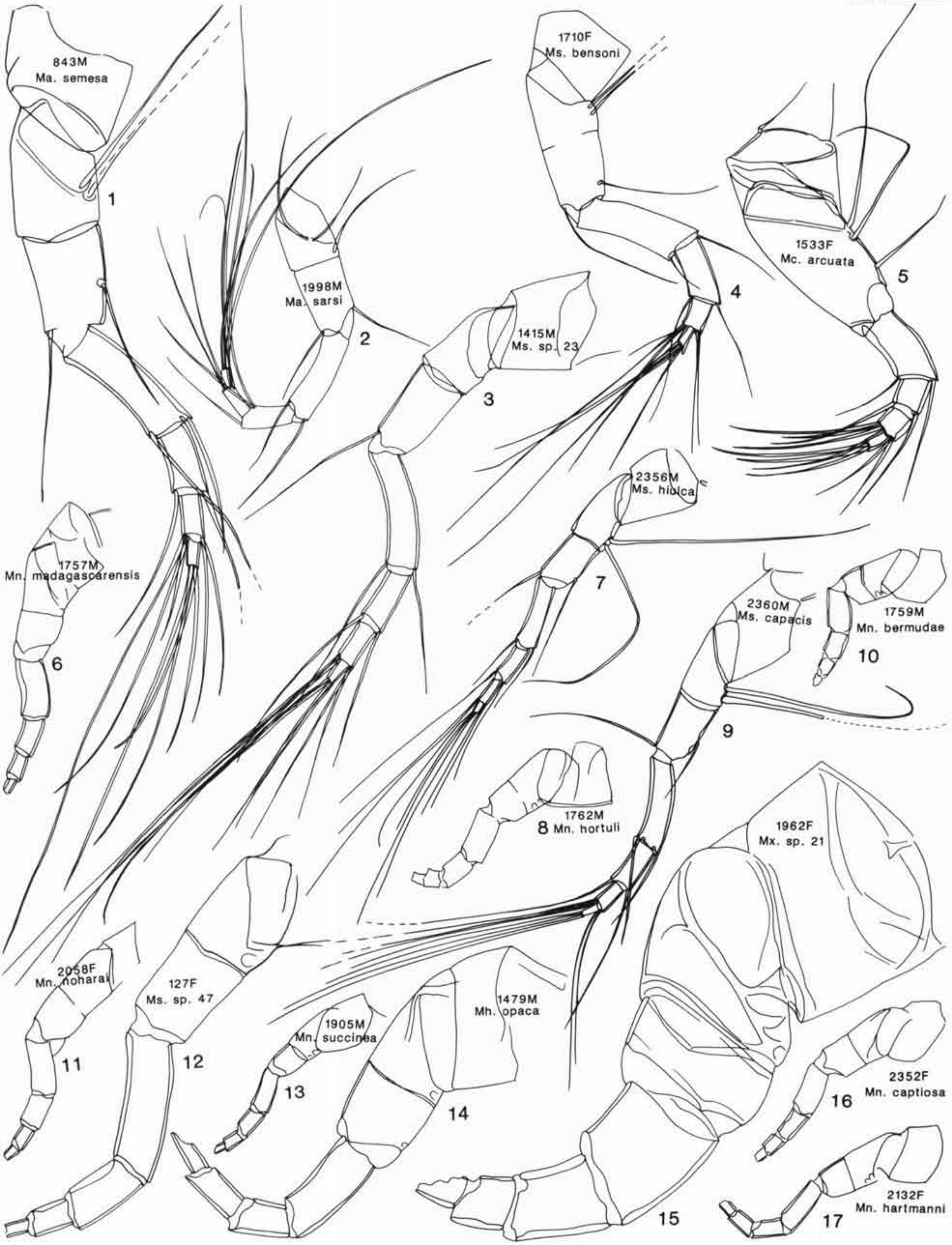

843M
Ma. semesa
1
1998M
Ma. sarsi
2
1415M
Ms. sp. 23
3
1710F
Ms. bensoni
4
1533F
Mc. arcuata
5
1757M
Mn. madagascarensis
6
2356M
Ms. hiulca
7
1762M
8 Mn. hortuli
2360M
Ms. capacis
9
1759M
Mn. bermudae
10
2058F
Mn. noharai
11
127F
Ms. sp. 47
12
1905M
Mn. succinea
13
1479M
Mh. opaca
14
1962F
Mx. sp. 21
15
2352F
Mn. captiosa
16
2132F
Mn. hartmanni
17

FIGURE 69


1982M
Mh. atlantica
1
1940M
Mh. inaequalis
2
1943M
Mh. turbida
3
Xe3367F
Mn. propinqua
4
1933M
Mn. dispar
7
1937M
Mn. africana
5
2365M
Mn. moza
6
1817M
Mn. hawkae
8
845M
Mh. sinuata
714M
Mh. inaequata
13
14
1909M
Mn. skinneri
861M
Mh. tensa
12
15
2400M
Mn. barbara
9
198M
Mh. sp. 25
11
1538M
Mn. schmitti
10

FIGURE 70

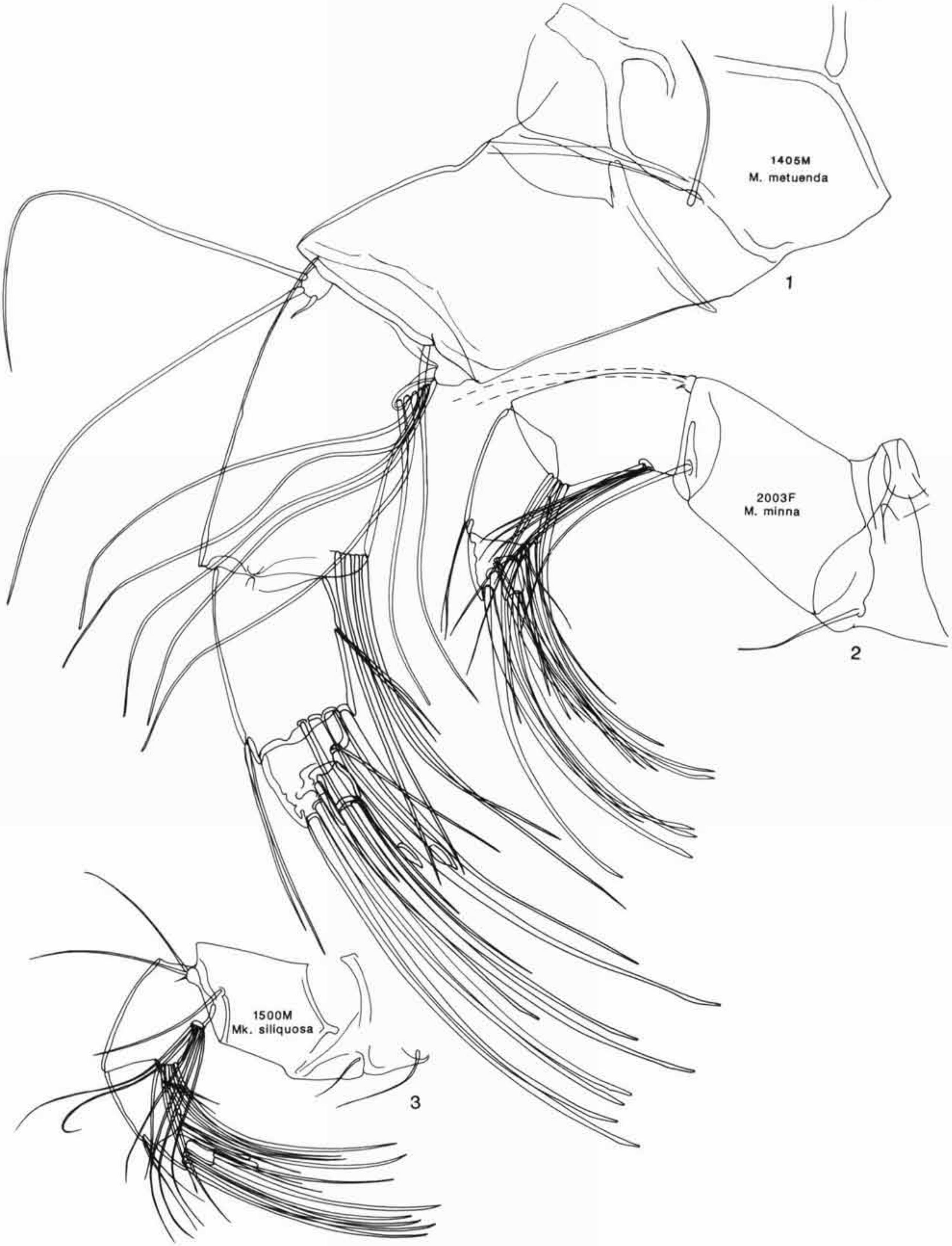


FIGURE 71


1
880M
Mk. glacierae
2
1774M
M. maioris
1355M
Mx. sapeloensis
3
1357F
Mx. sapeloensis
4
1967M
Mx. kaesleri
5

FIGURE 72

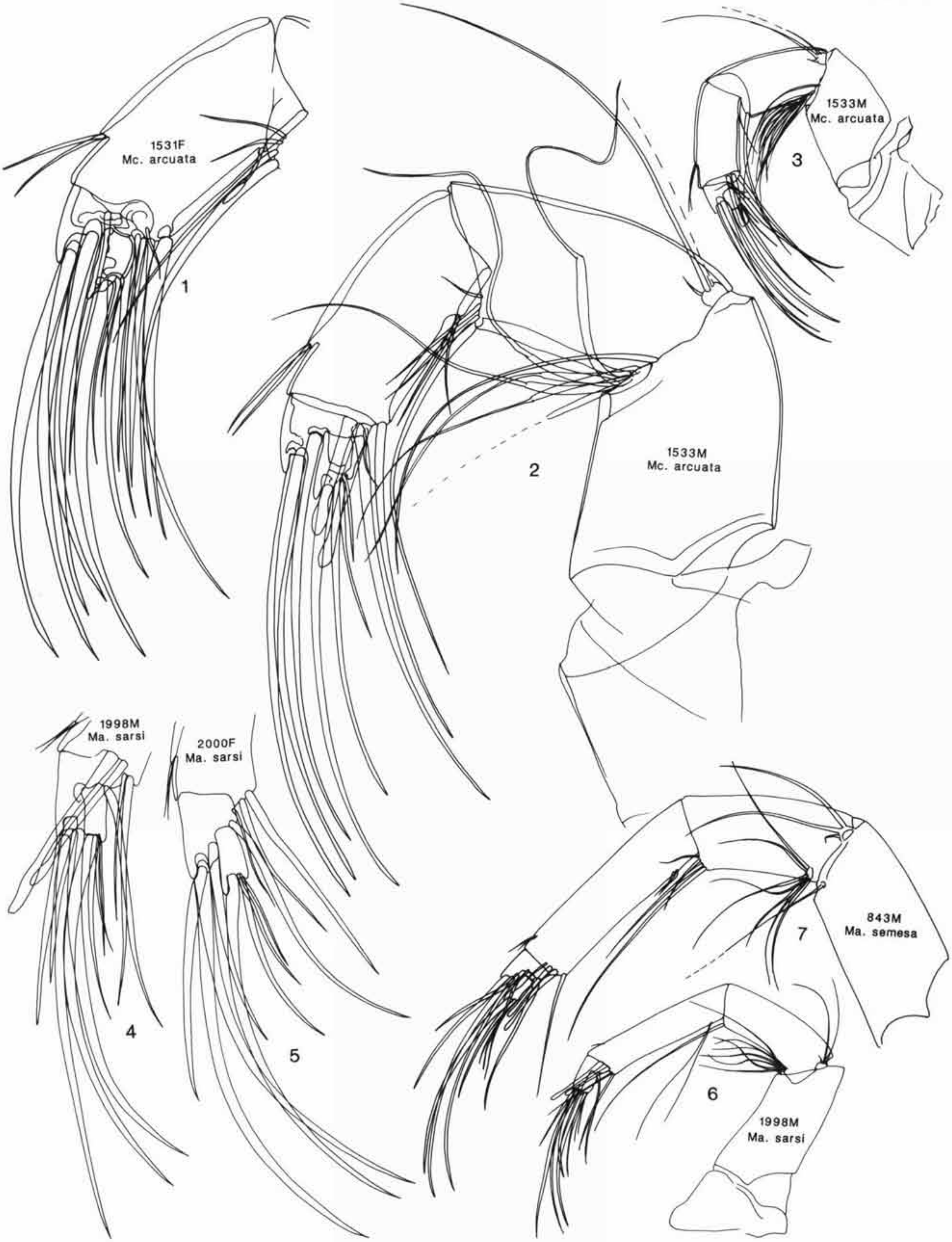

1531F
Mc. arcuata
1
1533M
Mc. arcuata
2
1533M
Mc. arcuata
3
1998M
Ma. sarsi
4
2000F
Ma. sarsi
5
843M
Ma. semesa
7
6
1998M
Ma. sarsi

FIGURE 73

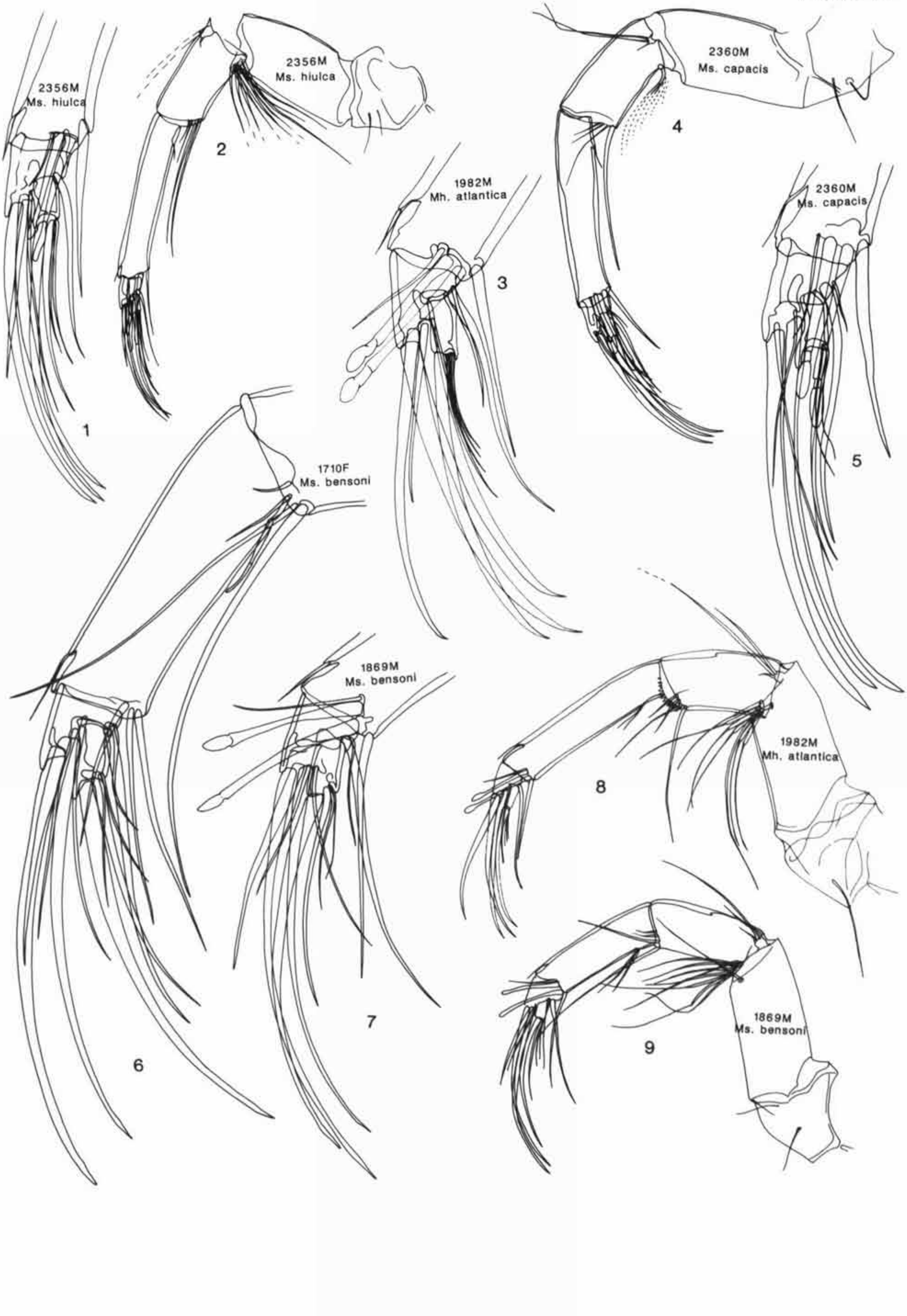

2356M
Ms. hiulca
1
2356M
Ms. hiulca
2
1982M
Mh. atlantica
3
2360M
Ms. capacis
4
2360M
Ms. capacis
5
1710F
Ms. bensoni
6
1869M
Ms. bensoni
7
1982M
Mh. atlantica
8
1869M
Ms. bensoni
9

FIGURE 74

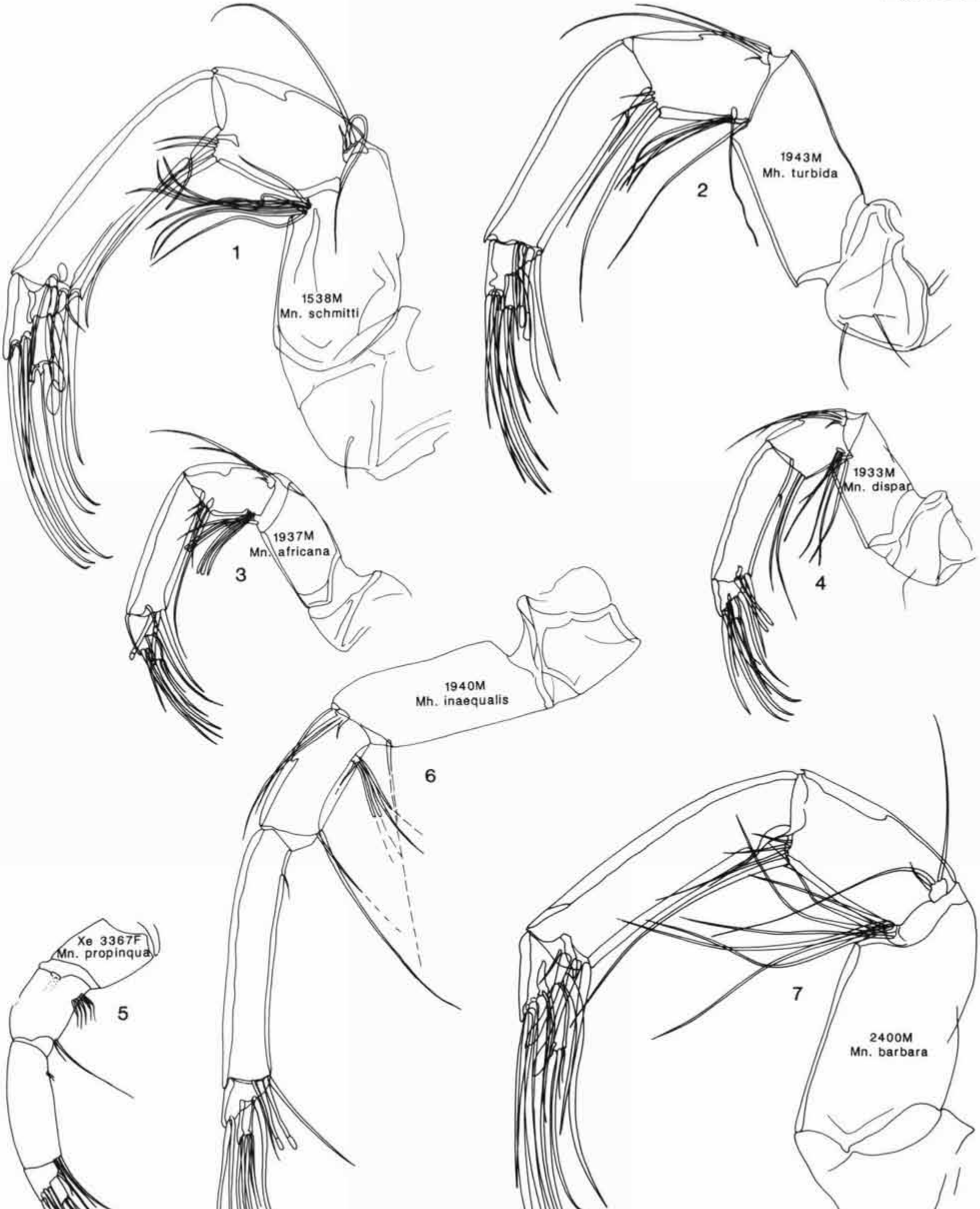

1
1538M
Mn. schmitti
2
1943M
Mh. turbida
3
1937M
Mn. africana
4
1933M
Mn. dispar
5
Xe 3367F
Mn. propinqua
6
1940M
Mh. inaequalis
7
2400M
Mn. barbara

FIGURE 75

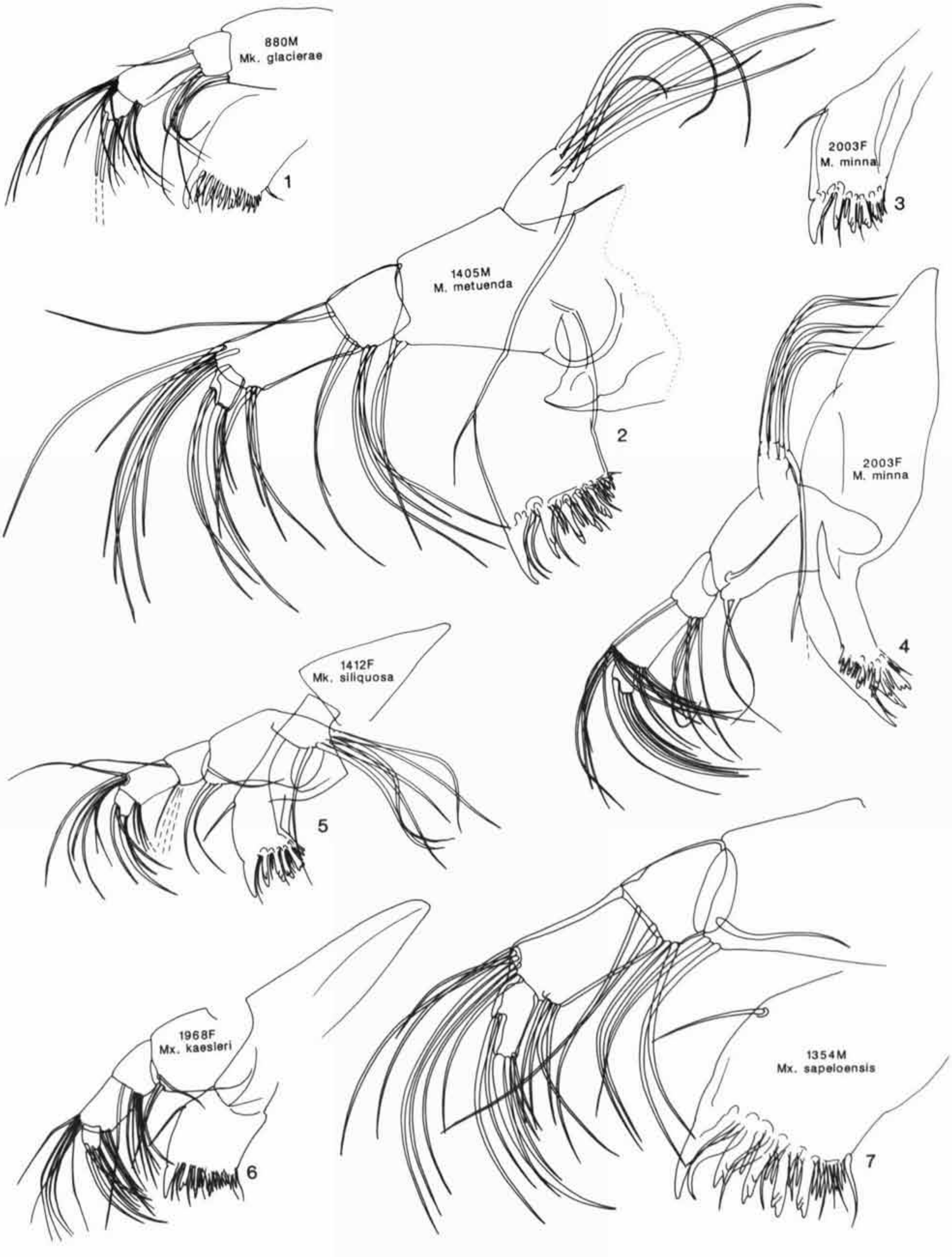

880M
Mk. glacierae
1
1405M
M. metuenda
2
2003F
M. minna
3
2003F
M. minna
4
1412F
Mk. siliquosa
5
1968F
Mx. kaesleri
6
1354M
Mx. sapeloensis
7

FIGURE 76

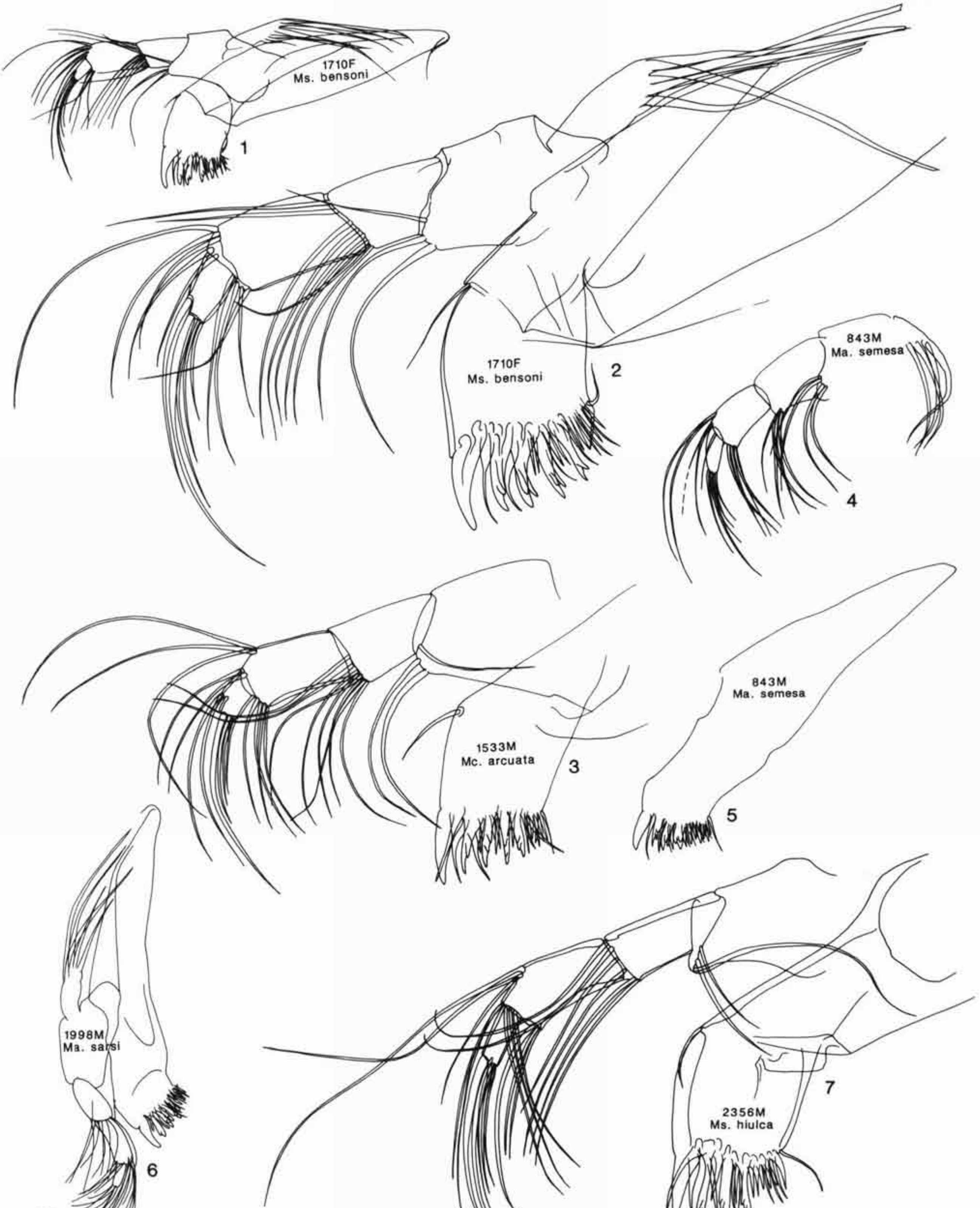
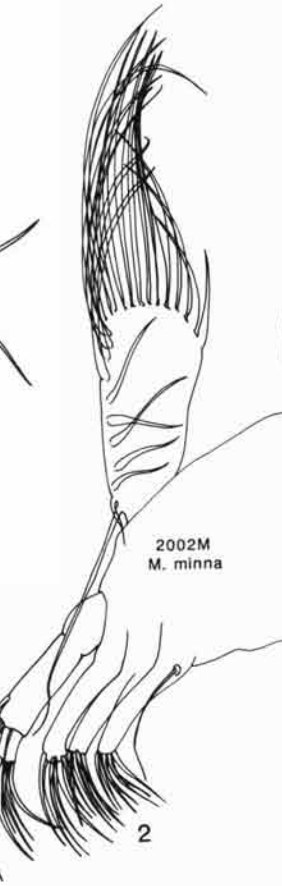

1710F
Ms. bensoni
1
1710F
Ms. bensoni
2
843M
Ma. semesa
4
1533M
Mc. arcuata
3
843M
Ma. semesa
5
1998M
Ma. sarsi
6
7
2356M
Ms. hiulca

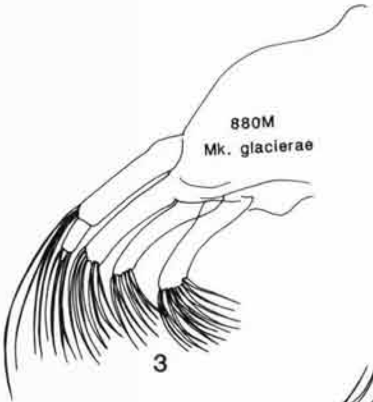
FIGURE 77

Xe3368M
Mn. propinqua
1
1538M
Mn. schmitti
4
1937M
Mn. africana
2
2400M
Mn. barbara
5
1933M
Mn. dispar
3
1982M
Mh. atlantica
7
1943M
Mh. turbida
6
1940M
Mh. inaequalis
8
1982M
Mh. atlantica
9

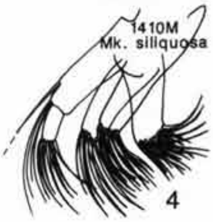
1



2

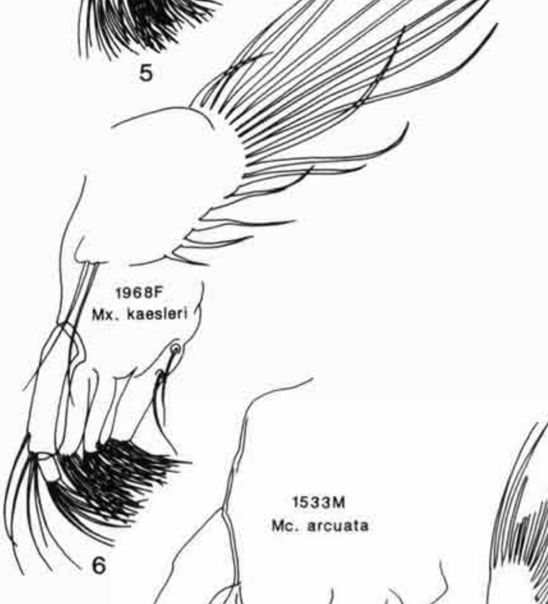


3



4

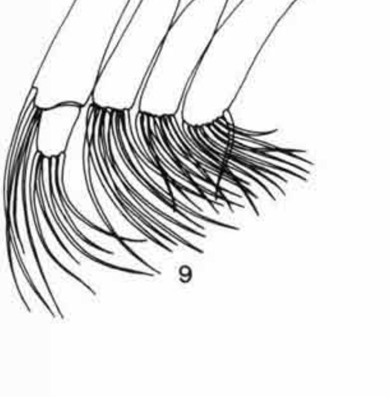
5



6

7

8



9

10

FIGURE 79

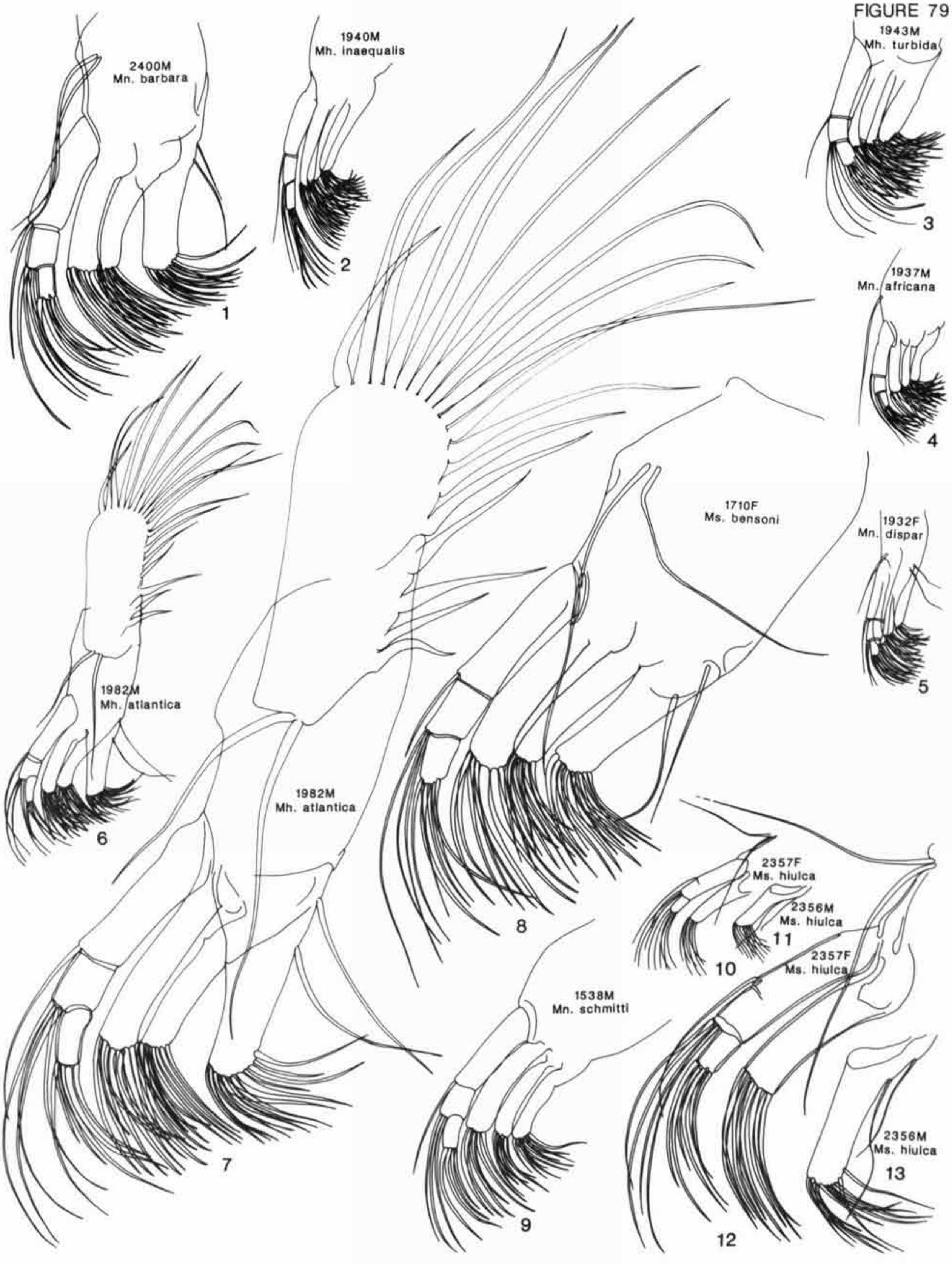
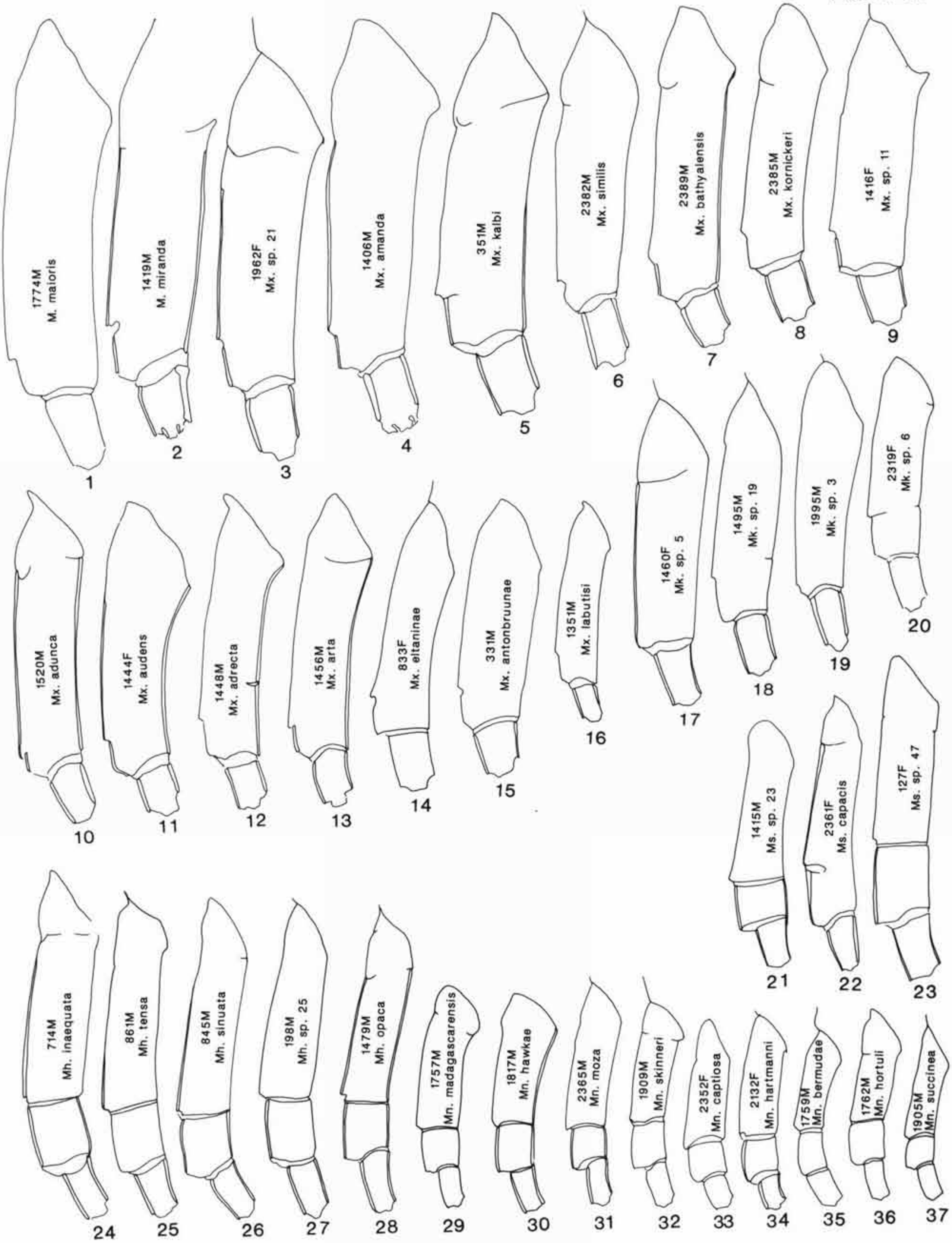

2400M
Mn. barbara
1
1940M
Mh. inaequalis
2
1943M
Mh. turbida
3
1937M
Mn. africana
4
1710F
Ms. bensoni
1932F
Mn. dispar
5
1982M
Mh. atlantica
6
1982M
Mh. atlantica
7
8
2357F
Ms. hiulca
2356M
Ms. hiulca
11
10
2357F
Ms. hiulca
1538M
Mn. schmitti
9
2356M
Ms. hiulca
13
12

FIGURE 80


1774M M. maioris
1
1419M M. miranda
2
1962F Mx. sp. 21
3
1406M Mx. amanda
4
351M Mx. kalbi
5
2382M Mx. similis
6
2389M Mx. bathyalensis
7
2385M Mx. kornickeri
8
1416F Mx. sp. 11
9
1520M Mx. adunca
10
1444F Mx. audens
11
1448M Mx. adrecta
12
1456M Mx. arta
13
833F Mx. eltaninae
14
331M Mx. antonbruunae
15
1351M Mx. labutisi
16
1460F Mk. sp. 5
17
1495M Mk. sp. 19
18
1995M Mk. sp. 3
19
2319F Mk. sp. 6
20
1415M Ms. sp. 23
21
2361F Ms. capacis
22
127F Ms. sp. 47
23
714M Mh. inaequata
24
861M Mh. tensa
25
845M Mh. sinuata
26
198M Mh. sp. 25
27
1479M Mh. opaca
28
1757M Mn. madagascarensis
29
1817M Mn. hawkae
30
2365M Mn. moza
31
1909M Mn. skinneri
32
2352F Mn. captiosa
33
2132F Mn. hartmanni
34
1759M Mn. bermudae
35
1762M Mn. hortuli
36
1905M Mn. succinea
37

Plates

Plate 1

Macropyxis kalbi n. sp., 335M, body without carapace, ×80.

Plate 2

Right valve exteriors, *Macrocypris.*——*1–4. Macrocypris minna* (Baird); *1,* 2002M, ×30; *2,* 2003F, ×30; *3,* 1347, ×30; *4,* 1346, ×30.——*5. Macrocypris proclivis* n. sp., 361F, ×27.5.——*6. Macrocypris nimia* n. sp., 1524, ×27.5.——*7. Macrocypris* sp. 1, 858F, ×27.5.——*8–12. Macrocypris maioris* n. sp.; *8,* 1435F, ×27.5; *9,* 1432F, ×27.5; *10,* 1431M, ×27.5; *11,* 1434M, ×27.5; *12,* 1774M, ×27.5.

Plate 3

Left valve exteriors, *Macrocypris.*——*1–4. Macrocypris minna* (Baird); *1,* 2002M, ×30; *2,* 2003F, ×30; *3,* BMNH 1910.3.6.166, a typical juvenile, ×30; *4,* 1349, with crystal overgrowths, ×30.——*5. Macrocypris proclivis* n. sp., 361F, ×27.5.——*6. Macrocypris nimia* n. sp., 1738, ×27.5.——*7. Macrocypris* sp. 1, 858F, ×27.5.——*8–12. Macrocypris maioris* n. sp.; *8,* 1435F, ×27.5; *9,* 1432F, ×27.5; *10,* 1431M, ×27.5; *11,* 1434M, ×27.5; *12,* 1774M, ×27.5.

Plate 4

Right valve exteriors, *Macrocypris.*——*1–6. Macrocypris metuenda* n. sp.; *1,* 1438F, ×22.5; *2,* 1439M, ×22.5; *3,* 1952M, ×22.5; *4,* 1401F, ×22.5; *5,* 1501M, ×22.5; *6,* 1405M, ×22.5.——*7–12. Macrocypris miranda* n. sp.; *7,* 1955M, ×25; *8,* 1419M, ×30; *9,* 1441M, ×30; *10,* 1442F, ×30; *11,* 1956F, ×25; *12,* 1815F, ×30.

Plate 5

Left valve exteriors, *Macrocypris.*——*1–6. Macrocypris metuenda* n. sp.; *1,* 1438F, ×22.5; *2,* 1439M, ×22.5; *3,* 1952M, ×22.5; *4,* 1780M, ×22.5; *5,* 1501M, ×22.5; *6,* 1405M, ×22.5.——*7–12. Macrocypris miranda* n. sp.; *7,* 1955M, ×25; *8,* 1419M, ×30; *9,* 1441M, ×30; *10,* 1442F, ×30; *11,* 1956F, ×25; *12,* 1815F, ×30.

Plate 6

Mostly right valve exteriors, *Macromckenziea.*——*1–6. Macromckenziea siliquosa* (Brady); *1,* 1530F, ×45; *2,* 1410M, ×45; *3–5,* 1950W, ventral, dorsal, and lateral views of whole carapace, ×45; *6,* 1412F, ×45.——*7. Macromckenziea australiana* (Neale), HU.65.C.6.60, interior of left valve with good muscle scar, posterodorsal region damaged, ×70.——*8. Macromckenziea* sp. 2, 1960, ×45.——*9. Macromckenziea* sp. 7, 836, ×50.——*10. Macromckenziea* sp. 3, 1995F, ×50.——*11, 12. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese); *11,* 2276, ×75; *12,* 2274F, ×75.

Plate 7

Left valve exteriors, *Macromckenziea.*——*1–6. Macromckenziea siliquosa* (Brady); *1,* 1530F, ×45; *2,* 1949, ×45; *3,* 1410M, ×45; *4,* 1414M, ×45; *5,* 1950, ×45; *6,* 1412F, ×45.——*7. Macromckenziea australiana* (Neale), HU.65.C.6.60, ×70.——*8. Macromckenziea* sp. 2, 1960, ×45.——*9. Macromckenziea* sp. 7, 836, ×50.——*10. Macromckenziea* sp. 3, 1995, ×50.——*11, 12. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese); *11,* 2275F, entire animal before dissection, ×75; *12,* 2276, ×75.

Plate 8

Right valve exteriors, *Macromckenziea.*——*1. Macromckenziea* sp. 5, 1460F, ×45.——*2. Macromckenziea* sp. 6, 2319F, ×45.——*3–6. Macromckenziea glacierae* n. sp.; *3,* 878M, ×40; *4,* 720M, ×40; *5,* 1957F, ×40; *6,* 721F, ×40.——*7. Macromckenziea* sp. 4, 2406, ×50.——*8, 9. Macromckenziea swansoni* n. sp.; *8,* 2309, ×45; *9,* 2312, ×45.——*10–12. Macromckenziea gregalis* n. sp.; *10,* 2330, ×35; *11,* 1913, ×35; *12,* 2326, ×35.

Plate 9

Left valve exteriors, *Macromckenziea.*——*1. Macromckenziea* sp. 5, 1460F, ×45.——*2. Macromckenziea* sp. 6, 2319F, ×45.——*3–6. Macromckenziea glacierae* n. sp.; *3,* 878M, ×40; *4,* 1957F, ×40; *5,* 877F, ×40; *6,* 721F, ×40.——*7–9. Macromckenziea swansoni* n. sp.; *7,* 2311, ×45; *8,* 2331, ×45; *9,* 2312W, ×45.——*10–12. Macromckenziea gregalis* n. sp.; *10,* 2330, ×35; *11,* 1913, ×35; *12,* 2326, ×35.

Plate 10

Right valve exteriors, *Macropyxis.*——*1–6. Macropyxis labutisi* n. sp.; *1,* 1978M, ×55 ; *2,* 1351M, ×55; *3,* 1350M, ×55; *4,* 1363M, ×55; *5,* 1352F, ×55; *6,* 1353F, ×55.——*7–12. Macropyxis sapeloensis* (Darby); *7,* 1779M, ×50 ; *8,* 1355M, ×50; *9,* 1354M, ×50; *10,* UMPM 48780, ×50; *11,* 1357F, ×50; *12,* 1359F, ×50.

Plate 11

Left valve exteriors, *Macropyxis.*——*1–6. Macropyxis labutisi* n. sp.; *1,* 1978M, ×55; *2,* 1351M, ×55; *3,* 1350M, ×55; *4,* 1363M, ×55; *5,* 1352F, ×55; *6,* 1353F, ×55.——*7–12. Macropyxis sapeloensis* (Darby); *7,* 1779M, ×50; *8,* 1355M, ×50; *9,* 1354M, ×50; *10,* UMPM 48780, ×50; *11,* 1357F, ×50; *12,* 1359F, ×50.

PLATE 12

Right valve exteriors, *Macropyxis.*——*1–6. Macropyxis amanda* n. sp.; *1,* 1457F, ×30; *2,* 1792F, ×30; *3,* 1408F, ×30; *4,* 1425F, ×30; *5,* 1407M, ×30; *6,* 1406M, ×30.——*7–12. Macropyxis bathyalensis* (Hulings); *7,* 2386M, ×35; *8,* 2387M, ×35; *9,* 1341F, ×30; *10,* 1741, ×30; *11,* AMNH 12733, ×30; *12,* 1341F, entire animal before dissection, ×30.

PLATE 13

Left valve exteriors, *Macropyxis.*——*1–6. Macropyxis amanda* n. sp.; *1,* 1457F, ×30; *2,* 1792F, ×30; *3,* 1408F, ×30; *4,* 1425F, ×30; *5,* 1407M, ×30; *6,* 1406M, ×30.——*7–12. Macropyxis bathyalensis* (Hulings); *7,* 2386M, ×35; *8,* 1742, ×30; *9,* 1341F, ×30; *10,* 1743, ×30; *11,* AMNH 12733, ×30; *12,* 1341F, entire animal before dissection, ×30.

PLATE 14

Right valve exteriors, *Macropyxis.*——*1,2,7,8. Macropyxis adunca* n. sp.; *1,* 1519M, ×35; *2,* 1520M, ×35; *7,* 1521F, ×35; *8,* 1523F, ×35.——*3–6. Macropyxis adrecta* n. sp.; *3,* 1522F, ×35; *4,* 1527F, ×35; *5,* 1786F, ×35; *6,* 1448M, ×35.——*9–12. Macropyxis audens* n. sp.; *9,* 1781F, ×35; *10,* 1444F, ×35; *11,* 1525M, ×35; *12,* 1446M, ×35.

PLATE 15

Left valve exteriors, *Macropyxis.*——*1–3,7,8. Macropyxis adunca* n. sp.; *1,* 1519M, ×35; *2,* 1520M, ×35; *3,* 1522F, ×35; *7,* 1521F, ×35; *8,* 1523F, ×35.——*4–6. Macropyxis adrecta* n. sp.; *4,* 1527F, ×35; *5,* 1786F, ×35; *6,* 1448M, ×35.——*9–12. Macropyxis audens* n. sp.; *9,* 1781F, ×35; *10,* 1444F, ×35; *11,* 1525M, ×35; *12,* 1446M, ×35.

PLATE 16

Right valve exteriors, *Macropyxis.*——*1. Macropyxis* sp. 9, 2338, ×32.5.——*2–4. Macropyxis arta* n. sp.; *2,* 1451M, ×35; *3,* 1456M, ×35; *4,* 1454F, ×35.——*5. Macropyxis* sp. 18, 1443F, ×35.——*6. Macropyxis* sp. 11, 1416F, ×40.——*7. Macropyxis* sp. 10, 2337, ×55.——*8. Macropyxis* sp. 15, 2425, ×40.——*9–12. Macropyxis adriatica* (Breman); *9,* 2085, ×30; *10,* 2091, ×30; *11,* 2086, ×30; *12,* 2087, ×30.

PLATE 17

Mostly left valve exteriors, *Macropyxis.*——*1,2,7. Macropyxis* sp. 10, 2337W; dorsal, ventral, and left lateral views of whole carapace, ×55.——*3–5. Macropyxis arta* n. sp.; *3,* 1451M, ×35; *4,* 1456M, ×35; *5,* 1454F, ×35.——*6. Macropyxis* sp. 11, 1416F, ×40.——*8. Macropyxis* sp. 15, 2426, ×40.——*9–12. Macropyxis adriatica* (Breman); *9,* 2080, ×30; *10,* 2083, ×30; *11,* 2082, ×30; *12,* 2081, ×30.

PLATE 18

Right valve exteriors, *Macropyxis and Macromckenziea.*——*1. Macromckenziea* sp. 19, 1495M, ×40.——*2. Macropyxis* sp. 21, 1962F, ×30.——*3–6. Macropyxis kalbi* n. sp.; *3,* 1972F, ×27.5; *4,* 334F, ×27.5; *5,* 352F, ×27.5; *6,* 351M, ×27.5.——*7–12. Macropyxis antonbruunae* n. sp.; *7,* 354F, ×40; *8,* 333F, ×40; *9,* 350M, ×40; *10,* 1966M, ×40; *11,* 341M, incompletely calcified carapace, ×40; *12,* 183M, ×40.

PLATE 19

Left valve exteriors, *Macropyxis and Macromckenziea.*——*1. Macromckenziea* sp. 19, 1495M, ×40.——*2–6. Macropyxis kalbi* n. sp.; *2,* 1962F, ×27.5; *3,* 1972F, ×27.5; *4,* 334F, ×27.5; *5,* 351M, ×27.5; *6,* 331M, ×27.5.——*7–12. Macropyxis antonbruunae* n. sp.; *7,* 354F, ×40; *8,* 333F, ×40; *9,* 350M, ×40; *10,* 1966M, ×40; *11,* 341M, incompletely calcified, ×40; *12,* 332M, ×40.

PLATE 20

Right valve exteriors, *Macropyxis.*——*1. Macropyxis* sp. 17, 1150F, ×40.——*2–6. Macropyxis kaesleri* n. sp.; *2,* 1967M, ×35; *3,* 1968F, ×35; *4,* 638F, ×35; *5,* 1496F, ×35; *6,* 1969F, ×35.——*7,8. Macropyxis amoena* n. sp.; *7,* 1463M, ×45; *8,* 1864F, ×47.——*9. Macropyxis* sp. 46, 1965F, ×40.——*10–12. Macropyxis eltaninae* n. sp.; *10,* 1964MF?, ×40; *11,* 833F, ×40; *12,* 831M, ×40.

PLATE 21

Left valve exteriors, *Macropyxis.*——*1–6. Macropyxis kaesleri* n. sp.; *1,* 1967M, ×35; *2,* 344F, ×35; *3,* 638F, ×35; *4,* 1968F, ×35; *5,* 1496F, ×35; *6,* 1969F, ×35.——*7,8. Macropyxis amoena* n. sp.; *7,* 1463M, ×47; *8,* 1864F, ×47.——*9. Macropyxis* sp. 46, 1965F, ×40.——*10–12. Macropyxis eltaninae* n. sp.; *10,* 1964MF?, ×40; *11,* 837F, ×40; *12,* 831M, ×40.

PLATE 22

Right valve exteriors, *Macropyxis.*——*1–3. Macropyxis steinecki* n. sp.; *1,* 2104, ×35; *2,* 2228, ×35; *3,* 2096, ×35.——*4–6. Macropyxis rhodana* (van den Bold); *4,* USNM 563496, ×50; *5,* USNM 563497, ×50; *6,* USNM 563498, ×50.——*7. Macropyxis bathyalensis* (Hulings), USNM 153744 (=*M. minna* of Tressler, 1941), ×30.——*8. Macropyxis* sp. 20, 1784, ×32.5.——*9. Macropyxis* sp. 12, 2411, ×20.——*10–12. Macropyxis longana* (van den Bold); *10,* 2252, ×40; *11,* USNM 563494, ×40; *12,* USNM 563493, ×40.

Plate 23

Mostly left valve exteriors, *Macropyxis*.——*1,2,7. Macropyxis steinecki* n. sp.; *1,2,* dorsal and left side of 2101, ×35; *7,* 2104, ×35.——*3–6. Macropyxis rhodana* (van den Bold); *3,* USNM 563496, ×50; *4,* USNM 563497, ×50; *5,* USNM 563498, ×50; *6,* USNM 563499, ×50. ——*8–12. Macropyxis longana* (van den Bold); *8,* 2252, ×40; *9,* 2251, ×40; *10,* USNM 563494, ×40; *11,12,* left and dorsal views of USNM 563493, ×40.

Plate 24

Right valve exteriors, *Macropyxis*.——*1,7. Macropyxis improcera* n. sp.; *1,* 2415, ×80; *7,* 2413, ×80.——*2,3,11,12. Macropyxis similis* (Brady); *2,* 2383F, ×30; *3,* 2382M, ×30; *11,* 2148, note secondary holes around normal pore canals, ×40; *12,* 2149, ×40.——*4,5. Macropyxis kornickeri* n. sp.; *4,* 2385F, ×35; *5,* 2384M, ×35.——*6. Macropyxis simulans* n. sp., 2416, ×35.——*8,9. Macropyxis* sp. 13; *8,* 2377, ×55; *9,* 2376, ×55.——*10. Macropyxis* sp. 14, 2424, ×50.

Plate 25

Left valve exteriors, *Macropyxis*.——*1,7. Macropyxis improcera* n. sp.; *1,* 2414, ×80; *7,* 2412, ×80.——*2,3. Macropyxis similis* (Brady); 2, 2383F, ×30; *3,* 2382M, ×30.——*4,5. Macropyxis kornickeri* n. sp.; *4,* 2385F, ×45; *5,* 2384M, ×45.——*6. Macropyxis simulans* n. sp., 2417, ×32.5.——*8,9. Macropyxis* sp. 13; *8,* 2378, ×55; *9,* 2379, ×55.——*10–12. Macropyxis tenuicauda* (Brady); *10,* 2161, ×45; *11,12,* 2160, ×45.

Plate 26

Mostly right valve exteriors, *Macrocypria* and *Macrosarisa*.——*1. Macrocypria semesa* n. sp., 857F, ×30.——*2–8. Macrocypria sarsi* (Müller); *2,* 1998M, ×40; *3,* 1999F, female with reversed overlap, ×40; *4,* 2000F, ×40; *5–7,* 1340F, lateral and dorsal views, ×40; *8,* anterior dentiform corner, ×400.——*9–12. Macrosarisa texana* n. sp.; *9,* 2239, ×65; *10,* 2286, ×65; *11,* 2241, ×65; *12,* 2020, ×65.——*13,14. Macrocypria canariensis* (Brady), 2196, ×40.

Plate 27

Mostly left valve exteriors, *Macrocypria* and *Macrosarisa*.——*1,9. Macrocypria semesa* n. sp.; *1,* 857F, ×30; *9,* 1484J, whole juvenile with body before dissection, ×30.——*2–6. Macrocypria sarsi* (Müller); *2,* 1998M, ×40 ; *3,* 1999F, female with reversed hingement, ×40; *4,* 2000F, ×40; *5,6,* 1340F, ×40.——*7,8. Macrosarisa* sp. 24; *7,* 2324, ×50; *8,* 2325, ×50.——*10–13. Macrosarisa texana* n. sp.; *10,* 2240J, juvenile, ×65; *11,* 2286, with fragments of antennules and antennae; *12,* 2242, ×65; *13,* 2020, ×65.——*14,15. Macrocypria canariensis* (Brady), 2196; note raised ring, perhaps caused by some kind of parasite, ×40.

Plate 28

Right valve exteriors, *Macrosarisa*.——*1–3. Macrosarisa* sp. 23, 1415M; part *3* shows the whole animal with a conspicuous food ball before dissection, ×37.——*4–7. Macrosarisa hiulca* n. sp.; *4,* 2356M, ×50; *5,6,* 2357F, ×50; *7,* 2358F, ×45.——*8. Macrosarisa* sp. 47, 127F, ×42. ——*9–14. Macrosarisa bensoni* n. sp.; *9,* 2162, ×35; *10,* 2303, ×42; *11,* 1710F, ×35; *12,* 1951, ×42; *13,14,* 1869M, ×42.

Plate 29

Mostly left valve exteriors, *Macrosarisa*.——*1–3. Macrosarisa* sp. 23, 1415M, dorsal and left views of entire animal before dissection, ×37.——*4–7. Macrosarisa hiulca* n. sp.; *4,* 2356M, ×50; *5,6,* 2357F, ×50; *7,* 2358F, ×45.——*8. Macrosarisa* sp. 47, 127F, ×42.——*9–14. Macrosarisa bensoni* n. sp.; *9,* 2174, ×35; *10,* 2303, ×42; *11,* 1710F, ×35; *12–14,* 1869M, part 14 shows the entire animal before dissection, ×42.

Plate 30

Right valve exteriors, *Macrocyprissa*.——*1–5. Macrocyprissa vandenboldi* n. sp.; *1,* 2123, ×65; *2,* 2224, ×65; *3,* 2118, ×65; *4,* 2223, ×65; *5,* 2123, ×65.——*6. Macrocyprissa* sp. 22, 2336, ×65.——*7–10. Macrocyprissa arcuata* (Colalongo and Pasini); *7,* 1534M, ×50; *8,* 1532M, ×50; *9,* 1536F, ×50; *10,* 1531F, ×50.——*11,12. Macrocyprissa cylindracea* (Bornemann); *11,* 2307, ×70; *12,* 2308, ×70.

Plate 31

Mostly left valve exteriors, *Macrocyprissa*.——*1–6. Macrocyprissa vandenboldi* n. sp.; *1,2,* 2119, ×65; *3,* 2203, ×65; *4,* 2122, ×65; *5,6,* dorsal and left views of 2121, ×65.——*7–11. Macrocyprissa arcuata* (Colalongo and Pasini); *7,* 1533M, ×50; *8,* 1535M, ×50; *9,* 1534M, ×50; *10,* 1536F, ×50; *11,* 1531F, ×50.——*12,13. Macrocyprissa cylindracea* (Bornemann); *12,* 2305, ×70; *13,* 2306, ×70.

Plate 32

Mostly right valve exteriors, *Macrosarisa*.——*1–4. Macrosarisa graysonensis* (Alexander); *1,4,* dorsal and right views of 2270, ×80; *2,* 2271, ×80; *3,* 2272, ×80.——*5–8. Macrosarisa siliqua* (Jones); *5,* BMNH Io.1594, ×35; *6,* BMNH In.51617, ×45; *7,* BMNH Io.51620, ×40; *8,* BMNH In.51619, ×45.——*9–13. Macrosarisa exquisita* (Kaye); *9,10,* BMNH Io.1271 (the acute posterior angle has been broken off this specimen), ×50; *11,* BMNH Io.1273, ×50; *12,* BMNH Io.1272, ×50; *13,* BMNH Io.1270, ×50.——*14. Macrosarisa simplex* (Chapman), BMNH Io.1275, ×55.——*15. Macrosarisa wrightii* (Jones and Hinde), BMNH Io.2473 (anterior edge of this specimen is broken), ×35.

PLATE 33

Mostly left valve exteriors, *Macrosarisa.*——*1–4. Macrosarisa graysonensis* (Alexander); *1,* 2271, ×80; *2,* 2270, ×80; *3,* 2272, ×80; *4,* TMM 11518, ×80.——*5–8. Macrosarisa siliqua* (Jones); *5,* BMNH Io.1593, ×40; *6,* BMNH Io.1276, ×45; *7,8,* BMNH In.51617, left and dorsal views, ×50.——*9–14. Macrosarisa exquisita* (Kaye); *9,* dorsal view of BMNH Io.1270, ×50; *10–12,* dorsal, ventral, and left views of BMNH Io.1272, ×50; *13,14,* BMNH Io.1274, ×50.——*15. Macrosarisa simplex* (Chapman), BMNH Io.1275, ×50.——*16. Macrosarisa wrightii* (Jones and Hinde), BMNH Io.1595, ×35.

PLATE 34

Right valve exteriors, *Macrosarisa* and *Macroscapha.*——*1–6. Macrosarisa capacis* n. sp.; *1,* 2360M, ×40; *2,* 2361F, ×40; *3,* 2363F, ×40; *4,* 2364F, ×40; *5,6,* 2362F, part *5* is tilted to show the posteroventral swelling of the carapace above the ventral margin, ×40.——*7,8. Macroscapha marchilensis* (Hartmann); *7,* K-27321B, ×40; *8,* K-27321A, ×40.——*9–12. Macroscapha atlantica* n. sp.; *9,* 1980M, ×45; *10,* 1982M, ×45; *11,* 1983F, ×45; *12,* 1984F, ×45.

PLATE 35

Mostly left valve exteriors, *Macrosarisa* and *Macroscapha.*——*1–6. Macrosarisa capacis* n. sp.; *1,* 2360M, ×40; *2,* 2361F, ×40; *3,* 2363F, ×40; *4,* 2364F, ×40; *5,6,* dorsal and left view of 2362F, ×40.——*7,8. Macroscapha marchilensis* (Hartmann); *7,* K-27321B, ×40; *8,* K-27321A, ×40.——*9–12. Macroscapha atlantica* n. sp.; *9,* 1981M, ×45; *10,* 1980M, ×45; *11,* 1982M, ×45; *12,* 1983F, ×45.

PLATE 36

Right valve exteriors, *Macroscapha.*——*1–6. Macroscapha inaequata* n. sp.; *1,* 1491F, ×35; *2,* 716M, ×40; *3,* 714M, ×35; *4,* 715F, ×35; *5,* 865M, ×35; *6,* 1459F, ×35.——*7–10. Macroscapha sinuata* n. sp.; *7,* 845M, ×35; *8,* 847F, ×35; *9,* 852F, ×35; *10,* 851F, ×35.——*11,12. Macroscapha inaequalis* (Müller), types embedded in Canada balsam; *11,* 1940M, ×35; *12,* 1939F, ×35.

PLATE 37

Left valve exteriors, *Macroscapha.*——*1. Macroscapha sinuata,* 848MF?, specimen of indeterminate sex, ×35.——*2–6. Macroscapha inaequata* n. sp.; *2,* 714M, note chitinous inner lining of outer lamella remaining where calcified portion of outer lamella has cracked and fallen off, ×35; *3,* 865M, ×35; *4,* 825F, with calcareous portion of outer lamella cracked and fallen off from central part, ×35; *5,* 190F, ×35; *6,* 1459F, ×35.——*7–10. Macroscapha sinuata* n. sp.; *7,* 846M, ×35; *8,* 850F, ×35; *9,* 852F, ×35; *10,* 851F, note air bubbles trapped between inner chitinous lining and calcified portion of outer lamella in posterodorsal region, ×35.——*11,12. Macroscapha inaequalis* (Müller), types embedded in Canada balsam; *11,* 1939F, ×35; *12,* 1940M, ×35.

PLATE 38

Right valve exteriors, *Macroscapha.*——*1. Macroscapha* sp. 32, 2427, ×40.——*2–6,12. Macroscapha opaca* n. sp.; *2,* 1963, ×35; *3,* 1958F, ×40; *4,* 1959M, ×40; *5,* 1477M, ×40; *6,* 1480F, ×40; *12,* 2027M, whole animal before dissection, ×30.——*7–11. Macroscapha tensa* (Müller); *7,* 866F, ×30; *8,* 859F, ×30; *9,* 860F, ×30; *10,* 861M, ×30; *11,* 1935F, embedded in Canada balsam, ×30.

PLATE 39

Left valve exteriors, *Macroscapha.*——*1. Macroscapha* sp. 32, 2427, ×40.——*2–6. Macroscapha opaca* n. sp.; *2,* 1963, ×35; *3,* 1958F, ×35; *4,* 2027M, ×40; *5,* 1479M, ×40; *6,* 1480F, ×40.——*7–12. Macroscapha tensa* (Müller); *7,* 866F, ×30; *8,* 862F, ×30; *9,* 867F, ×30; *10,* 860F, ×30; *11,* 861M, note chitinous inner lining of outer lamella where calcarous portion has cracked and fallen off, ×30; *12,* 1935F, type embedded in Canada balsam, ×30.

PLATE 40

Right valve exteriors, *Macroscapha.*——*1,2. Macroscapha gyreae* n. sp.; *1,* 2245, ×55; *2,* 1509, ×55.——*3–13. Macroscapha turbida* (Müller); *3,* 1487M, ×40; *4,* 375M, ×40; *5,* 828F, ×40; *6,* 1488F, ×40; *7,* 1467F, ×40; *8,* 189F, ×40; *9,* 373M, ×40; *10,* 1943M, ×40; *11,* 1944M, ×40; *12,* 1934M, in Canada balsam, ×40; *13,* 1945, in Canada balsam, ×40.

PLATE 41

Left valve exteriors, *Macroscapha.*——*1,2. Macroscapha gyreae* n. sp.; *1,* 2012, ×55; *2,* 1284, ×55.——*3. Macroscapha* sp. 27, 2410, ×50.——*4. Macroscapha* sp. 28, 2408, ×35.——*5–14. Macroscapha turbida* (Müller); *5,* 1490M, ×40; *6,* 1475M, ×40; *7,* 197M, ×40; *8,* 827M, note inner chitinous lining where outer calcareous portion has cracked and fallen off, ×40; *9,* 1488F, ×40; *10,* 189F, ×40; *11,* 189F, ×45; *12–14,* types mounted in Canada balsam; *12,* 1944M, ×40; *13,* 1946M, ×40; *14,* 1945, ×40.

PLATE 42

Mostly right valve exteriors, *Macrosarisa* and *Macroscapha.*——*1. Macroscapha* sp. 31, 2423, ×60.——*2–6. Macroscapha jiangi* n. sp.; *2,* 2333, ×40; *3,* 1921, ×40; *4,5,* dorsal and right views of 2313, ×40; *6,* 1922, ×40.——*7. Macroscapha* sp. 29, 2407, ×60.——*8,9. Macroscapha heroica* n. sp.; *8,* 1462M, ×40; *9,* 1461F, ×40.——*10–12. Macrosarisa muensteriana* (Jones and Hinde); *10,12,* ventral and right view of BMNH In.51618, ×70; *11,* BMNH In.51622, ×70.

PLATE 43

Mostly left valve exteriors, *Macrosarisa* and *Macroscapha*.——*1.* *Macroscapha* sp. 31, 2423, ×60.——*2–6.* *Macroscapha jiangi* n. sp.; *2,* 2334, ×50; *3,* 2335, ×40; *4,* 1921, ×40; *5,* 2313, ×40; *6,* 1922, ×40.——*7.* *Macroscapha* sp. 29, 2407, ×60.——*8,9.* *Macroscapha heroica* n. sp.; *8,* 1462M, ×40; *9,* 1461F, ×40.——*10–12.* *Macrosarisa muensteriana* (Jones and Hinde); *10,12,* dorsal and left views of BMNH In.51618, ×70; *11,* BMNH In.51622, ×70.

PLATE 44

Mostly right valve exteriors, *Macrocyprina*.——*1–4.* *Macrocyprina succinea* (Müller); *1,* 2277M, ×75; *2,* 1905M, ×75; *3,* 1906F, ×75; *4,* 2278F, ×75.——*5.* *Macrocyprina* sp. 44, 2420, ×75.——*6.* *Macrocyprina caiman* n. sp., 2418, ×75.——*7–12.* *Macrocyprina propinqua* Triebel; *7,11,* dorsal and right views of Xe 3365M, ×75; *8,10,* dorsal and right views of Xe 3367F, ×75; *9,* Xe 3362M, ×75; *12,* Xe 3364F, ×75.

PLATE 45

Left valve exteriors, *Macrocyprina*.——*1–4.* *Macrocyprina succinea* (Müller); *1,* 2277M, ×75; *2,* 1904M, ×75; *3,* 1906F, ×75; *4,* 2278F, ×75.——*5.* *Macrocyprina* sp. 41, 2421, ×50.——*6.* *Macrocyprina caiman* n. sp., 2419, ×75.—— *7–11.* *Macrocyprina propinqua* Triebel; *7,* Xe 3362M, ×75; *8,* Xe 3368, ×75; *9,* Xe 3364F, ×75; *10,* Xe 3367F, ×75; *11,* Xe 3365M, whole animal with dry body inside, ×75.——*12.* *Macrocyprina quadrimaculata* n. sp., 1700J–1, juvenile showing the characteristic four opaque spots, ×70.

PLATE 46

Right valve exteriors, *Macrocyprina*.——*1,2,7.* *Macrocyprina hortuli* n. sp.; *1,* 1762M, ×70; *2,* 1508M, ×70; *7,* 1761F, ×70.——*3–6.* *Macrocyprina bermudae* n. sp.; *3,* 1843A, ×75; *4,* 130M, ×75; *5,6,* 131F, ×75.——*8–12.* *Macrocyprina skinneri* Kontrovitz; *8,* 1910M, ×60; *9,* 1909M, ×60; *10,* 1911F, ×60; *11,* HVH 9438, gold-coated, ×60; *12,* HVH 9439, ×60.

PLATE 47

Left valve exteriors, *Macrocyprina*.——*1,2,7,8.* *Macrocyprina hortuli* n. sp.; *1,* 1762M, ×70; *2,* 1508M, ×70; *7,* 1761F, ×70; *8,* 993M, ×70.——*3–6.* *Macrocyprina bermudae* n. sp.; *3,* 1759M, totally decalcified, ×75; *4,* 1843A, ×75; *5,* 130M, ×75; *6,* 131F, ×75.——*9–12.* *Macrocyprina skinneri* Kontrovitz; *9,* 1910M, ×60; *10,* 1909M, ×60; *11,* 1911F, ×60 ; *12,* HVH 9437, gold-coated, ×60.

PLATE 48

Mostly right valve exteriors, *Macrocyprina*.——*1–6.* *Macrocyprina hawkae* n. sp.; *1,* 1818M, ×55; *2,* 1853M, ×55; *3,* 1852M, ×55; *4,* 2289, ×55; *5,* 2298, ×50; *6,* 2296, ×55.——*7–12.* *Macrocyprina schmitti* (Tressler); *7,* USNM 168088, totally decalcified, ×70; *8,* 1763M, ×70; *9,* 1806F, ×70; *10,* 1764M, ×70; *11,12,* dorsal and right views of HVH 9441, ×70.

PLATE 49

Left valve exteriors, *Macrocyprina*.——*1–6.* *Macrocyprina hawkae* n. sp.; *1,* 1819F, ×55; *2,* 1852M, ×55; *3,* 2290, ×55; *4,* 2299, ×50; *5,* 2300, ×55; *6,* 2323, ×55.——*7–12.* *Macrocyprina schmitti* (Tressler); *7,* USNM 88847, totally decalcified and mounted in balsam, ×70; *8,* 1763M, ×70; *9,* 1806F, ×70; *10,* 1764M, ×70; *11,* HVH 9441, ×70; *12,* HVH 9440, ×70.

PLATE 50

Right valve exteriors, *Macrocyprina*.——*1.* *Macrocyprina* sp. 36, 1705, ×60.——*2.* *Macrocyprina* sp. 35, 1344, colored yellow, amber, and brown, ×60.——*3,4.* *Macrocyprina hartmanni* n. sp.; *3,* 2130M, ×60; *4,* 2132F, colored yellow, amber, and brown, ×60.——*5,6,11,12.* *Macrocyprina belizensis* n. sp.; *5,* 1828, ×65; *6,* 2302J–1, ×65; *11,* 1996, ×65; *12,* 2301, ×65.——*7–10.* *Macrocyprina jamaicae* n. sp.; *7,* 1835, ×50; *8,* 2250, ×50; *9,* 2247, ×50; *10,* 2246, ×50.

PLATE 51

Left valve exteriors, *Macrocyprina*.——*1.* *Macrocyprina* sp. 33, 1707, ×60.——*2.* *Macrocyprina* sp. 34, 1513, ×60.——*3.* *Macrocyprina* sp. 35, 1345, in three shades of yellow, amber, and brown, ×60.——*4,5.* *Macrocyprina hartmanni* n. sp.; *4,* 2130M, ×60; *5,* 2132F, ×60; colored yellow, amber, and brown.——*7.* HM "*Macrocyprina maculata + decora* (Brady)," the only remaining juvenile specimen, with adhering dirt, ×60.——*8–11.* *Macrocyprina jamaicae* n. sp.; *8,* 2249, ×50; *9,* 2248, ×50; *10,* 1836, ×50; *11,* 2005, ×50.——*6,12.* *Macrocyprina belizensis* n. sp.; *6,* 1829, ×65; *12,* 1997, ×65.

PLATE 52

Right valve exteriors, *Macrocyprina*.——*1–3.* *Macrocyprina madagascarensis* n. sp.; *1,* 2025, ×55; *2,* 1757M, ×55; *3,* 1149F, ×55.——*4–6.* *Macrocyprina moza* n. sp.; *4,* 2059, ×70; *5,* 2344, ×70; *6,* 2345, ×70.——*7–9.* *Macrocyprina captiosa* n. sp.; *7,* 1193M, ×55; *8,* 2351M, ×65; *9,* 2352F, ×65.——*10.* *Macrocyprina* sp. 43, 2409, dorsal margin damaged, ×75.——*11.* *Macrocyprina* sp. 42, 2422, ×60.——*12.* *Macrocyprina* sp. 37, 2291, ×70.

Plate 53

Left valve exteriors, *Macrocyprina.*——*1–3, 7. Macrocyprina madagascarensis* n. sp.; *1,* 2025, ×55; *2,* 83F, ×55; *3,* 84M, ×55; *7,* 1757M, ×55.——*4–6. Macrocyprina moza* n. sp.; *4,* 2059, ×70; *5,* 2344F, ×70; *6,* 2345, ×70.——*8–10. Macrocyprina captiosa* n. sp.; *8,* 2351M, ×65; *9,* 2352F, ×65; *10,* 2355, ×65.——*11. Macrocyprina* sp. 43, 2409, ×75.——*12. Macrocyprina* sp. 42, 2422, ×60.

Plate 54

Right valve exteriors, *Macrocyprina.*——*1,2. Macrocyprina noharai* n. sp.; *1,* 2058, ×50; *2,* 2063, ×50.——*3,4. Macrocyprina bonaducei* n. sp.; *3,* 2264, ×65; *4,* 2263, ×65.——*5. Macrocyprina* sp. 38, 2004, ×55.——*6. Macrocyprina* sp. 39, 1854, ×60.——*7. Macrocyprina okinawae* n. sp., 2068, ×50.——*8,9. Macrocyprina africana* (Müller), types mounted in Canada balsam; *8,* 1937M, ×50; *9,* 1938F, damaged, ×50.——*10–12. Macrocyprina dispar* (Müller), types mounted in Canada balsam; *10,* 1931F, ×60; *11,* 1933M, ×60; *12,* 1932F, ×60.

Plate 55

Left valve exteriors, *Macrocyprina.*——*1. Macrocyprina noharai* n. sp., 2058, ×50.——*2,3. Macrocyprina bonaducei* n. sp.; *2,* 2260, ×65; *3,* 2261, ×65.——*4,5. Macrocyprina* sp. 40; *4,* 1902F, ×75; *5,* 1901F, ×75.——*6. Macrocyprina* sp. 39, 1854F, ×60.——*7. Macrocyprina okinawae* n. sp., 2064, ×50.——*8,9. Macrocyprina africana* (Müller), mounted in Canada balsam; *8,* 1936F, ×50; *9,* 1938, ×50.——*10–12. Macrocyprina dispar* (Müller), mounted in Canada balsam; *10,* 1933M, ×60; *11,* 1931F, ×60; *12,* 1932F, ×60.

Plate 56

Mostly right valve exteriors, *Macrocyprina.*——*1–4. Macrocyprina vargata* Allison and Holden; *1,* 1507F, ×75; *2,* USNM 128096, ×75; *3,* USNM 128095, ×75; *4,* USNM 128096, ×75.——*5,6,12. Macrocyprina swaini* n. sp.; *5,6,* dorsal and right views of 2284, ×70; *12,* 1994, totally decalcified, ×70.——*7. Macrocyprina* sp. 45, 2428, ×60.——*8,9. Macrocyprina barbara* n. sp.; *8,* 2400M, ×70; *9,* 2401F, ×70.——*10. Macrocyprina parcens* n. sp., 2266, ×55.——*11. Macrocyprina* sp. 34, 1704, ×60.

Plate 57

Mostly left valve exteriors, *Macrocyprina.*——*1–5. Macrocyprina vargata* Allison and Holden; *1,* 1507F, ×75; *2,5,* USNM 128096, ×75; *3,4,* dorsal and right views of USNM 128095, ×75.——*6,11,12. Macrocyprina swaini* n. sp.; *6,* 1995A, ×70; *11,* 2285, ×70; *12,* 2284, ×70.——*7. Macrocyprina* sp. 45, 2429, ×45.——*8,9. Macrocyprina barbara* n. sp.; *8,* 2400, ×70; *9,* 2401F, ×65.——*10. Macrocyprina parcens* n. sp., 2265, ×55.

Plate 58

Right exteriors and posterior spines, *Macrocypris, Macropyxis, Macroscapha,* and *Macrocyprina.*——*1,2,9–15. Macrocypris miranda* n. sp.; *1,2,* right exteriors; *1,* 1420F, ×30; *2,* 1765FJ–1, ×30; *9–15,* details of posteroventral spine; *9,* 1765FJ–1, ×1386; *10,13,* 1776MJ–1, ×250; *11,14,* 1440F, ×250; *12,15,* 1419M, ×250.——*3. Macrocypris opinabilis* n. sp., 2404, ×30.——*4. Macrocyprina skinneri* Kontrovitz, HVH 9739, ×65.——*5. Macropyxis adunca* n. sp., 1519M, ×40.——*6. Macroscapha* sp. 26, HU.13.R.12.91, ×55.——*7. Macrocypris metuenda* n. sp., 1780M, ×20.——*8. Macrocypris maioris* n. sp., 1774M, ×20.

Plate 59

Left exteriors and posterior spine, *Macrocypris, Macropyxis, Macroscapha,* and *Macrocyprina.*——*1,2,11. Macrocypris miranda* n. sp.; *1,* 1420F, ×30; *2,* 1765FJ–1, ×30; *11,* 1765FJ–1, ×773.——*3. Macrocypris opinabilis* n. sp., 2405, ×30.——*4. Macropyxis* sp. 8, 126F, ×33.——*5. Macrocyprina skinneri* Kontrovitz, UM 48679, ×90.——*6. Macropyxis improcera* n. sp., HVH 9738, ×80.——*7. Macrocyprina* sp. 48, HVH 8267, ×65.——*8. Macroscapha* sp. 26, HU.13.R.12.93, ×55.——*9. Macrocypris proclivis* n. sp., 128F, ×20.——*10. Macrocypris maioris* n. sp., 1774M, ×20.

Plate 60

Left interior hinges, *Macromckenziea, Macropyxis,* and *Macrosarisa.*——*1–4. Macromckenziea siliquosa* (Brady), 1411F; *1,* ×130; *2,* ×63; *3,* ×46; *4,* ×67.——*5–7. Macropyxis audens* n. sp., 1445M; *5,* ×69; *6,7,* ×202.——*8. Macrosarisa bensoni* n. sp., 1869M, ×71.——*9. Macropyxis kalbi* n. sp., 839M, ×30.

Plate 61

Right interior hinges, *Macromckenziea, Macropyxis,* and *Macrosarisa.*——*1–4. Macromckenziea siliquosa* (Brady), 1411F; *1,* ×130; *2,* ×63; *3,* ×46; *4,* ×67.——*5–7. Macropyxis audens* n. sp., 1445M; *5,* ×69; *6,7,* ×202.——*8. Macrosarisa bensoni* n. sp., 1869M, ×71.——*9. Macropyxis kalbi* n. sp., 839M, ×30.

Plate 62

Right and left dorsal views and hinges, *Macropyxis, Macroscapha,* and *Macrocyprina.*——*1. Macropyxis bathyalensis* (Hulings), 1341F, ×38.——*2,3. Macropyxis labutisi* n. sp.; *2,* 1363M, ×60; *3,* 1388F, ×60.——*4,5. Macropyxis sapeloensis* (Darby); *4,* 1359F, ×50; *5,* 1354M,

×50 and ×40.——*6,7.* *Macropyxis eltaninae* n. sp.; *6,* 833F, ×40; *7,* 831M, ×40.——*8.* *Macropyxis antonbruunae* n. sp., 358M, ×50.——*9,10.* *Macrocyprina bermudae* n. sp., 131F; *9,* ×90; *10,* ×80.——*11.* *Macrocyprina propinqua* Triebel, Xe 3367, ×75.——*12.* *Macroscapha turbida* (Müller), 823F, ×45.

PLATE 63

Left and right interior views of hinges and details of hinge teeth, *Macropyxis, Macrocyprissa, Macroscapha,* and *Macrocyprina.*——*1,2.* *Macropyxis adrecta* n. sp., 1448M, ×65.——*3,4.* *Macropyxis audens* n. sp., 1445M, ×65.——*5,6.* *Macropyxis sapeloensis* (Darby), AMNH 12733, ×65.——*7–10,12.* *Macropyxis bathyalensis* (Hulings), 1341F; *7,8,10,12,* ×65; *9,* ×60.——*11,14.* *Macrocyprissa cylindracea* (Bornemann); *11,* 2306, ×100; *14,* 2308, ×100.——*13,16.* *Macroscapha turbida* (Müller); *13,* 358M, ×110; *16,* 375M, ×110.——*15.* *Macroscapha sinuata* n. sp., 328M, ×110.——*17.* *Macrocyprina madagascarensis* n. sp., 1193M, ×120.——*18.* *Macrocypris minna* (Baird), 1347, ×120.

PLATE 64

External setae of *Macrocypris.*——*1,2.* *Macrocypris minna* (Baird); *1,* 1349LV, with post-mortem crystalline overgrowth, ×2016; *2,* 1347RV, ×1428.——*3,4.* *Macrocypris maioris* n. sp., 1434M, ×1386.——*5–8.* *Macrocypris miranda* n. sp.; *5,* 1420F, ×2268; *6,* 1420F, ×739; *7,* 1765FJ–1, ×1386; *8,* 1765FJ–1, ×773.——*9.* *Macrocypris proclivis* n. sp., 128F, ×1554.

PLATE 65

External setae of *Macromckenziea.*——*1–5.* *Macromckenziea siliquosa* (Brady), 1500M; *1,* ×2585; *2,3,5,* ×1175; *4,* ×1218.——*6.* *Macromckenziea siliquosa* (Brady), 1411F, ×1646.——*7–10.* *Macromckenziea glacierae* n. sp.; *7,* 722M, ×1386; *8,* 725M, ×344; *9,* 722M, ×2142; *10,* 720M, ×1327.

PLATE 66

External setae of *Macropyxis.*——*1,2.* *Macropyxis adrecta* n. sp., 1448M; *1,* ×362; *2,* ×1428.——*3,4.* *Macropyxis antonbruunae* n. sp.; *3,* 358M, ×3444; *4,* 183M, ×1327.——*5.* *Macropyxis bathyalensis* (Hulings), 1341F, ×1386.——*6,7.* *Macropyxis eltaninae* n. sp.; *6,* 833F, ×3192; *7,* 831M, ×3192.——*8–11.* *Macropyxis sapeloensis* (Darby); *8,* 1354M, ×1344; *9,10,* 1359F, ×1890; *11,* 1354M, ×1302.

PLATE 67

External setae of *Macropyxis* and *Macrocyprissa.*——*1–4.* *Macropyxis kalbi* n. sp.; *1,* 331M, ×722; *2,* 335M, ×1470; *3,* 331M, ×1445; *4,* 839M, ×1974.——*5–7.* *Macropyxis labutisi* n. sp., 1363M; *5,* ×1882; *6,* ×336; *7,* ×672.——*8,9.* *Macrocyprissa arcuata* (Colalongo and Pasini), 1531F; *8,* ×344; *9,* ×672.

PLATE 68

Anteroventral and posteroventral dentiform corners of *Macrocypria, Macrocyprissa,* and *Macrosarisa.*——*1–5.* *Macrocypria sarsi* (Müller); *1–4,* 1998M, ×400; *5,* 2000F, ×600.——*6–14.* *Macrocyprissa arcuata* (Colalongo and Pasini); *6,12,* 1732MJ–1, ×900; *7,8,* 1532M, ×600; *9,* 1531F, ×600; *10,11,* 1733FJ–1, ×900; *13,* 1731J–3, ×600; *14,* 1535M, ×900.——*15,16.* *Macrosarisa bensoni* n. sp.; *15,* 2163LV, ×300; *16,* 827F, ×300.

PLATE 69

Anteroventral and posteroventral dentiform corners of *Macrocypria, Macrocyprissa,* and *Macrosarisa.* Arrows point toward the anterior.——*1.* *Macrocyprissa arcuata* (Colalongo and Pasini), 1535M, ×900.——*2–8.* *Macrocypria sarsi* (Müller); *2,* 1999F, ×900; *3,4,* 2000F, ×900; *5,* 2001J–1, ×80; *6,* 2001J–1, ×40; *7,* 1998M, ×40; *8,* 1998M, ×200.——*9.* *Macrocypria semesa* n. sp., 857F, ×600.——*10.* *Macrosarisa bensoni* n. sp., 1869M, ×180.

PLATE 70

Anteroventral and posteroventral dentiform corners of *Macrocyprissa* and *Macrosarisa.* Arrows point toward the anterior.——*1–4.* *Macrocyprissa arcuata* (Colalongo and Pasini); *1,* 1532M, ×1361; *2,* 1532M, ×1386; *3,* 1732MJ–1, ×1361; *4,* 1531F, ×1352.——*5.* *Macrosarisa bensoni* n. sp., 1869M, ×1361.——*6.* *Macrosarisa* sp. 47, 127F, ×1302.

PLATE 71

Anteroventral dentiform corners of *Macrosarisa.*——*1,2,4.* *Macrosarisa bensoni* n. sp., 1869M, ×1361.——*3,5,6.* *Macrosarisa* sp. 47, 127F; *3,* ×647; *5,* ×1302; *6,* ×1554.

PLATE 72

Right anterior (*1–10, 13–15*) and posterior (*11,12, 16–20*) dentiform corners of *Macrocyprissa* and *Macrosarisa.*——*1,2.* *Macrosarisa bensoni* n. sp.; *1,* 2303, ×350 ; *2,* 1869M, ×300.——*3,4,11.* *Macrosarisa texana* n. sp.; *3,11,* 2286, ×300; *4,* 2241, ×350.——*5,12.* *Macrocyprissa cylindracea* (Bornemann), 2307; *5,* ×300; *12,* ×300.——*6,7,16,17.* *Macrosarisa capacis* n. sp.; *6,16,* 2366F, ×500; *7,17,* 2361F,

×500.——*8,13–15,19. Macrosarisa hiulca* n. sp.; *8,19,* 2356M, ×250; *13,* 2358F, ×250; *14,* 2358F, ×500; *15,* 2357F, ×500.——*9. Macrosarisa siliqua* (Jones), BMNH Io.1594, ×250.——*10,18. Macrosarisa exquisita* (Kaye); *10,* BMNH Io.1271, ×425; *18,* BMNH Io.1270, ×425.——*20. Macrosarisa muensteriana* (Jones and Hinde), BMNH In.51622, ×180.

PLATE 73

Left anterior (*1–14*) and posterior (*15–20*) dentiform corners of *Macrosarisa.*——*1–3,16. Macrosarisa bensoni* n. sp.; *1,* 1869M, ×130; *16,* 1869M, ×200; *2,* 2303, ×350; *3,* 1711J, ×400.——*4,5,15. Macrosarisa texana* n. sp.; *4,15,* 2286, ×300; *5,* 2242, ×350.——*6–9,17–19. Macrosarisa capacis* n. sp.; *6,18,* 2360M, ×500; *7,17,* 2363F, ×500; *8,19,* 2366F, ×500; *9,* 2361F, ×500.——*10. Macrosarisa graysonensis* (Alexander), 2270, ×250.——*11,12,20. Macrosarisa hiulca* n. sp.; *11,20,* 2356M, ×250; *12,* 2358F, ×250.——*13,14. Macrosarisa exquisita* (Kaye); *13,* BMNH Io.1273, ×425; *14,* BMNH Io.1272, ×250.

PLATE 74

Exterior setae of *Macrosarisa* and *Macroscapha*——*1. Macrosarisa bensoni* n. sp., 1417M, ×1680.——*2,4. Macrosarisa* sp. 23, 1415M; *2,* ×2142; *4,* ×5376.——*3,6. Macroscapha inaequata* n. sp.; *3,* 825F, ×1344; *6,* 716M, ×1512.——*5,7–10. Macroscapha opaca* n. sp.; *5,* 1481F, ×1814; *7,* 1478M, ×756; *8,* 1478M, ×1386; *9,* 1481F, ×1386; *10,* 1478M, ×1512.

PLATE 75

Exterior setae of *Macroscapha.*——*1–4. Macroscapha tensa* (Müller), 861M; 1, ×798; *2,* ×764; *3,* ×1596; *4,* ×2713.——*5–7. Macroscapha turbida* (Müller); *5,* 373M, ×1512; *6,* 189F, ×1806; *7,* 350M, ×882.——*8. Macroscapha sinuata* n. sp., 850F, ×3444.

PLATE 76

Exterior setae of *Macrocyprina.*——*1–8. Macrocyprina bermudae* n. sp.; *1,5,* 130M, ×2646; *2,* 130M, ×2671; *3,* 130M, ×1327; *4,* 130M, ×3612; *6,8,* 131F, ×1470, *7,* 131F, ×2671.

PLATE 77

Exterior setae of *Macrocyprina.*——*1,2. Macrocyprina hortuli* n. sp., 993M; *1,* ×6510; *2,* ×2604.——*3. Macrocyprina* sp. 35, 1344RV, ×1302.——*4,5. Macrocyprina vargata* Allison and Holden, 1507F; *4,* ×3360; *5,* ×1344.——*6. Macrocyprina schmitti* (Tressler), 1505M, ×1386.——*7–9. Macrocyprina madagascarensis* n. sp., 83F; *7,* ×1428; *8,* ×714; *9,* ×2285.

PLATE 78

Right exterior muscle scars of *Macrocypris, Macromckenziea,* and *Macropyxis.*——*1,2. Macrocypris minna* (Baird); *1,* 1347, ×120; *2,* 2002M, ×120.——*3–5. Macrocypris maioris* n. sp.; *3,* 1433M, ×120; *4,* 1434M, ×90; *5,* 1435F, ×100.——*6,7. Macrocypris metuenda* n. sp.; *6,* 1405M, ×90; *7,* 1501M, ×90.——*8–10. Macrocypris miranda* n. sp.; *8,* 1420F, ×90; *9,* 1441M, ×90; *10,* 1442F, ×90.——*11. Macrocypris* sp. 1, 858F, ×90.——*12–14. Macromckenziea siliquosa* (Brady); *12,* 1530F, ×120; *13,* 1414M, ×120; *14,* 1410M, ×120.——*15. Macromckenziea australiana* (Neale), HU.65.C.6, ×180.——*16,17. Macromckenziea glacierae* n. sp.; *16,* 721F, ×120; *17,* 1957F, ×110.——*18. Macromckenziea gregalis* n. sp., 2326, ×100.——*19,20. Macromckenziea ligustica* (Bonaduce, Masoli, and Pugliese); *19,* 2276, ×150; *20,* BCM 333, ×180.——*21. Macromckenziea* sp. 3, 1995F, ×100.——*22. Macromckenziea* sp. 5, 1460F, ×110.——*23. Macromckenziea* sp. 19, 1495M, ×140.——*24–26. Macropyxis sapeloensis* (Darby); *24,* AMNH 12733, ×130; *25,* 1355M, ×130; *26,* 1979M, ×130.——*27,28. Macropyxis adrecta* n. sp.; *27,* 1527F, ×110; *28,* 1448M, ×120.——*29. Macropyxis adunca,* 1521F, ×120.——*30. Macropyxis adriatica* (Breman), 2087, ×120.

PLATE 79

Right exterior muscle scars of *Macropyxis.*——*1,2. Macropyxis amanda* n. sp.; *1,* 1425F, ×110; *2,* 1406M, ×110.—— *3. Macropyxis amoena* n. sp., 1463M, ×130.——*4,5. Macropyxis antonbruunae* n. sp.; *4,* 183M, ×150; *5,* 350M, ×130.——*6,7 Macropyxis arta* n. sp.; *6,* 1456M, ×130; *7,* 1451M, ×130.——*8–10. Macropyxis audens* n. sp.; *8,* 1781F, ×130; *9,* 1445M, ×120; *10,* 1444F, ×130.——*11–13. Macropyxis bathyalensis* (Hulings); *11,* USNM 153744, ×120; *12,* 2387M, ×120; *13,* 2386M, ×120.——*14,15. Macropyxis eltaninae* n. sp.; *14,* 834J, ×150; *15,* 833F, ×150.——*16,17. Macropyxis kaesleri* n. sp.; *16,* 638F, ×110; *17,* 1968F, ×110.——*18–20. Macropyxis kalbi* n. sp.; *18,* 334F, ×80; *19,* 1972F, ×80; *20,* 331M, ×90.——*21. Macropyxis kornickeri* n. sp., 2384M, ×120.——*22,23. Macropyxis labutisi* n. sp.; *22,* 1351M, ×130; *23,* 1352F, ×130.——*24. Macropyxis longana* (van den Bold), USNM 563494, ×130.——*25. Macropyxis rhodana* (van den Bold), USNM 563497, ×130.——*26,27. Macropyxis similis* (Brady); *26,* 2382M, ×120; *27,* 2383F, ×120.——*28. Macropyxis* sp. 8, 126F, ×150. ——*29. Macropyxis* sp. 9, 2338, ×120.——*30. Macropyxis* sp. 16, 327F, ×90.

PLATE 80

Right exterior (*1–4, 6–30*) and left interior (*5*) muscle scars of *Macropyxis, Macrocypria, Macrocyprissa, Macrosarisa, Macroscapha,* and *Macrocyprina.*——*1. Macropyxis* sp. 17, 1150F, ×120.——*2. Macropyxis* sp. 18, 1443F, ×100.——*3. Macropyxis* sp. 21, 1962F, ×100.——*4. Macrocypria sarsi* (Müller), 1998M, ×180.——*5,6. Macrocyprissa cylindracea* (Bornemann); *5,* 2305, ×150; *6,* 2307, ×150.—— *7. Macrocyprissa arcuata* (Colalongo and Pasini), 1533M, ×150.——*8. Macrocyprissa vandenboldi* n. sp., 2118, ×130.——*9. Macrocyprissa* sp. 22, 2336, ×250.——*10–12. Macrosarisa capacis* n. sp.; *10,* 2361F, ×130; *11,* 2364F, ×130; *12,* 2360M, ×130.——*13. Macrosarisa hiulca* n. sp., 2357, ×180.——*14–16. Macrosarisa texana* n. sp.; *14,* 2020, ×210; *15,* 2241, ×200; *16,* 2286, ×200.——*17,18. Macroscapha atlantica* n. sp.; *17,* 1983F, ×150; *18,* 1981M, ×150.——*19. Macroscapha gyreae* n. sp., 1509, ×190.——*20. Macroscapha heroica* n. sp., 1461F, ×150. ——*21. Macroscapha inaequalis* (Müller), 824J, ×120.——*22. Macroscapha inaequata* n. sp., 1459F, ×110.——*23. Macroscapha sinuata* n. sp., 329M, ×150.——*24. Macroscapha tensa* n. sp., 861M, ×140.——*25,26. Macroscapha turbida* n. sp.; *25,* 1934M, ×100; *26,* 375M, ×150.——*27. Macrocyprina propinqua* Triebel, Xe 3367F, ×210.——*28. Macrocyprina belizensis* n. sp., 1506J–2, ×180.——*29,30. Macrocyprina bermudae* n. sp.; *29,* 130M, ×180; *30,* 131F, ×180.

Plate 81

Right (*1–20, 27*) and left (*21–26*) exterior (*1–26*) and interior (*26,27*) muscle scars of *Macrocypris, Macromckenzie, Macropyxis, Macrocypria, Macrosarisa,* and *Macrocyprina.*——*1. Macrocyprina bonaducei* n. sp., 2264, ×180.——*2,3. Macrocyprina captiosa* n. sp.; *2,* 2351M, ×160; *3,* 2352F, ×160.——*4. Macrocyprina hartmanni* n. sp., 2130M, ×150.——*5. Macrocyprina hawkae* n. sp., 1853M, ×150.——*6–8. Macrocyprina hortuli* n. sp.; *6,* 1508M, ×180; *7,* 1762M, ×150; *8,* 1761F, ×150.——*9,10. Macrocyprina jamaicae* n. sp.; *9,* 2247, ×150; *10,* 2250, ×150.——*11,12. Macrocyprina madagascarensis* n. sp.; *11,* 1149F, ×150; *12,* 2025, ×130.——*13–15. Macrocyprina moza* n. sp.; *13,* 2346, ×180; *14,* 2345, ×180; *15,* 2344, ×180.——*16. Macrocyprina noharai* n. sp., 2063, ×130.——*17. Macrocyprina succinea* (Müller), 1906F, ×150.——*18. Macrocyprina vargata* Allison and Holden, 1507, ×250.——*19. Macrocyprina* sp. 35, 1342, ×150.——*20. Macrocyprina* sp. 39, 1854F, ×150.——*21. Macrocypris minna* (Baird), 1347, ×90.——*22. Macromckenziea siliquosa* (Brady), 1950, ×110.——*23. Macrocypria sarsi* (Müller), 1998M, ×180.——*24. Macrosarisa exquisita* (Kaye), BMNH Io.1270, ×180.——*25. Macrosarisa texana* n. sp., 2242, ×200.——*26,27. Macropyxis audens* n. sp., 1445M, ×197.

Plate 82

Fecal balls of *Macrocypris* and *Macropyxis* in plane and cross-polarized light.——*1,2,5. Macrocypris minna* (Baird), 2002M; *1,2,* fine-grained fecal ball with rounded, birefringent mineral grains, ×100; *5,* enlarged view of same to show organic pellicle surrounding ball, ×250.——*3,4. Macropyxis audens* n. sp., 1445M, same fecal ball in plane and cross-polarized light, ×75.——*6,11,12. Macrocypris minna* (Baird), 2003F; *6,* detail of mottled texture showing rounded, quadrate, and spicular shapes, ×250; *11,12,* same fecal balls in plane and cross-polarized light, showing spherical organic clumps, ×40.——*7. Macropyxis sapeloensis* (Darby), 1355M, in cross-polarized light, showing lamellar and equant mineral grains, ×90.——*8–10. Macrocypris maioris* n. sp., 1434M; same fecal ball in plane and cross-polarized light, and detail showing articulated calcareous plates of a skeleton; *8,9,* ×75; *10,* ×225.——*13,14. Macrocypris miranda* n. sp., 1442F, same fecal balls in plane and cross-polarized light, with prismatic mineral grains, ×100.

Plate 83

Fecal balls and soft anatomy.——*1. Macropyxis amanda* n. sp., 1792F, fine-grained ball with dark organic clumps, ×65.——*2. Macroscapha turbida* (Müller), 2372F, very fine-grained balls with large, irregular mineral grains, ×110.——*3. Macromckenziea glacierae* n. sp., 721F, coarse-grained ball with large mineral grains and dark organic masses, ×100.——*4. Macropyxis arta* n. sp., 1454F, detail of organic clump or organism (?) within very fine-grained organic matrix, ×400.——*5. Macrocypris miranda* n. sp., 1442F, detail of coarse-grained ball showing spherical organic clumps and wisps or shards of non-birefringent skeletal fragments, possibly arthropods or diatoms, ×450.——*6. Macrocypris miranda* n. sp., 1419M, detail of very fine-grained organic matrix with dark, organic filaments or fragments, ×250.——*7. Macropyxis antonbruunae* n. sp., 356FJ–1, detail of coarse-grained fecal ball with irregular mineral grains and numerous, non-birefringent spicules or setae, ×250.——*8. Macropyxis arta* n. sp., 1451M, detail of coarse-grained fecal ball with dark organic clumps, small foraminiferal test in upper right, and possible diatom in lower center, ×225.——*9. Macrocypris maioris* n. sp., 1774M; ventral view of entire copulatory organ to show tetrahedral form of each hemipenis, anterodistal tip is to the left, ×60.——*10. Macroscapha tensa* (Müller), 862F; colony of ciliates (?) attached on dorsal edge of next-to-last podomere of seventh limb; several other colonies were attached elsewhere on the body of this animal, ×300.——*11. Macrocypris metuenda* n. sp., 1952M; detail of terminal hook of male fifth limb, to show the saucer-shaped distal aesthetasc resembling a suction cup, possibly sensory in function, ×350.——*12. Macrosarisa* sp. 23, 1415M; fecal ball in cross-polarized light to birefringent filaments or spicules (?), ×225.

Plate 84

Lateral, dorsal, and ventral views of whole animals and carapaces.——*1. Macrosarisa* sp. 23, 1415M, lateral view of whole animal in transmitted light before dissection, ×75.——*2. Macrocypria sarsi* (Müller), 1999F, dorsal midsection of whole animal in transmitted light before dissection, showing reversed hingement and overlap, ×65.——*3. Macrosarisa bensoni* n. sp., 1869M, dorsal view of whole animal in reflected light before dissection, ×45.——*4. Macromckenziea siliquosa* (Brady), 1414M, right lateral view of whole animal with right valve removed, in transmitted light before dissection, ×45.——*5. Macrocyprina hartmanni* n. sp., 2130M, ventral view of whole animal in reflected light before dissection, ×65.——*6. Macrocypris maioris* n. sp., 1774M, right lateral view of animal with right valve removed, in reflected light before dissection, ×20.——*7,8. Macrosarisa simplex* (Chapman), BMNH Io.1275, dorsal and ventral views of whole carapace, ×55.——*9,10. Macropyxis* sp. 10, 2337, dorsal and ventral views of whole carapace, ×55.

Plate 85

Hemipenes of *Macrocypris.*——*1. Macrocypris minna* (Baird), 2002M, ×80.——*2,3,6. Macrocypris maioris* n. sp.; *2,* 1433M, ×80; *3,* 1434M, ×80; *6,* 1774M, ×80.——*4,5,7–9. Macrocypris metuenda* n. sp.; *4,* 1404M, ×55; *5,8,* 1405M, ×55; *7,* 1439M, ×60; *9,* 1780M, ×55. ——*10–12. Macrocypris miranda* n. sp.; *10,* 1441M, ×80; *11,* 1955M, ×65; *12,* 1419M, ×85.

PLATE 86

Hemipenes and male furcae of *Macromckenziea* and *Macropyxis.*——*1–4,10,11. Macromckenziea siliquosa* (Brady); *1,* 1414M, ×160; *2,* 1410M, ×160; *3,4,* 1500M, ×160; *10,* 1414M, furcae, ×640; *11,* 1410M, furcae, ×640.——*5–9. Macromckenziea glacierae* n. sp.; *5,* 722M, ×140; *6,* 720M, ×130; *7,8,* 880M, ×130; *9,* 722M, ×130.——*12,13. Macromckenziea* sp. 19, 1495M; *12,* both hemipenes, ×170; *13,* detail of copulatory rod, ×425.——*14,15. Macropyxis amoena* n. sp., 1463M, ×115.

PLATE 87

Hemipenes of *Macropyxis.*——*1–6. Macropyxis sapeloensis* (Darby); *1,* 1355M, ×170; *2,* 1391M, ×170; *3,* UMPM 48780, ×180; *4,* 1354M, ×170; *5,6,* 1979M, ×170.——*7. Macropyxis kaesleri* n. sp., 1967M, ×130.——*8–13. Macropyxis labutisi* n. sp.; *8,* 1978M, ×180; *9,* 1351M, ×180; *10,12,* 1977M, ×180; *11,* 1350M, ×180; *13,* 1364M, ×180.

PLATE 88

Hemipenes of *Macropyxis.*——*1. Macropyxis adrecta* n. sp., 1448M, ×130.——*2–4. Macropyxis arta* n. sp.; *2,* 1456M, ×130; *3,4,* 1451M, ×130.——*5–7. Macropyxis amanda* n. sp.; *5,* 1529M, ×80; *6,7,* 1406M, ×80.——*8–12. Macropyxis audens* n. sp.; *8,9,* 1525M, ×130; *10,* 1446M, ×130; *11,12,* 1445M, ×130.——*13–17. Macropyxis adunca* n. sp.; *13,* 1519M, ×100; *14,* 1520M, ×110; *15,* 1519M, ×100; *16,17,* 1519M, details of copulatory rod, ×275.

PLATE 89

Hemipenes of *Macropyxis.*——*1–6. Macropyxis antonbruunae* n. sp.; *1,* 183M, ×130; *2,* 1966M, ×130; *3,* 341M, ×110; *4,* 358M, ×130; *5,6,* 332M, ×130.——*7–9. Macropyxis eltaninae* n. sp., 831M, ×120.——*10–15. Macropyxis kalbi* n. sp.; *10,11,* 331M, ×75; *12,* 351M, ×75; *13,* 335M, ×75; *14,* 1970M, ×75; *15,* 839M, ×75.

PLATE 90

Hemipenes of *Macropyxis* and *Macrocyprina.*——*1–3,15. Macrocyprina barbara* n. sp., 2400M; *1,2,* ×180; *3,15,* ×425.——*4,12. Macropyxis kornickeri* n. sp., 2384M; *4,* ×105; *12,* ×250.——*5–8,11,13. Macropyxis bathyalensis* (Hulings); *5,6,* 2387M, ×100; *7,8,* 2386M, ×115; *11,13,* 2386M, ×250.——*9,10,14. Macropyxis similis* (Brady), 2382M; *9,10,* ×110; *14,* ×250.

PLATE 91

Hemipenes of *Macrocypria, Macrocyprissa,* and *Macrosarisa.*——*1,2. Macrocypria sarsi* (Müller), 1998M, ×170.——*3,4. Macrosarisa bensoni* n. sp., 1869M, at high and low planes of focus, ×250.——*5,6. Macrosarisa hiulca* n. sp., 2356M, ×140.——*7,8. Macrosarisa* sp. 23, 1415M, ×125.——*9. Macrocypria semesa* n. sp., 843M, ×130.——*10–14. Macrocyprissa arcuata* (Colalongo and Pasini); *10,11,* 1534M, ×200; *12,* 1535M, ×200; *13,14,* 1533M, ×200.

PLATE 92

Hemipenes of *Macroscapha.*——*1,2,4–6. Macroscapha opaca* n. sp.; *1,* 1478M, ×110; *2,* 1959M, ×110; *4,* 1478M, details of copulatory rod, ×120; *5,6,* 1479M, ×110.——*3,7,10. Macroscapha inaequata* n. sp.; *3,* 716M, ×100; *7,* 2380M, ×120; *10,* 714M, ×100.——*8,9. Macroscapha* sp. 25, 198M; *8,* ×140; *9,* ×110.

PLATE 93

Hemipenes of *Macroscapha* and *Macrosarisa.*——*1–4. Macroscapha inaequalis* (Müller); *1,4,* 1941M, ×95; *2,3,* 1940M, ×95.——*5,6. Macrosarisa capacis* n. sp., 2360M, ×110.——*7–11. Macroscapha sinuata* n. sp.; *7,* 845M, ×65; *8,9,* 328M, ×90; *10,11,* 329M, ×90.——*12–16. Macroscapha heroica* n. sp., 1462M; *13,14,* fragments of copulatory rod and adjacent structures, ×90; *12,15,16,* fragments of capsule, ×90.

PLATE 94

Hemipenes of *Macroscapha.*——*1–13. Macroscapha turbida* (Müller); *1,4,* 1943M, ×110; *2,* 1944M, ×110; *3,* 1487M, ×140; *5,* 197M, ×140; *6,9,* 1946M, ×110; *7,10,* 1475M, ×140; *8,* 821M, ×140; *11,* 1934M, ×100; *12,* 375M, ×140; *13,* 827M, ×140.

PLATE 95

Hemipenes of *Macroscapha* and *Macrocyprina.*——*1–6,9. Macrocyprina madagascarensis* n. sp.; *1,* 19M, ×120; *2–5,* 1757M, ×130; *6,* 668M, ×130; *9,* 2364M, ×130.——*7,8. Macrocyprina moza* n. sp., 2365M, ×140.——*10–15. Macroscapha atlantica* n. sp.; *10,11,* 1982M, ×105; *12,13,* 1981M, ×105; *14,15,* 1980M, ×105.

PLATE 96

Hemipenes of *Macrocyprina.*——*1–3. Macrocyprina propinqua* Triebel; *1,* Xe 3368, ×200; *2,3,* Xe 3362, ×210.——*4–6. Macrocyprina succinea* (Müller); *4,* 1904M, ×210; *5,6,* 1905M, ×210.——*7,8. Macrocyprina dispar* (Müller), 1933M, ×100.——*9,10. Macrocyprina* *hartmanni* n. sp., 2130M, ×50.——*11. Macrocyprina swaini* n. sp., 1992M, ×120.——*12,13. Macrocyprina africana* (Müller), 1937M, ×150.——*14–17. Macrocyprina captiosa* n. sp.; *14,15,* 2353M, ×200; *16,17,* 2351M, ×200.

PLATE 97

Hemipenes of *Macrocyprina.*——*1–4. Macrocyprina hortuli* n. sp.; *1,2,* 1762M, ×180; *3,4,* 1760M, ×200.——*5,6. Macrocyprina bermudae* n. sp., 1759M, ×200.——*7–10. Macrocyprina skinneri* Kontrovitz; *7,8,* 1910M, ×165; *9,* 1909M, ×150; *10,* 1909M, ×165.——*11–14. Macrocyprina schmitti* (Tressler); *11,12,* 1763M, ×180; *13,14,* 1538M, ×180.——*15–18. Macrocyprina hawkae* n. sp.; *15,16,* 1852M, ×120; *17,18,* 1853M, ×120.

PLATE 98

Zenker's organ, vas deferens, and sperm of *Macrocypris.*——*1,2. Macrocypris minna* (Baird), 2002M, ×50.——*3–7. Macrocypris miranda* n. sp.; *3,* 1441M, ×50; *4,5,* 1419M, ×50; *6,7,* 1955M, ×85.——*8–11. Macrocypris metuenda* n. sp.; *8,* 1780M, ×35; *9,* 1952M, ×35; *10,* 1952M, ×140; *11,* 1952M, ×85.

PLATE 99

Zenker's organ, vas deferens, and sperm of *Macrocypris* and *Macropyxis.*——*1–4. Macrocypris metuenda* n. sp.; *1,2,* 1404M, ×35; *3,4,* 1405M, ×35.——*5–9. Macrocypris maioris* n. sp.; *5,* 1431M, ×50; *6,7,* 1433M, ×50; *8,* 1434M, ×50; *9,* 1434M, ×80.——*10–15. Macropyxis antonbruunae* n. sp.; *10,* 358M, ×75; *11,13,* 332M, ×85; *12,* 183M, ×75; *14,15,* 1966M, ×85.

PLATE 100

Zenker's organ, vas deferens, and sperm of *Macromckenziea* and *Macropyxis.*——*1–6. Macromckenziea glacierae* n. sp.; *1,3,5,* 720M, ×65; *2,* 722M, ×65; *4,6,* 880M, ×65.——*7–9,11,12,14. Macromckenziea siliquosa* (Brady); *7,* 1410M, ×80; *8,9,* 1500M, ×70; *11,12,* 1414M, ×70; *14,* 1410M, ×70.——*10,13,15–19. Macropyxis adunca* n. sp.; *10,* 1519M, ×100; *13,* 1519M, ×87; *15–19,* 1520M; *15,* ×65; *16–19,* ×100.——*20,21. Macromckenziea* sp. 19, 1495M, ×80.

PLATE 101

Zenker's organ, vas deferens, and sperm of *Macropyxis.*——*1–4. Macropyxis sapeloensis* (Darby); *1,* UMPM 48780, ×102; *2,* 1391M, ×95; *3,4,* 1355M, ×95.——*5–11. Macropyxis labutisi* n. sp.; *5,* 1367M, ×80; *6,* 1367M, ×90; *7,9,* 1351M, ×80; *8,* 1977M, ×80; *10,* 1350M, ×90; *11,* 1978M, ×80.——*12–15. Macropyxis kalbi* n. sp.; *12,* 1970M, ×40; *13,* 335M, ×45; *14,* 351M, ×45; *15,* 331M, ×85.

PLATE 102

Zenker's organ, vas deferens, and sperm of *Macropyxis.*——*1–4. Macropyxis amanda* n. sp.; *1,2,* 1406M, ×75; *3,4,* 1407M, ×60.——*5–9. Macropyxis audens* n. sp.; *5,8,9,* 1525M, ×110; *6,* 1446M, ×75; *7,* 1446M, ×110.——*11,12. Macropyxis bathyalensis* (Hulings); *11,* 2386M, ×60; *12,* 2387M, ×60.——*10,13. Macropyxis adrecta* n. sp., 1448M, ×75.

PLATE 103

Zenker's organ, vas deferens, and sperm of *Macropyxis.*——*1–3. Macropyxis kornickeri* n. sp., 2384M, ×85.——*4–9. Macropyxis bathyalensis* (Hulings); *4,* 2386M, ×130; *5,* 2386M, ×60; *6,* 2387M, ×70; *7,* 2387M, ×135; *8,* 2389M, ×50; *9,* 2389M, ×100.——*10–12. Macropyxis similis* (Brady), 2382M; *10,11,* ×120; *12,* ×60.

PLATE 104

Zenker's organ, vas deferens, and sperm of *Macrocyprissa* and *Macrosarisa.*——*1–5. Macrocyprissa arcuata* (Colalongo and Pasini); *1,* 1532M, ×65; *2,3,* 1534M, ×65; *4,5,* 1533M, ×65.——*6,7. Macrosarisa bensoni* n. sp., 1869M, ×190.——*8,9. Macrosarisa* sp. 23, 1415M, ×90.

PLATE 105

Zenker's organ, vas deferens, and sperm of *Macrocypria, Macrosarisa,* and *Macroscapha.*——*1,2. Macrosarisa hiulca* n. sp., 2356M, ×90.——*3. Macroscapha* sp. 25, 198M, ×95.——*4,5. Macrocypria sarsi* (Müller), 1998M, ×90.——*6. Macrocypria semesa* n. sp., 843M, ×80.——*7,8. Macroscapha marchilensis* (Hartmann), K-27321; *7,* ×90; *8,* ×80.——*9–13. Macroscapha inaequalis* (Müller); *9,10,* 1941M, ×50; *11–13,* 1940M, ×55.——*14–19. Macroscapha opaca* n. sp.; *14,* 1479M, ×55; *15,* 1959M, ×65; *16,* 1959M, ×55; *17,* 1479M, ×55; *18,19,* 1478M, ×55.

PLATE 106

Zenker's organ, vas deferens, and sperm of *Macroscapha* and *Macrosarisa.*——*1,2. Macroscapha heroica* n. sp., 1462M, ×95.——*3–8. Macroscapha atlantica* n. sp.; *3,8,* 1981M, ×70; *4,5,* 1980M, ×60; *6,7,* 1982M, ×70.——*9–11. Macroscapha sinuata* n. sp.; *9,10,* 846M, ×65; *11,* 845M, ×65.——*12–15. Macrosarisa capacis* n. sp., 2360M, ×85.

Plate 107

Zenker's organ, vas deferens, and sperm of *Macroscapha.*——*1–14. Macroscapha turbida* (Müller); *1,* 1944M, ×50; *2,10,* 1487M, ×70; *3,6,* 197M, ×60; *4,* 1943M, ×50; *5,9,* 1948M, ×50; *7,8,* 827, ×90; *11,* 375M, ×90; *12,14,* 821M, ×90; *13,* 1475M, ×70.——*15,16. Macroscapha inaequata* n. sp., 865M, ×60.——*17–19. Macroscapha tensa* n. sp., 861M, ×55.

Plate 108

Zenker's organ, vas deferens, and sperm of *Macrocyprina.*——*1,2. Macrocyprina africana* (Müller), 1937M, ×75.——*3,4,7. Macrocyprina moza* n. sp., 2365M; *3,7,* ×80; *4,* ×275.——*5,6,8,9. Macrocyprina captiosa* n. sp.; *5,6,* 2351M, ×100; *8,9,* 2353M, ×90.——*10,11,13–15. Macrocyprina succinea* (Müller); *10,11,13,* 1905M, ×160; *14,15,* 1904M, ×160.——*12,16–20. Macrocyprina madagascarensis* n. sp.; *12,16,20,* 1757M, ×90; *17,18,* 2364M, ×90; *19,* 668M, ×90.

Plate 109

Zenker's organ, vas deferens, and sperm of *Macrocyprina.*——*1,2. Macrocyprina dispar* (Müller), 1933M, ×80.——*3,7,8. Macrocyprina hortuli* n. sp.; *3,* 993M, ×80; *7,8,* 1508M, ×130.——*4,5. Macrocyprina propinqua* Triebel, Xe 3368, ×85.——*6,9. Macrocyprina barbara* n. sp., 2400M, ×95.——*10,11. Macrocyprina skinneri* Kontrovitz; *10,* 1910M, ×65; *11,* 1909M, ×65.——*12–14. Macrocyprina bermudae* n. sp.; *12,* 1760M, ×80; *13,14,* 1759M, ×80.——*15. Macrocyprina swaini* n. sp., 1992M, ×90.——*16,17. Macrocyprina hawkae* n. sp., 1852M, ×65.——*18,19. Macrocyprina schmitti* (Tressler); *18,* 1763M, ×65; *19,* 1538M, ×65.——*20–24. Macrocyprina hartmanni* n. sp., 2130M; *20,21,* ×115; *22–24,* ×290.

Plate 110

Furcal attachment and male and female genitalia, *Macrocypris, Macromckenziea,* and *Macropyxis.*——*1. Macrocypris minna* (Baird), 2003F, posterior body of female with furcae, genital lobes, and coiled ducts, ×180.——*2. Macrocypris miranda* n. sp., 1442F, posterior body of female with furcae, genital lobes, two large bundles of sperm, and numerous eggs, ×110.——*3. Macrocypris miranda* n. sp., 1441M, posterior body of male showing furcae, furcal attachment, and support for hemipenes, ×110.——*4. Macrocypris metuenda* n. sp., 1438F, posterior body of female with furcae, genital lobes, two large bundles of sperm, eggs, and ovaries, ×90.——*5. Macromckenziea glacierae* n. sp., 721F, posterior body of female with genital lobes, eggs, and two large, circular coils of sperm; furcae are too small to be seen, ×90.——*6. Macropyxis kalbi* n. sp., 351M, posterior body of male with furcae, furcal attachment, hemipenes and support, and thoracic legs, ×60.——*7. Macromckenziea glacierae* n. sp., 719F, posterior body of female with genital lobes; arrow marks vestigial furcae, ×130.——*8,9. Macromckenziea siliquosa* n. sp., 1412F; posterior body of female with ovoid bundle of sperm, vestigial furcae, and genital lobes; *8,* ×130; *9,* ×225.

Plate 111

Furcal attachment and male and female genitalia, *Macropyxis, Macrocypria, Macrocyprissa, Macrosarisa, Macroscapha,* and *Macrocyprina.*——*1. Macropyxis* sp. 21, 1962F, posterior body of female with furcae and genital lobes, ×150.——*2. Macropyxis kaesleri* n. sp., 1969F, posterior body of female with furcae and genital lobes, ×150.——*3. Macropyxis adunca* n. sp., 1521F, posterior body of female with furcae, genital lobes, and sperm, ×150.——*4. Macropyxis labutisi* n. sp., 1352F, posterior body of female with furcae, genital lobes, sperm, and eggs, ×180.——*5. Macrosarisa bensoni* n. sp., 1417F, posterior body of female with furcae and genital lobes, ×150.——*6. Macrocyprissa arcuata* (Colalongo and Pasini), 1531F, posterior body of female with furcae and genital lobes, ×180.——*7. Macroscapha sinuata* n. sp., 852F, body of female after removing carapace and limbs, showing forehead, mouth, adductor muscles, eggs, sperm, furcal attachment, and furcae, ×50.——*8. Macrocyprina madagascarensis* n. sp., 1757M, body of male after removing carapace and limbs, showing forehead, mouth, adductor muscles, support for hemipenes, furcal attachment, and furcae, ×75.——*9. Macroscapha sinuata* n. sp., 845M, posterior of male body with furcae, furcal attachment, support for hemipenes, and hemipenes, ×80.——*10. Macroscapha inaequalis* (Müller), 1939F, posterior of female body with furcae, furcal attachment, and genital lobes, ×75.——*11. Macropyxis sapeloensis* (Darby), UM 48780, posterior of male body with furcae, furcal attachment, and support for hemipenes, ×200.——*12. Macrocypria sarsi* Müller, 1999F, furcae and furcal attachment, ×80.

Plate 112

Furcal attachment and setae of thoracic legs, *Macrocypris, Macropyxis, Macroscapha,* and *Macrocyprina.*——*1. Macrocyprina hartmanni* n. sp., 2130M, posterior of male body with furcae, furcal attachment, and support for hemipenes, ×180.——*2. Macrocyprina dispar* (Müller), 1931F, posterior of female body with furcae and furcal attachment, ×120.——*3. Macrocyprina africana* (Müller), 1937M, posterior of male body with furcae and furcal attachment, ×120.——*4. Macroscapha opaca* n. sp., 1480F, posterior of female body with furcae, furcal attachment, and genital lobes, ×120.——*5. Macropyxis kalbi* n. sp., 351M, posterior of male body with furcae, furcal attachment, and part of support for hemipenes, ×160.——*6. Macroscapha turbida* (Müller), 1948M, posterior of male body with furcae, furcal attachment, and part of support for hemipenes, ×75.——*7. Macroscapha turbida* (Müller), 1488F, posterior of female body with furcae, furcal attachment, and genital lobes, ×150.——*8. Macrocyprina bermudae* n. sp., 1758F, posterior of female body with furcae, furcal attachment, and genital lobes, ×170.——*9. Macrocyprina hortuli* n. sp., 1762M, posterior of male body with furcae and furcal attachment, ×120.——*10. Macrocyprina hartmanni* n. sp., 2132F, posterior of female body with furcae, furcal attachment, genital lobes, eggs, and ovaries, ×150.——*11. Macrocypris maioris* n. sp., 1433M, distal part of pinnate (reflexed) seta of seventh limb, ×150.——*12. Macrocypris metuenda* n. sp., 1401F, distal part of very elongate, reverse-barbed knee seta of seventh limb, ×500.——*13. Macrocyprina* *madagascarensis* n. sp., 1757M, both knee setae of seventh limb, ×500.——*14. Macrocyprina skinneri* Kontrovitz, 1910M, one knee seta of seventh limb, ×500.——*15. Macrocyprina propinqua* Triebel, Xe 3367, both knee setae of seventh limb, ×500.

PLATE 113

Species referred to family Pontocyprididae.——*1,6,8. Propontocypris (Propontocypris) parva* (Kaye); *1,6,* HU.20.C.8.1.13, right valve exterior and pontocypridid muscle scar pattern, *1,* ×150; *6,* ×250; *8,* HU.20.C.7.1., left valve exterior, ×80.——*2–5. Propontocypris (Propontocypris) minutus* (Swain and Peterson); *2,3,* left exterior and dorsal views of USNM 116640, ×80; *4,* left exterior of USNM 117965, ×80; *5,* ventral view of USNM 116639, ×80.——*7,15–25. Propontocypris (Propontocypris)* sp. indet. (="*Macrocypris?* sp. aff. *M. dimorpha*" of Holden, 1976); *7,18,23,24,* right exterior muscle scar pattern, dorsal, right, and left exteriors of USNM 184365, *7,* ×220; *18,23,24,* ×80; *15–17,* dorsal, right, and left exteriors of USNM 184363, ×80; *19,25,* dorsal and right exteriors of USNM 184367, ×80; *20,21,* right and left exteriors of USNM 184364, ×80; *22,* right exterior of USNM 184366, ×80.——*9–11. Propontocypris (Propontocypris) dimorpha* Hazel and Holden, dorsal, right, and left views of holotype, USNM 651442, ×80.——*12–14. Propontocypris (Propontocypris)* sp. indet. (=paratype specimen of "*Macrocypris? dimorpha* Hazel and Holden, 1971"); dorsal, right, and left views of USNM 651441, ×80.

PLATE 114

Species referred to family Cyprididae, subfamily Paracypridinae.——*1,2,13–15. Tasmanocypris setigera* (Brady); *1,13,* right exterior and muscle scar pattern of 2337, *1,* ×65; *13,* ×130; *2,* left exterior of 2338, ×65; *14,* right muscle scar pattern of 1041, ×70; *15,* right muscle scar pattern of 1042, ×70.——*3–8,10,16. Novocypris eocaenana* Ducasse; *3,* right exterior of 2343RV, ×60; *4,10,16,* left exterior, interior, and muscle scars of 2339LV, *4,10,* ×60; *16,* ×250; *5,8,* right exterior and hinge of 2342RV, *5,* ×60; *8,* ×180; *6,* left exterior of 2340LV, ×60; *7,* right hinge of 2341RV, ×180.——*9,11,12,17. Paracypris pacifica* Leroy; right, dorsal, and left exteriors and right muscle scar pattern of SU 6769, *9,11,12,* ×65; *17,* ×150.

PLATE 1

PLATE 2

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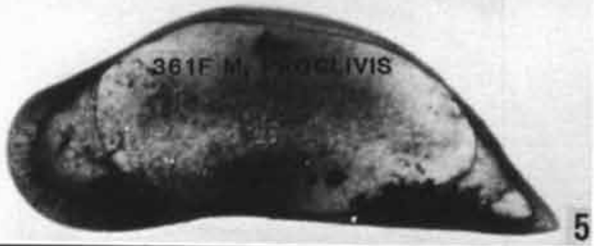

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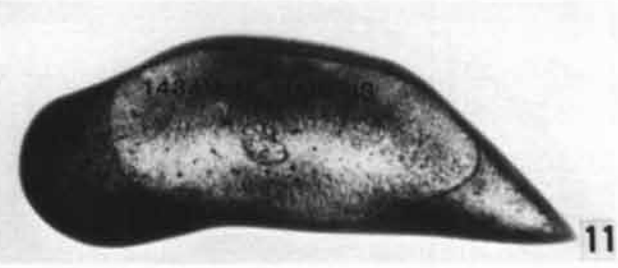

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PLATE 4

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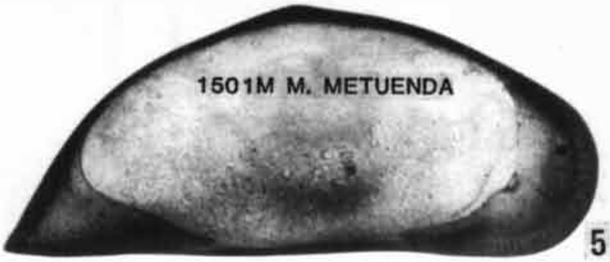

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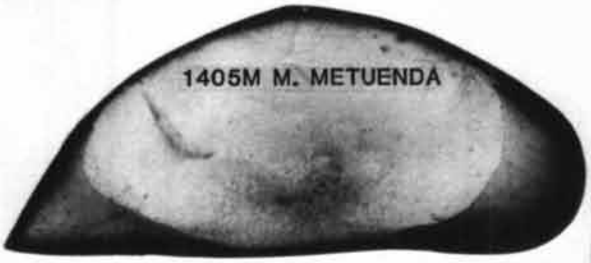

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PLATE 5

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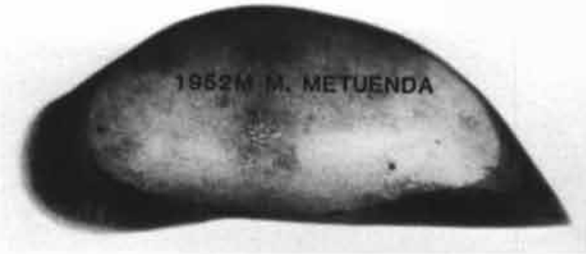

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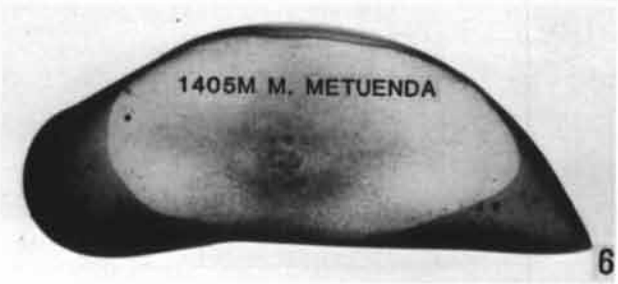

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PLATE 6

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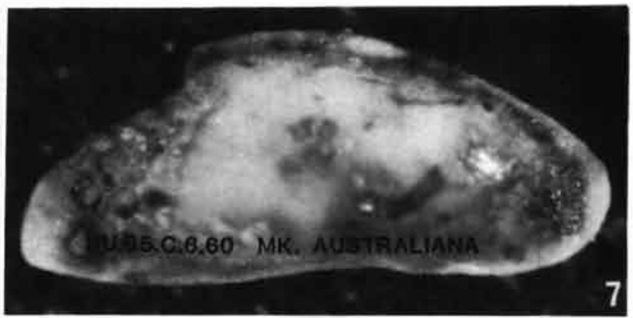

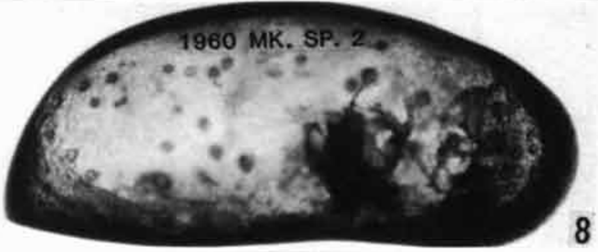

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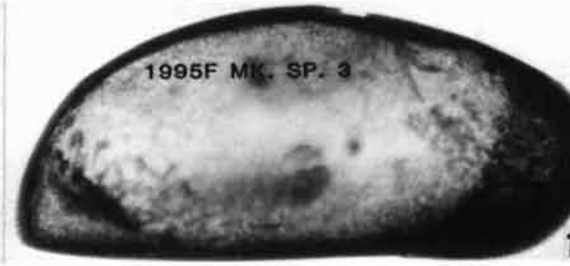

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PLATE 7

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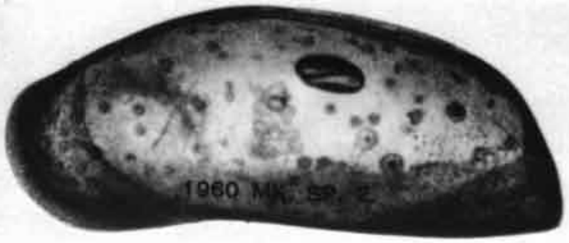

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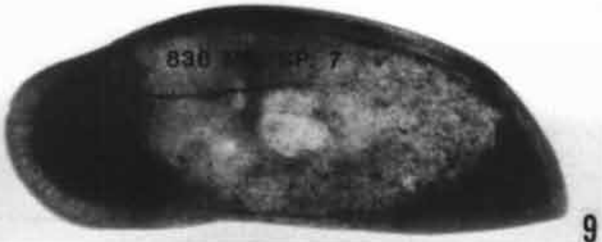

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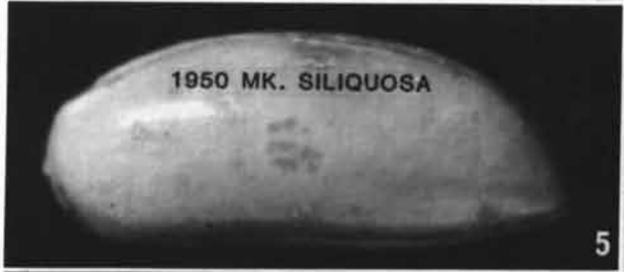

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PLATE 8

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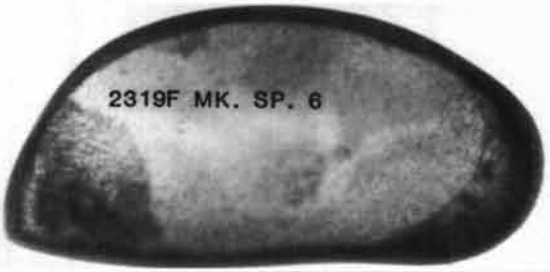

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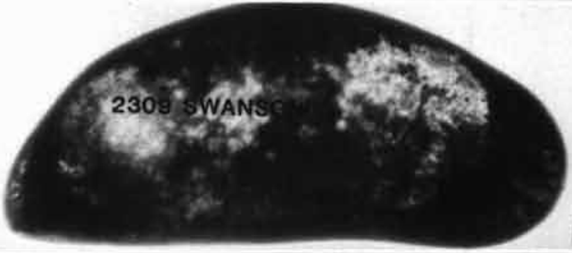

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PLATE 9

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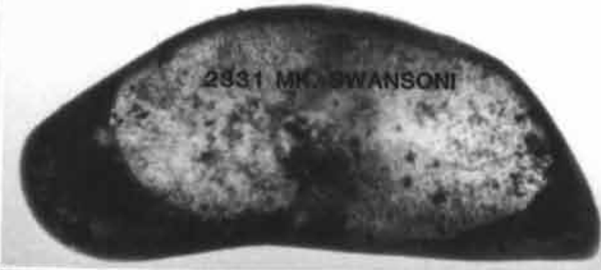

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PLATE 10

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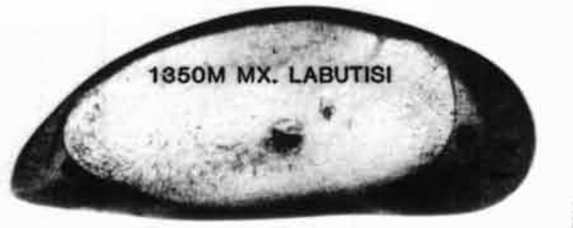

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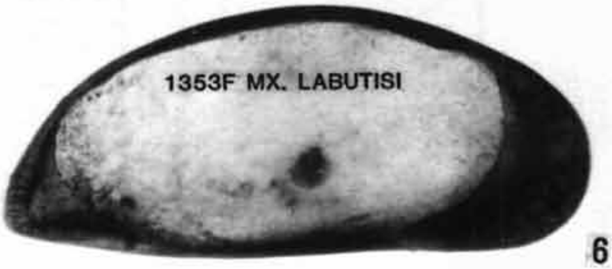

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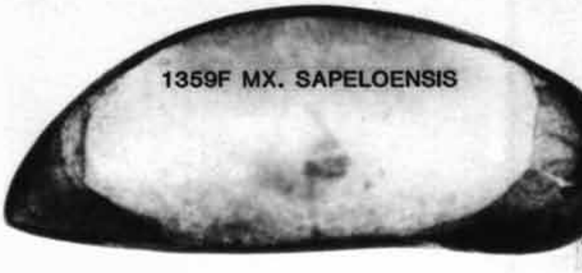

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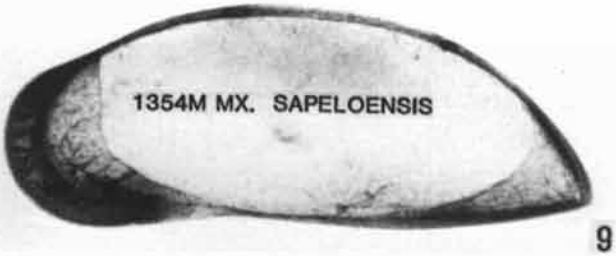

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PLATE 12

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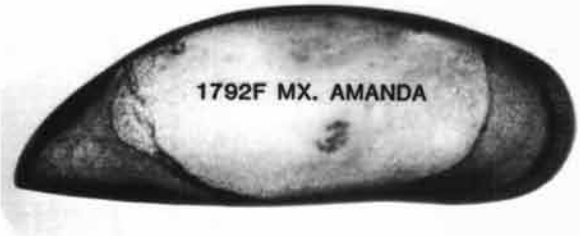

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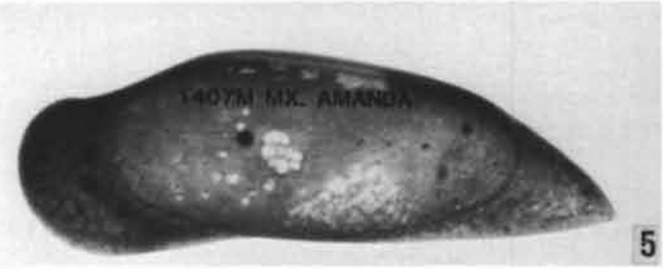

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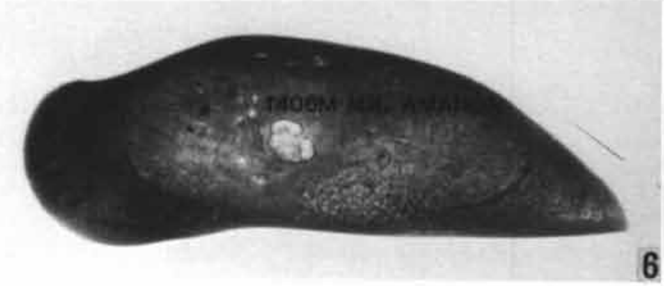

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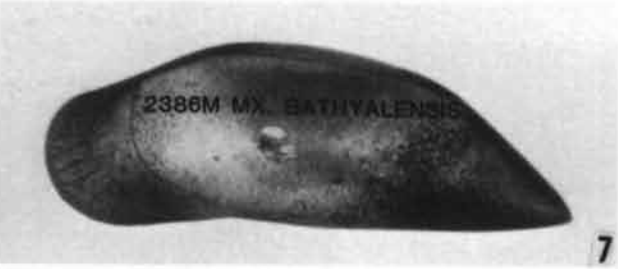

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PLATE 14

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PLATE 15

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PLATE 16

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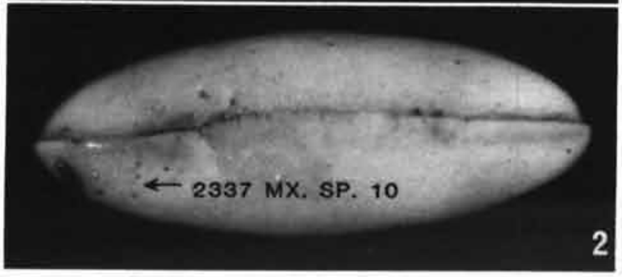

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PLATE 18

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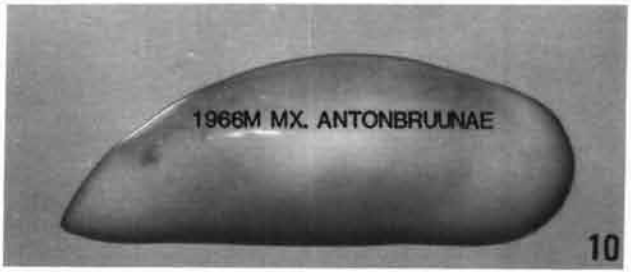

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PLATE 19

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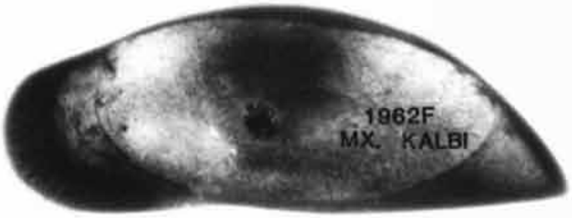

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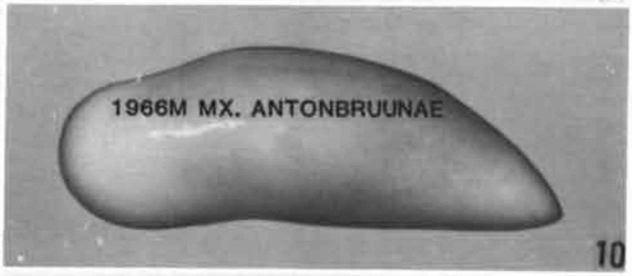

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PLATE 20

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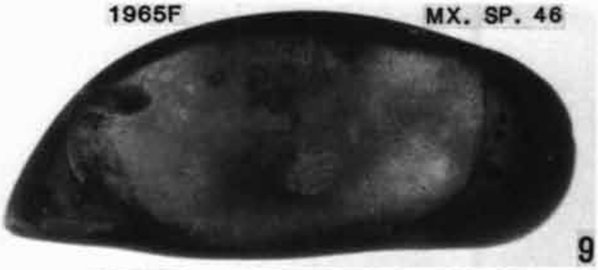

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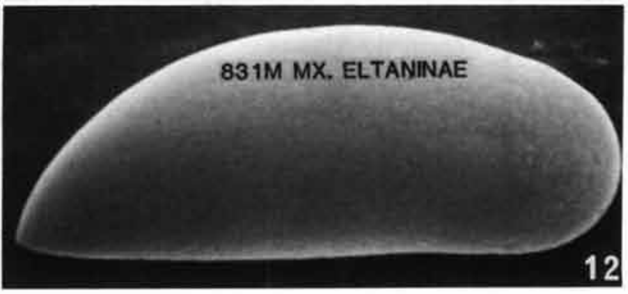

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PLATE 21

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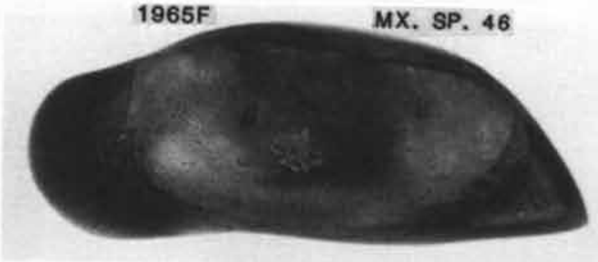

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PLATE 22


2104 MX. STEINECKI
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2228 MX. STEINECKI
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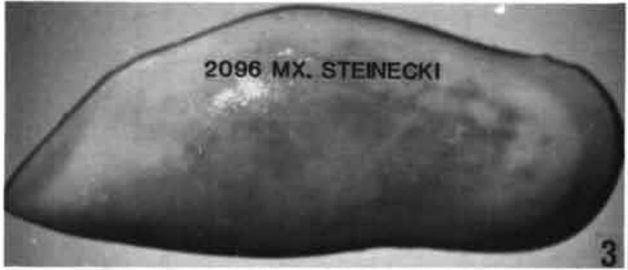
2096 MX. STEINECKI
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USNM 563496 MX. RHODANA
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USNM 563497 MX. RHODANA
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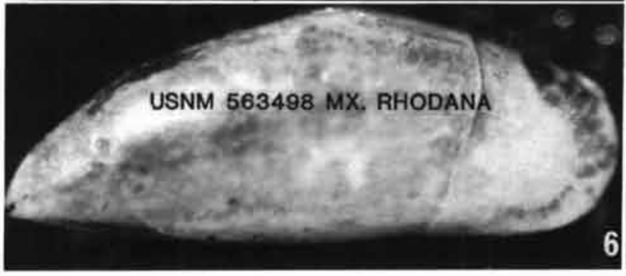
USNM 563498 MX. RHODANA
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USNM 153744 MX. BATHYALENSIS
7


1784 MX. SP. 20
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2411 MX. SP. 12
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2252
MX. LONGANA
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USNM 563494 MX. LONGANA
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USNM 563493 MX. LONGANA
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PLATE 24

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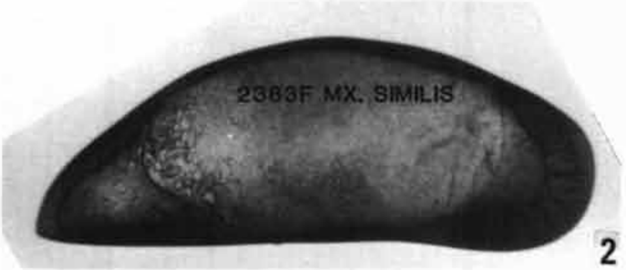

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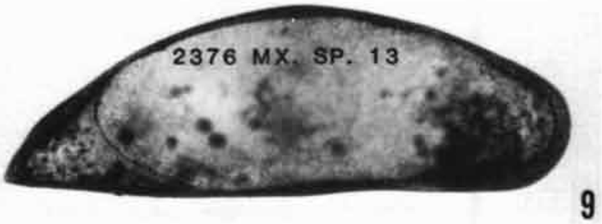

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PLATE 25

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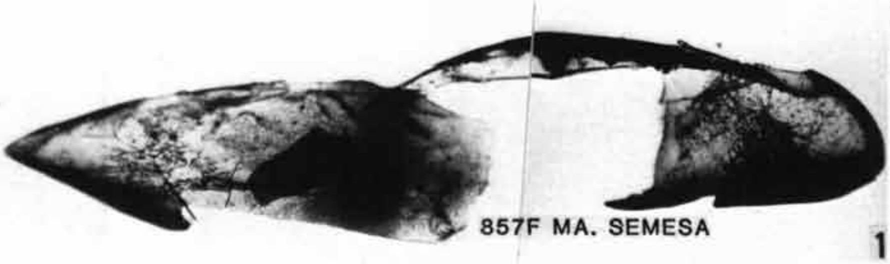
PLATE 26



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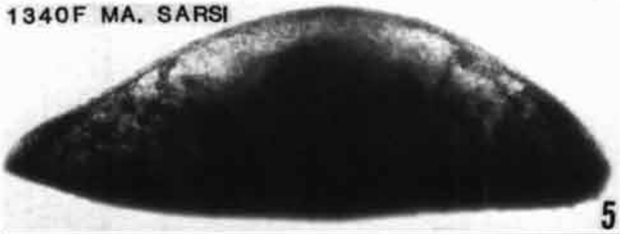

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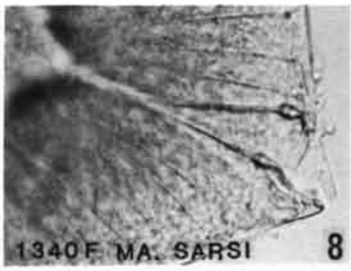

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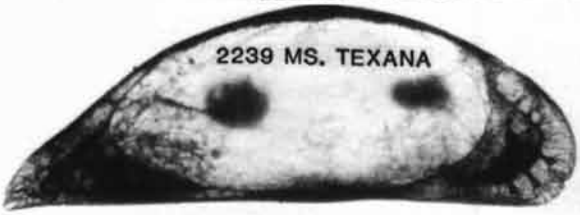

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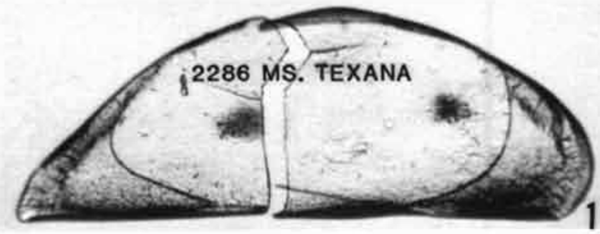

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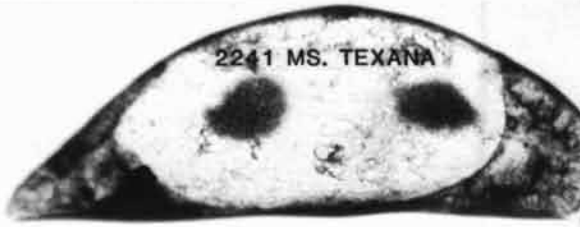

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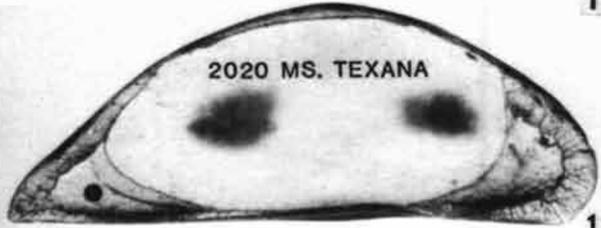

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PLATE 27

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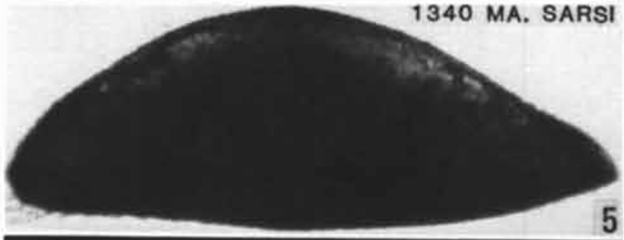

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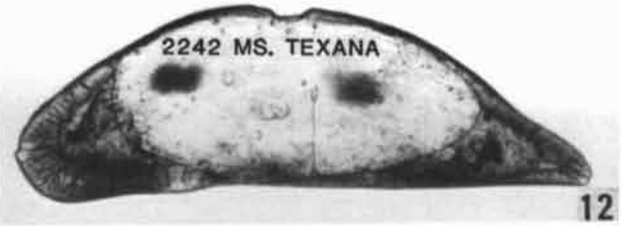

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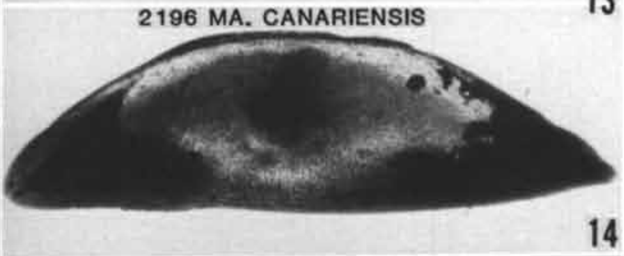

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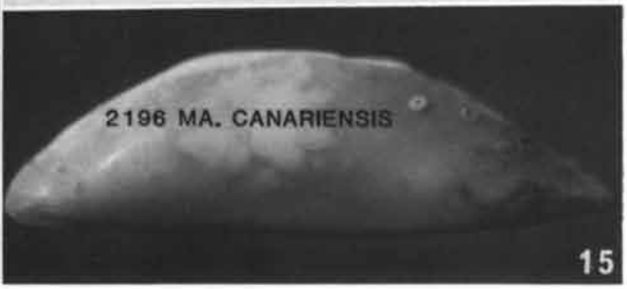

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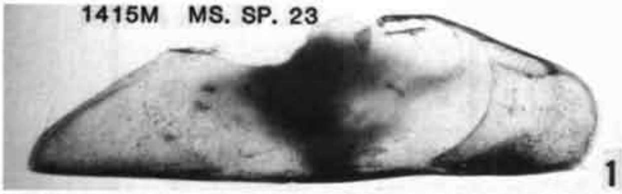
PLATE 28



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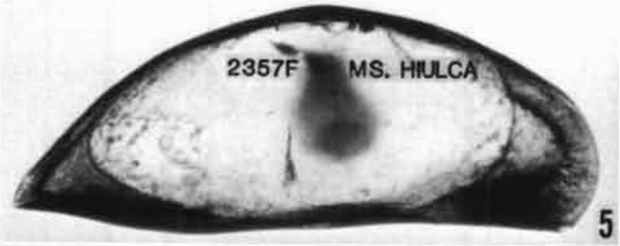

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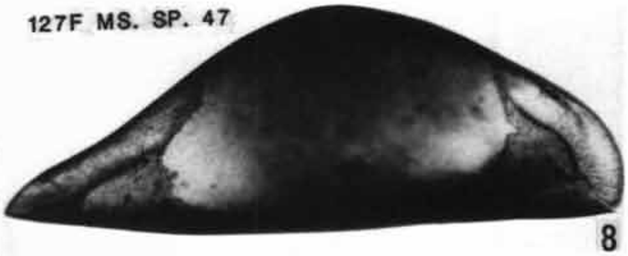

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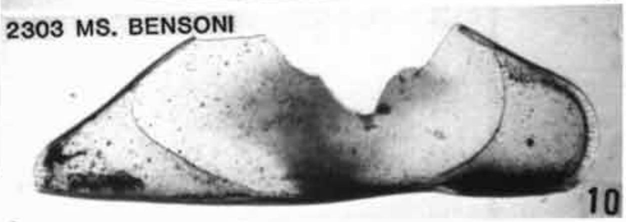

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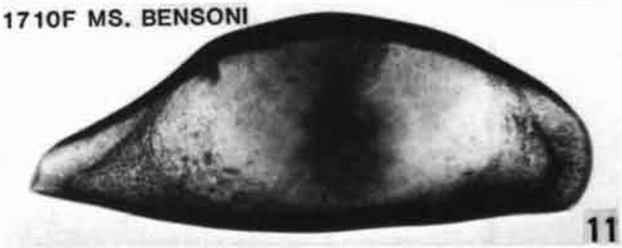

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PLATE 29

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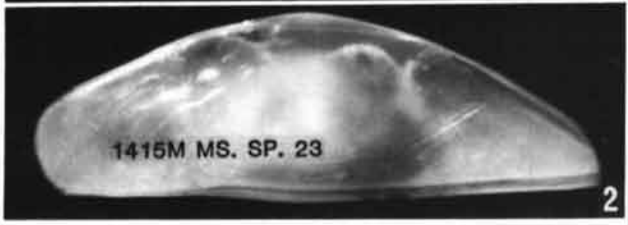

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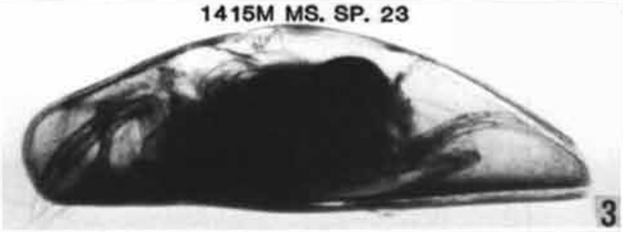

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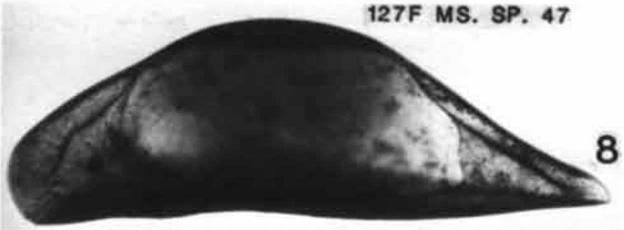

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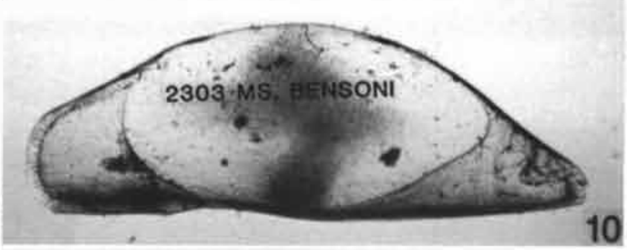

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PLATE 30

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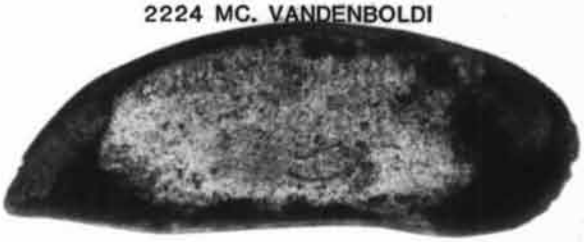

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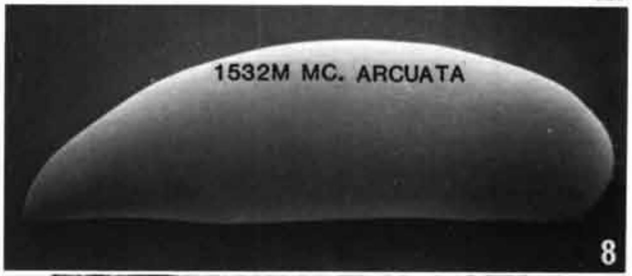

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PLATE 31

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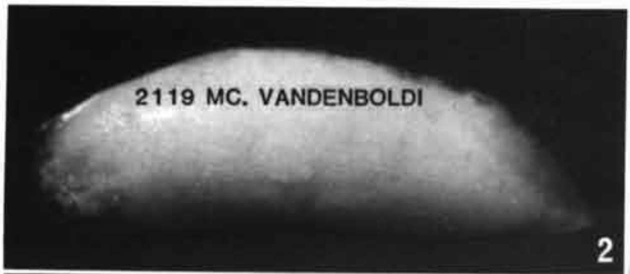

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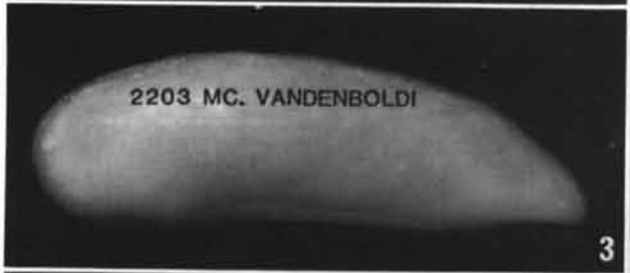

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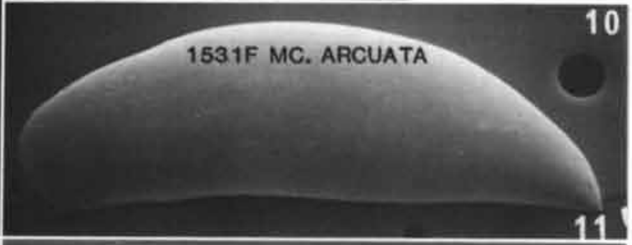

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PLATE 32

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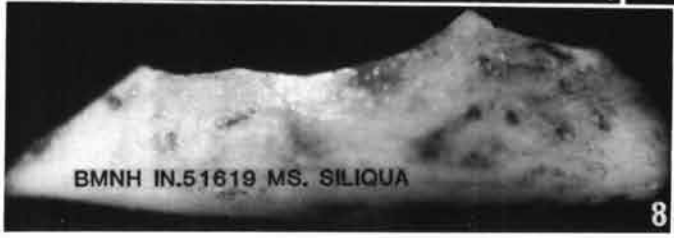

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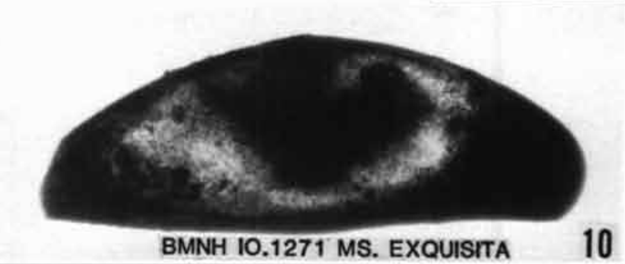

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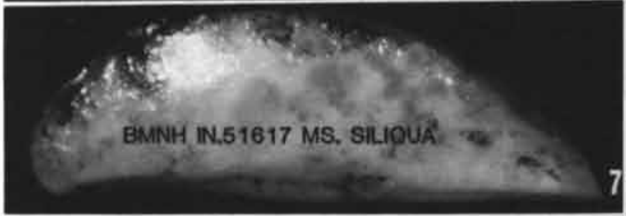

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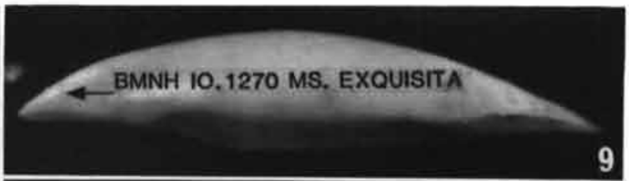

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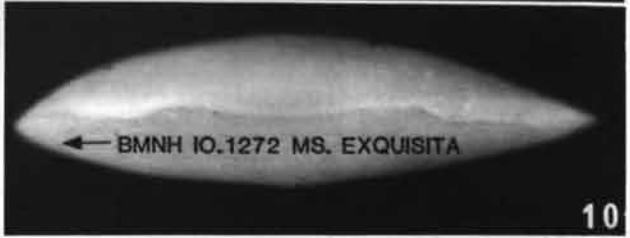

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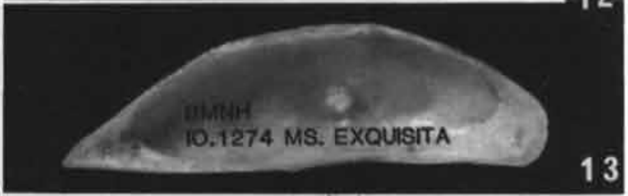

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PLATE 34

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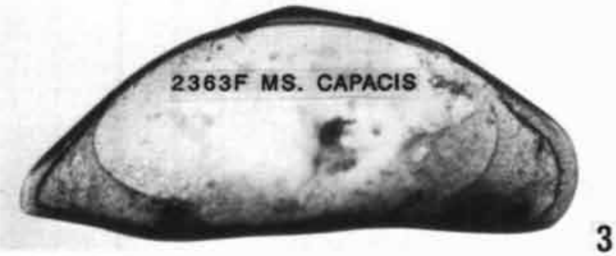

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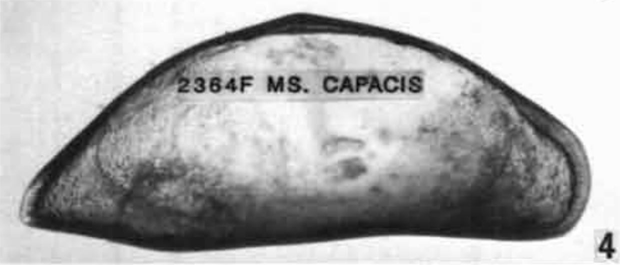

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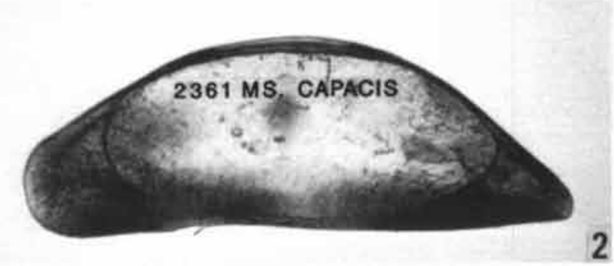

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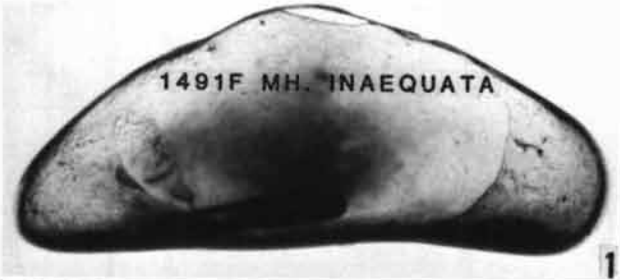
PLATE 36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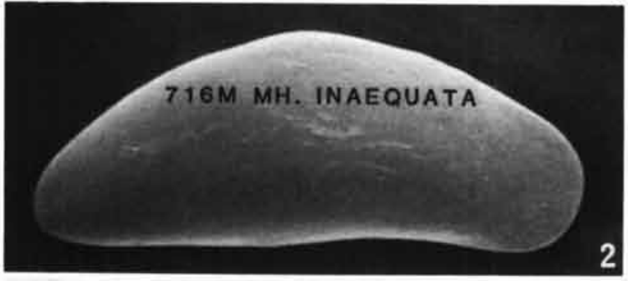
716M MH. INAEQUATA

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845M MH. SINUATA

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851F MH. SINUATA

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1940M MH. INAEQUALIS

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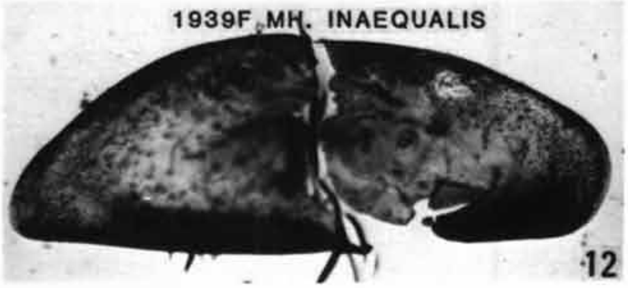
1939F MH. INAEQUALIS

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PLATE 37

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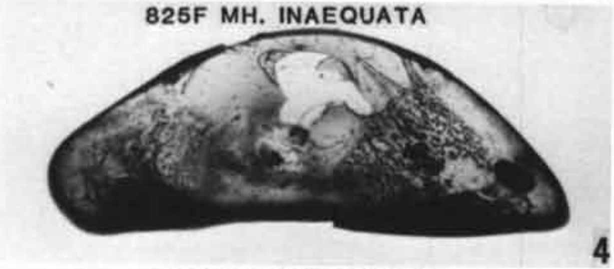

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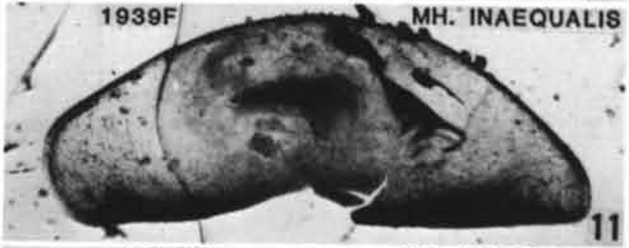

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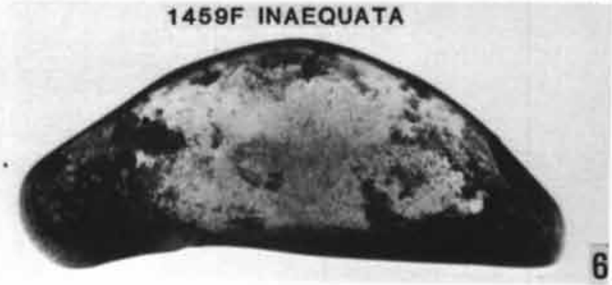

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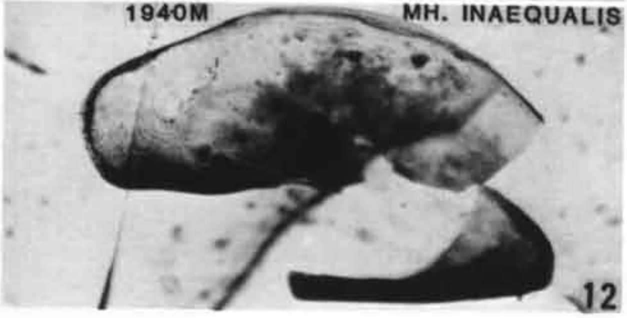

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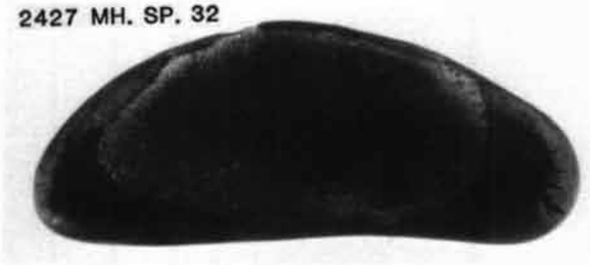
PLATE 38



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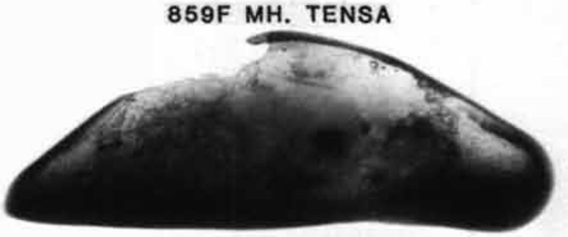

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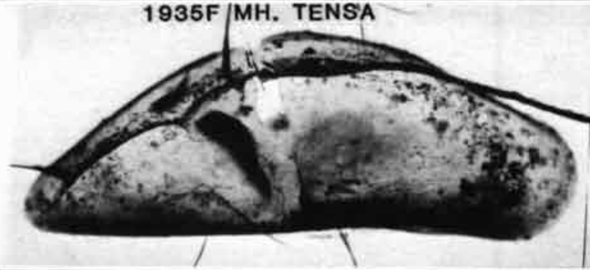

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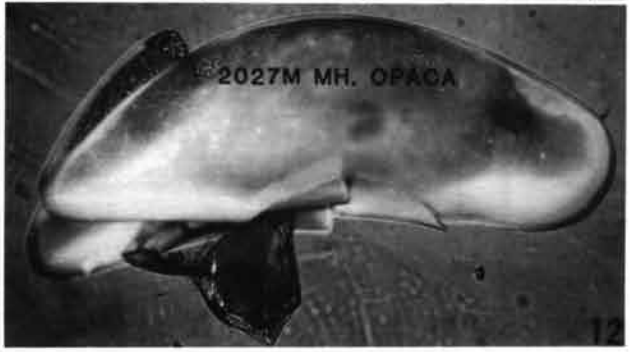

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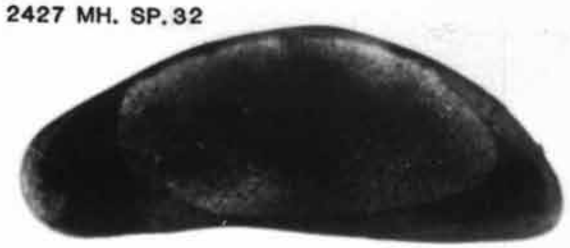
PLATE 39



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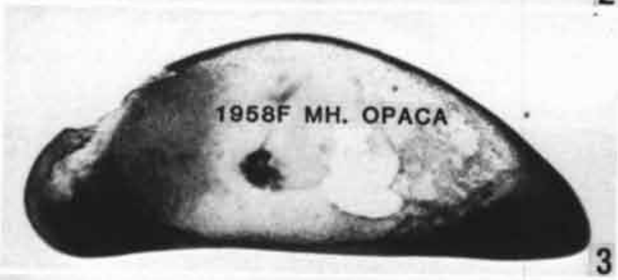

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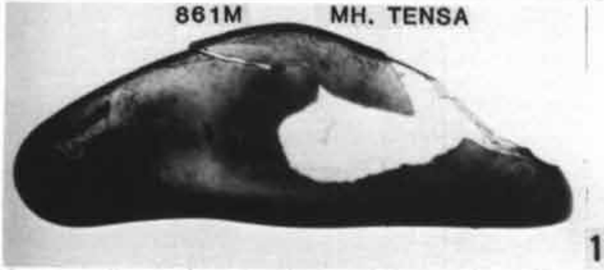

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PLATE 40

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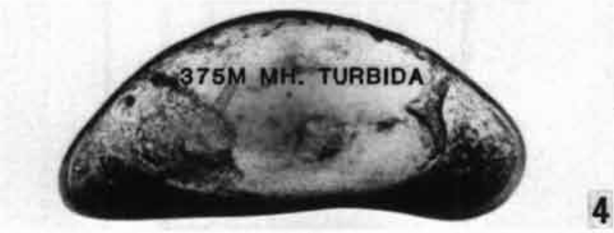

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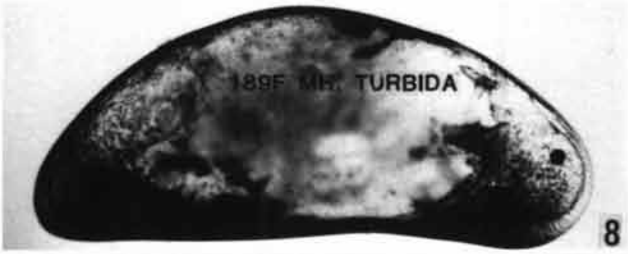

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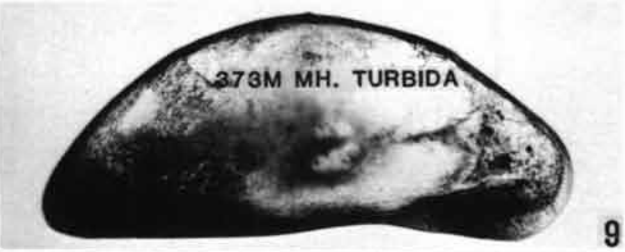

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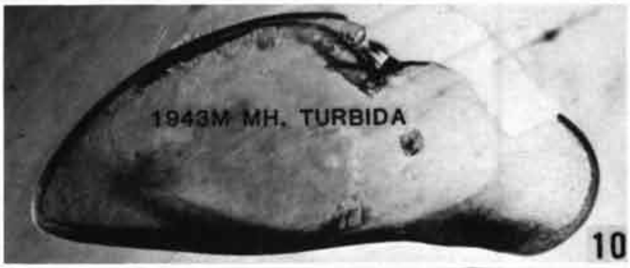

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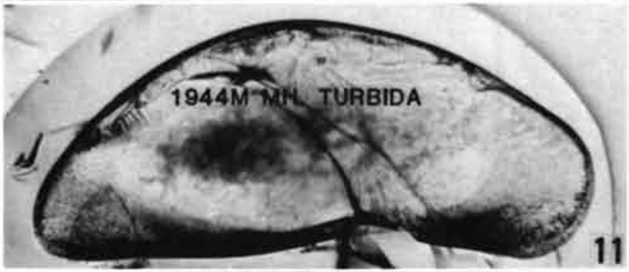

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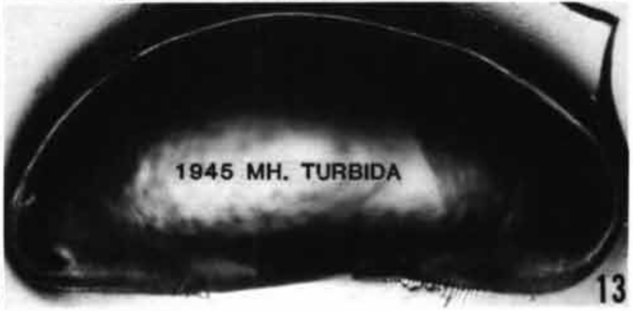

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PLATE 41

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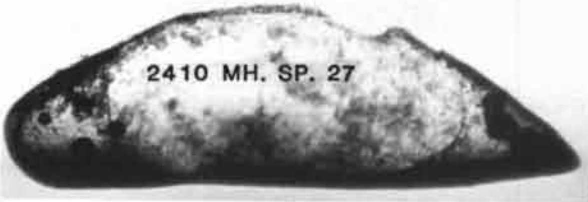

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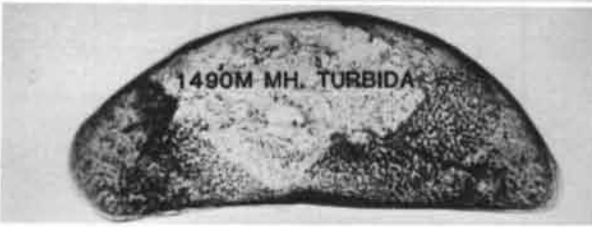

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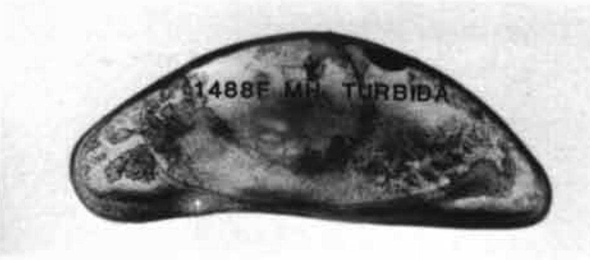

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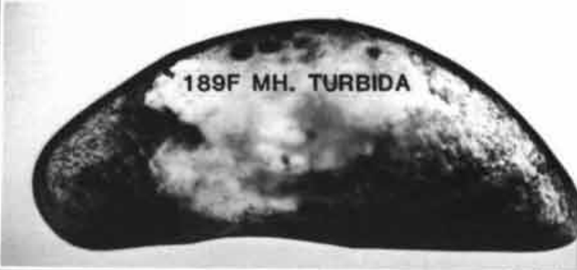

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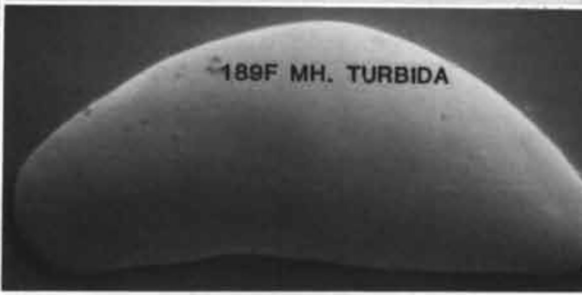

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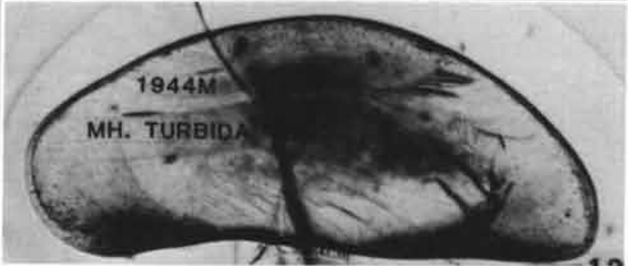

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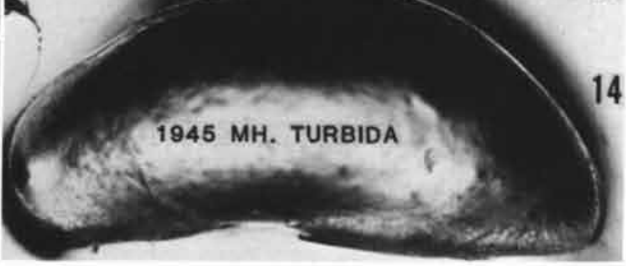

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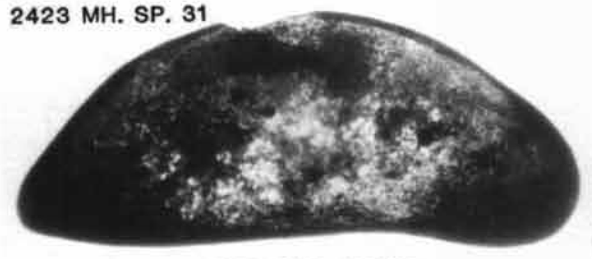
PLATE 42



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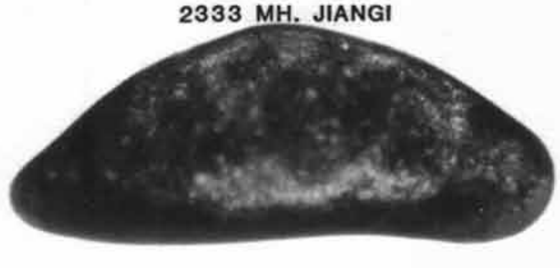

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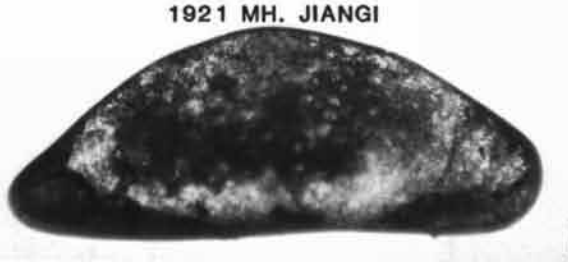

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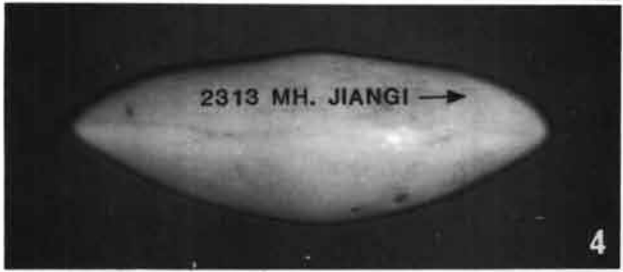

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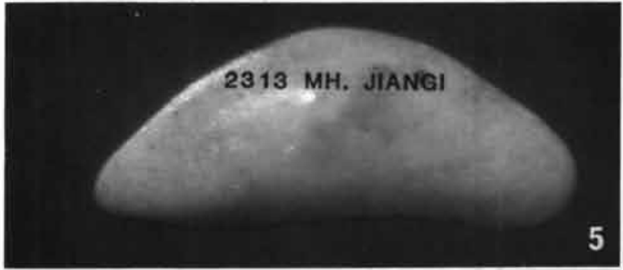

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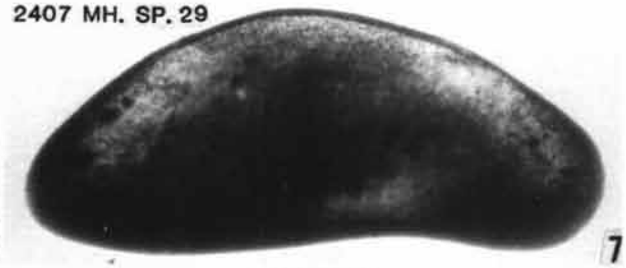

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PLATE 43

2423 MH. SP. 31

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2334 MH. JIANGI

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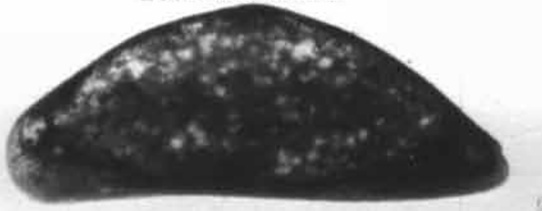
2335 MH. JIANGI



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1921 MH. JIANGI

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2313 MH. JIANGI

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1922 MH. JIANGI

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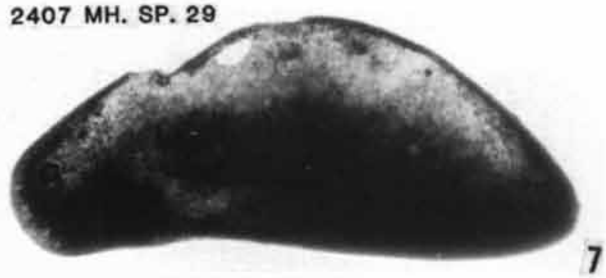
2407 MH. SP. 29



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1462M MH. HEROICA

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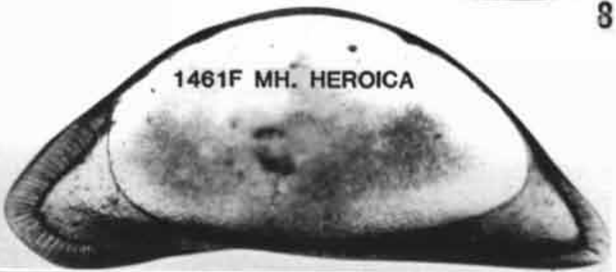

1461F MH. HEROICA

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BMNH IN.51618 MS. MUENSTERIANA

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BMNH IN.51622 MS. MUENSTERIANA

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BMNH IN.51618 MS. MUENSTERIANA

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PLATE 44

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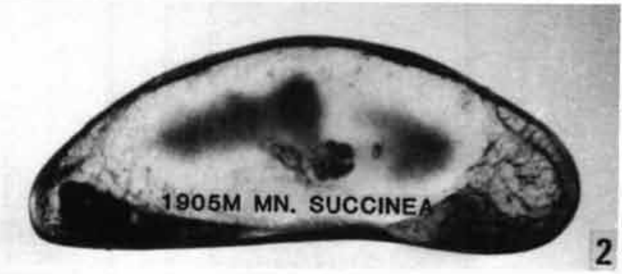

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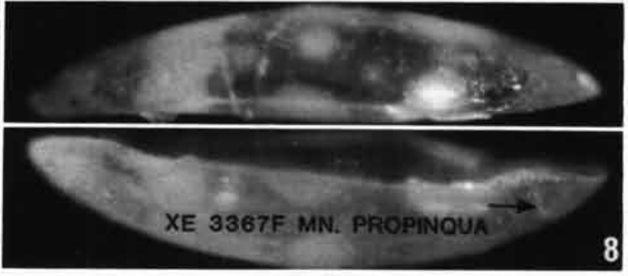

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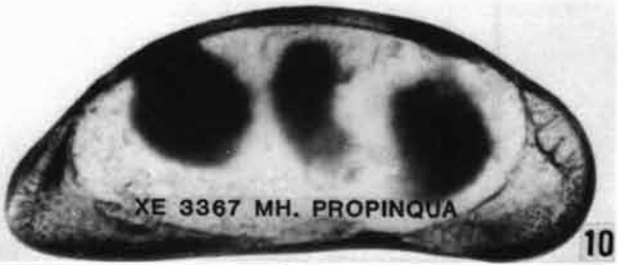

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PLATE 45

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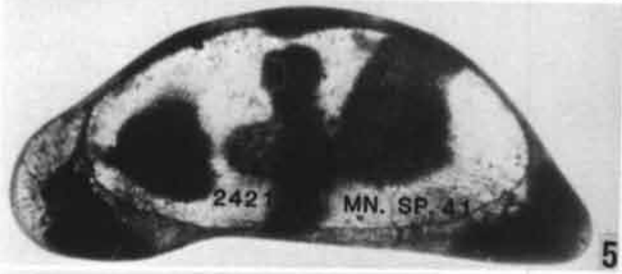

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1700J-1 MN. QUADRIMACULATA

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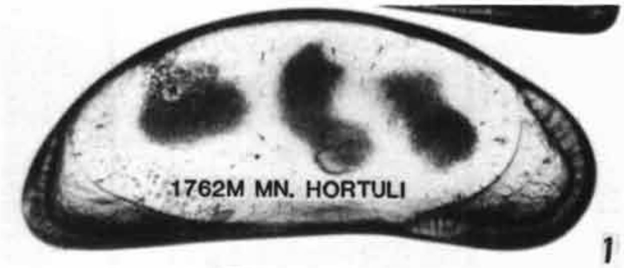
PLATE 46



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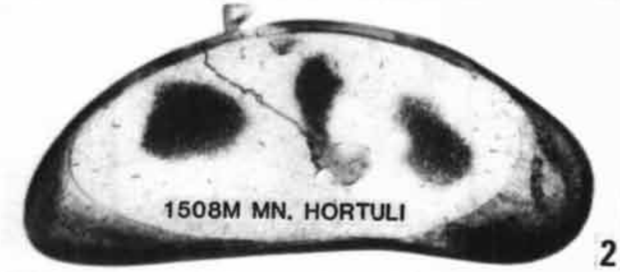

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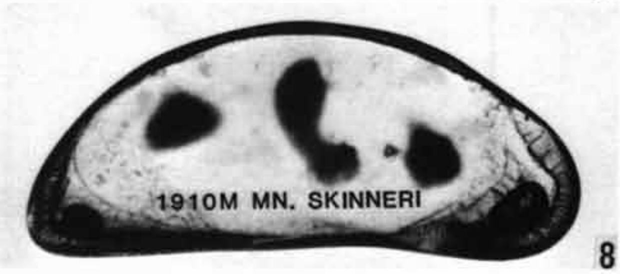

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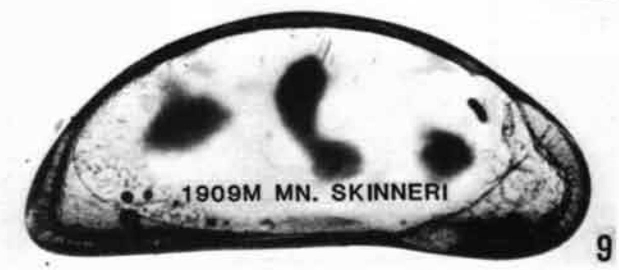

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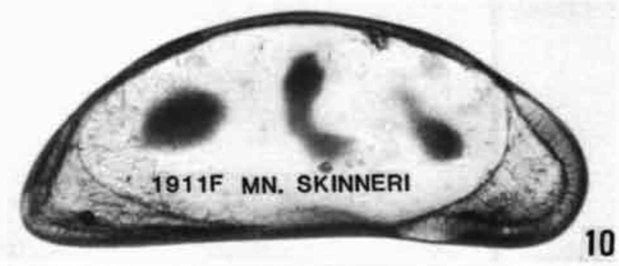

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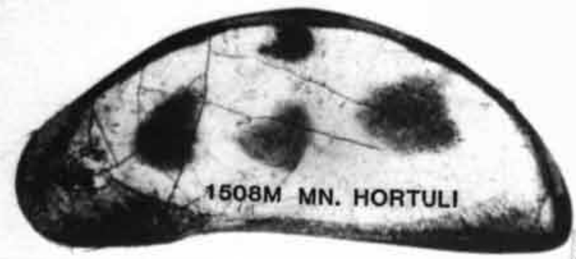

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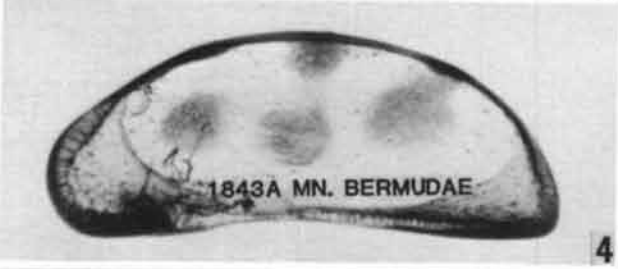

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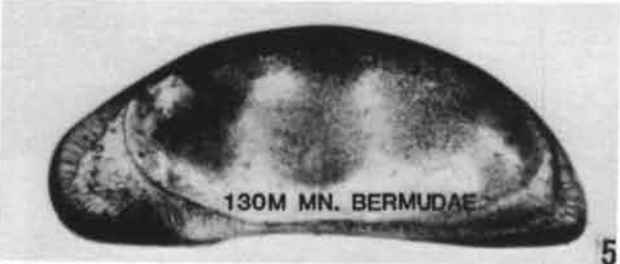

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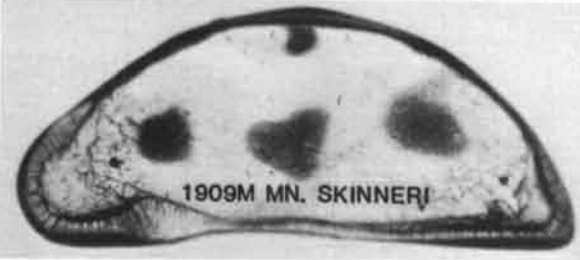

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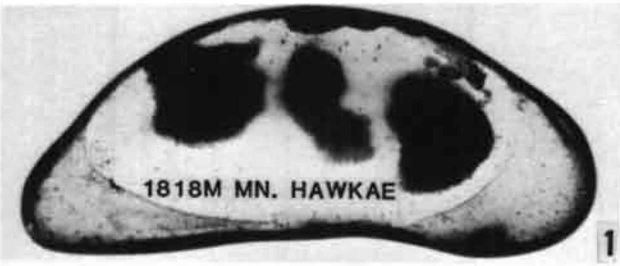
PLATE 48



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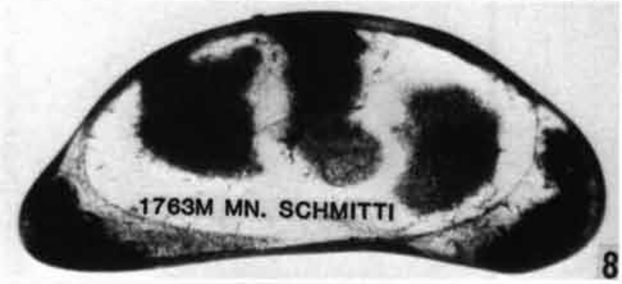

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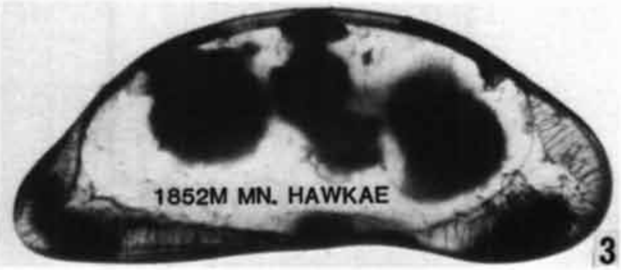

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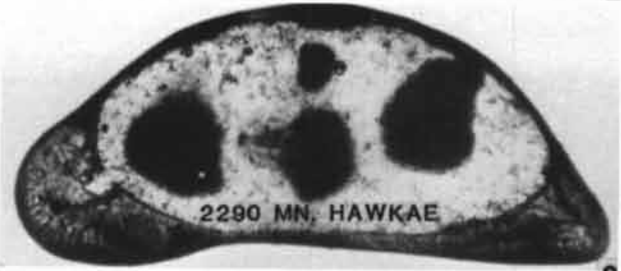

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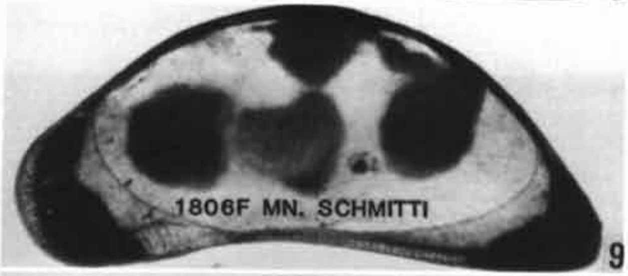

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PLATE 50

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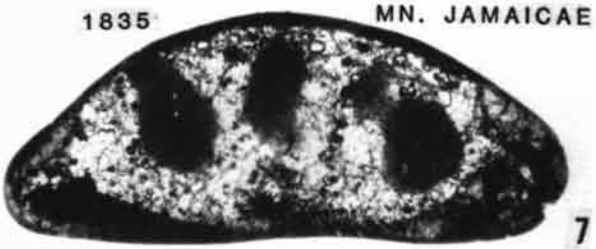

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PLATE 51

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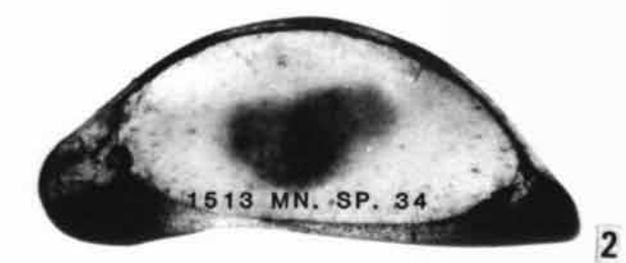

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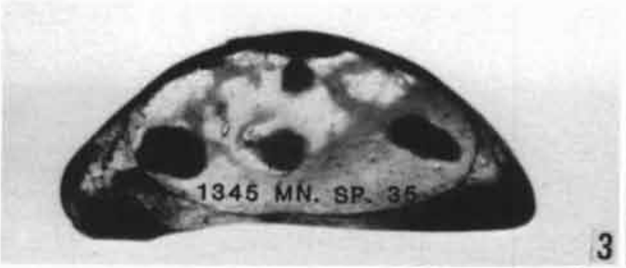

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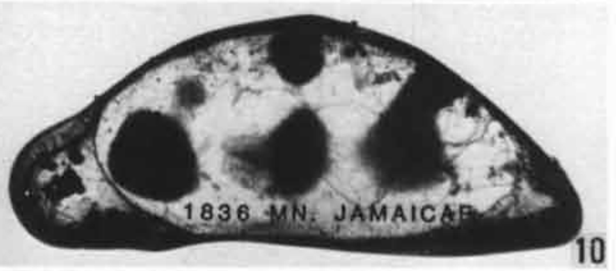

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PLATE 52

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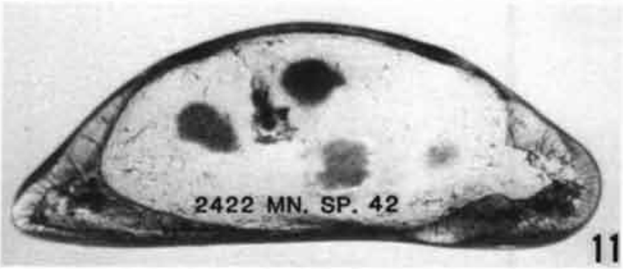

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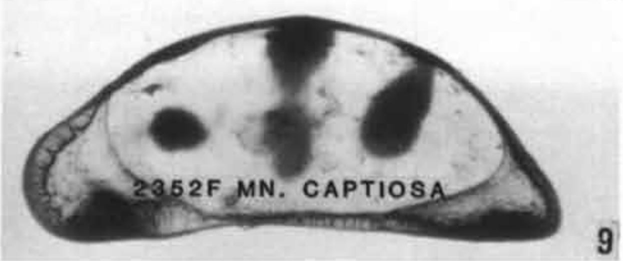

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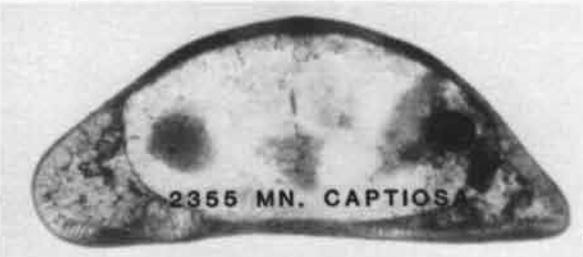

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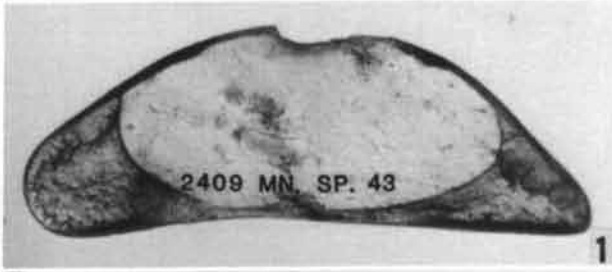

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PLATE 54

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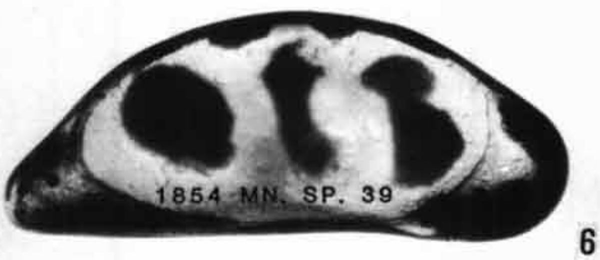

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1937M MN. AFRICANA

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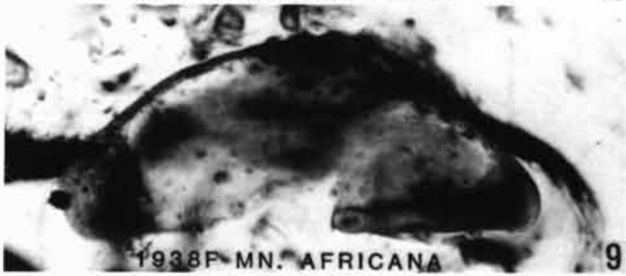

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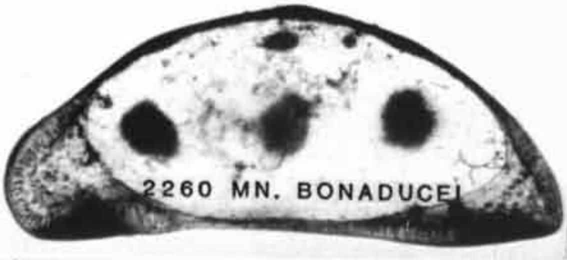

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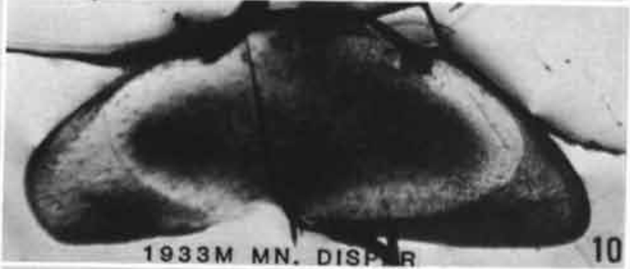

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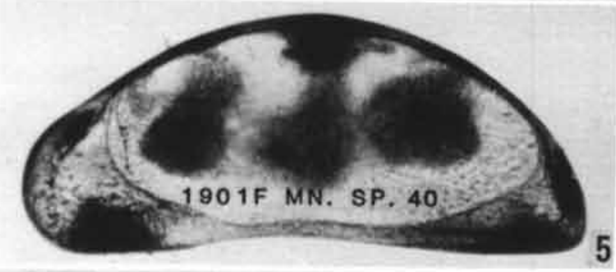

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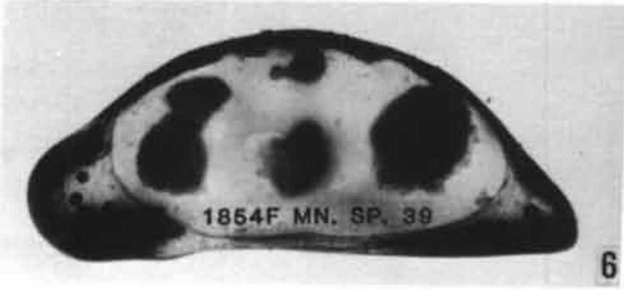

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PLATE 56

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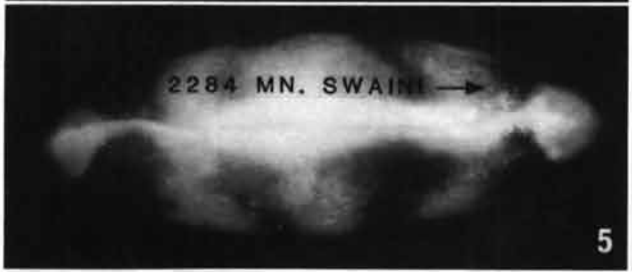

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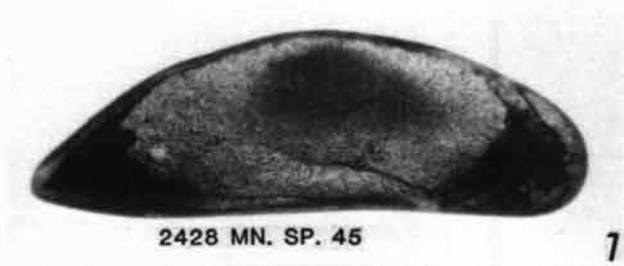

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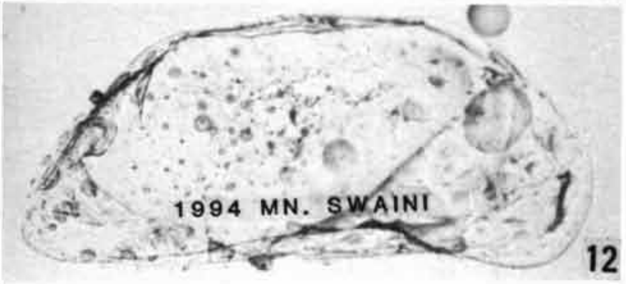

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PLATE 57

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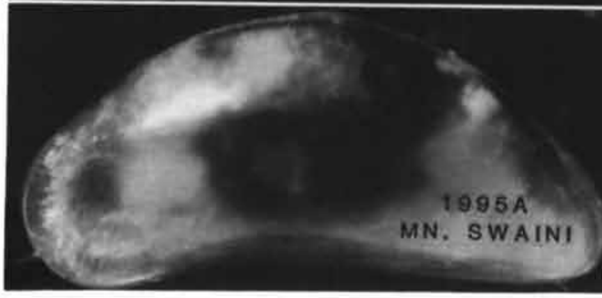

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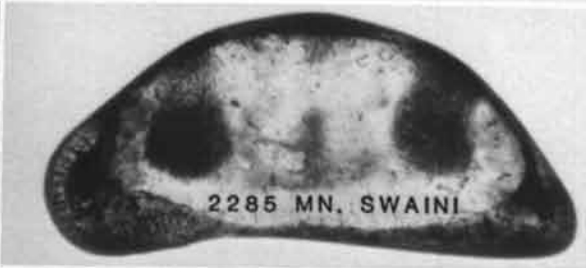

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PLATE 58

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HVH9739 MN. SKINNERI 4

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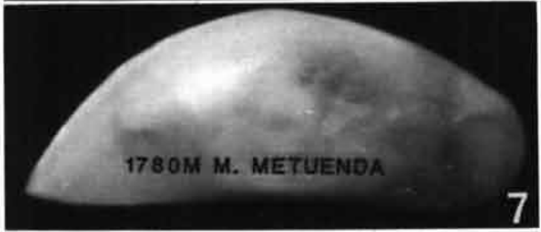

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1766MJ-1
M. MIRANDA 10


1440F
M. MIRANDA 11


1419M
M. MIRANDA 12


1766MJ-1
M. MIRANDA 13


1440F
M. MIRANDA 14


1419M
M. MIRANDA 15

PLATE 59

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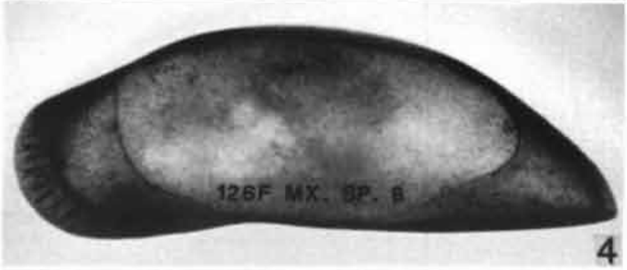

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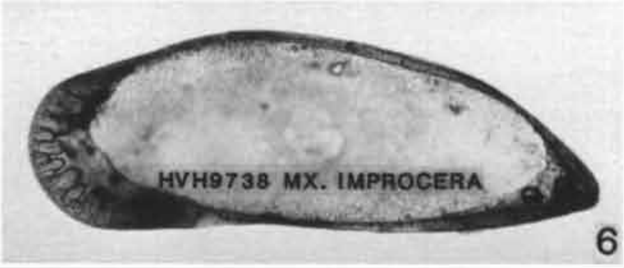

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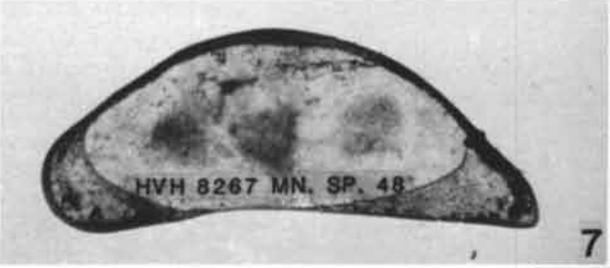

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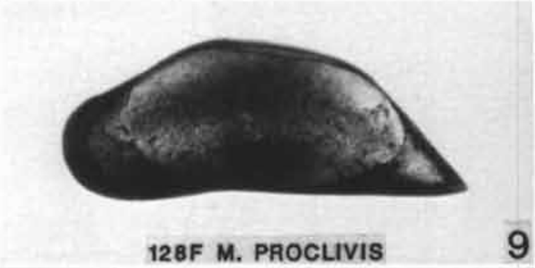

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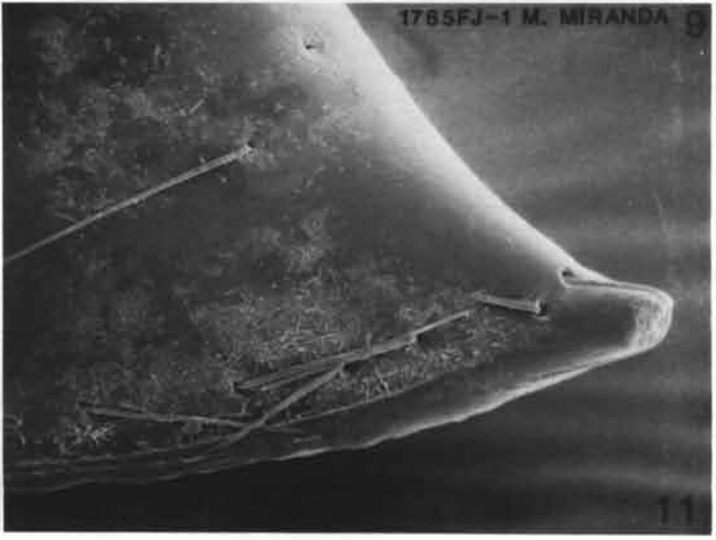
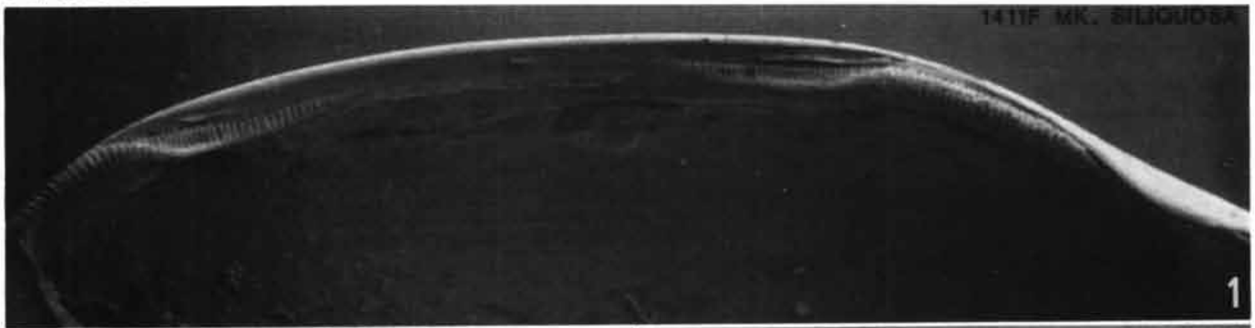
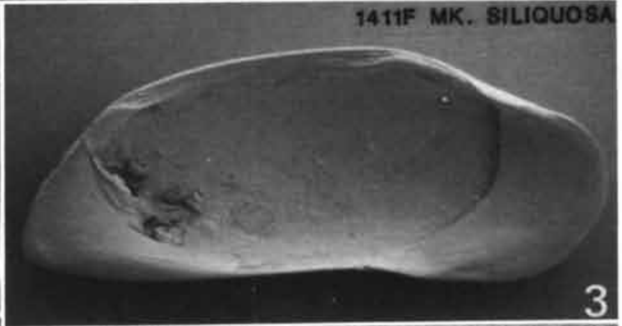


11

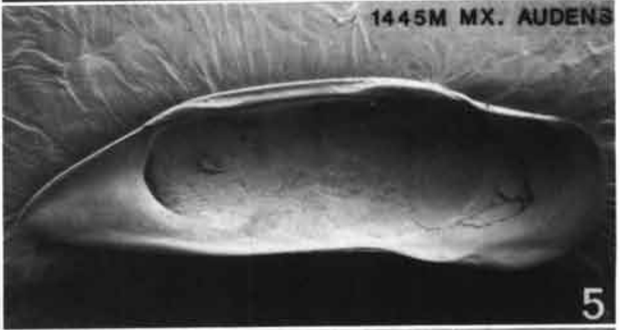
PLATE 60


1411F MK. SILIQUOSA
1


1411F MK. SILIQUOSA
2


1411F MK. SILIQUOSA
3


1411F MK. SILIQUOSA
4


1445M MX. AUDENS
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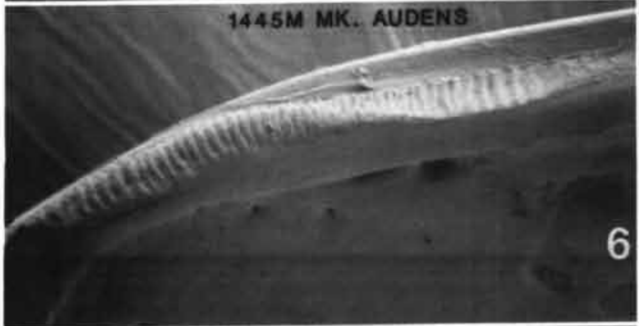
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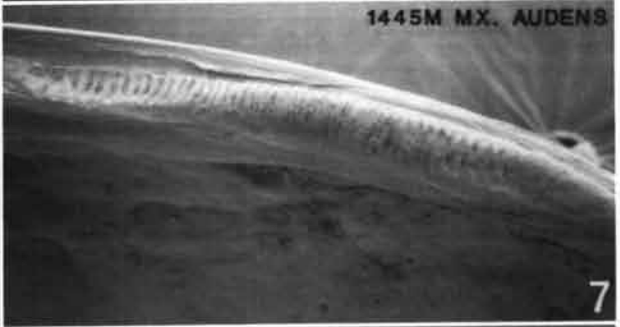
1445M MX. AUDENS
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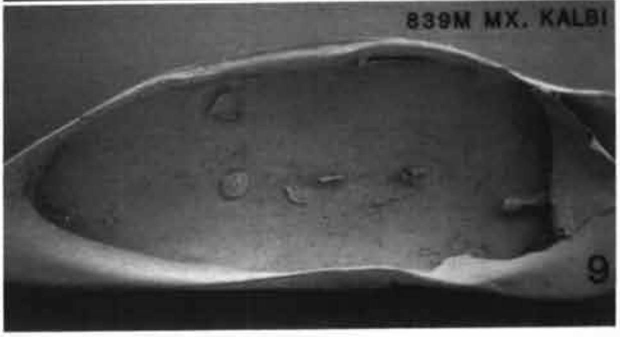
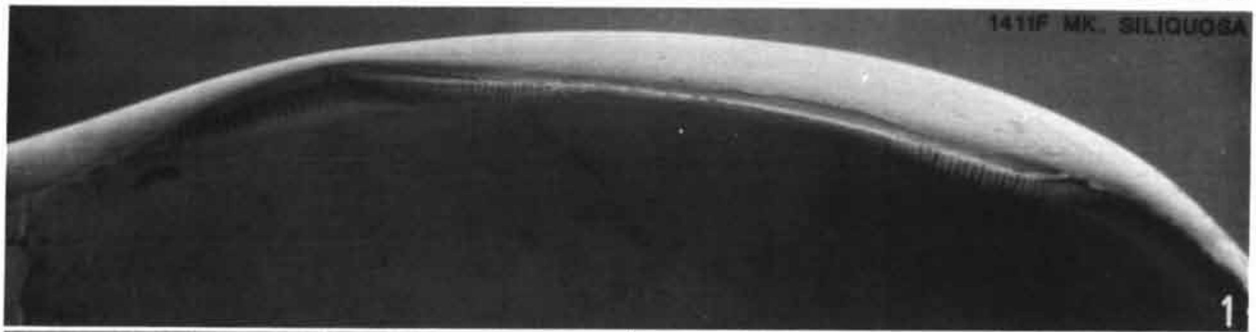
1869M MS. BENSONI
8


839M MX. KALBI
9


1411F MK. SILIQUOSA
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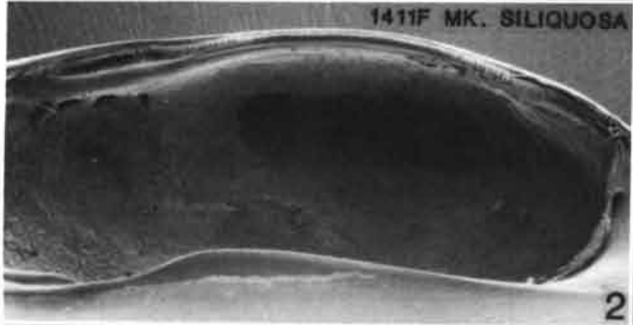
1411F MK. SILIQUOSA
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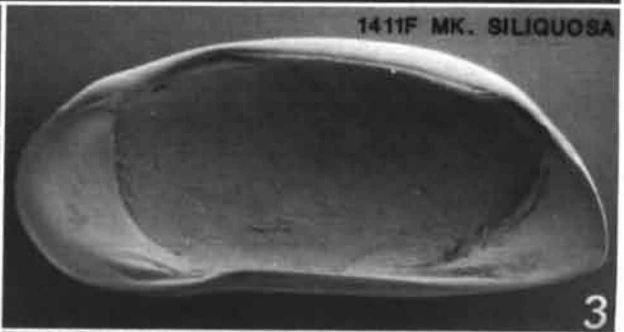
1411F MK. SILIQUOSA
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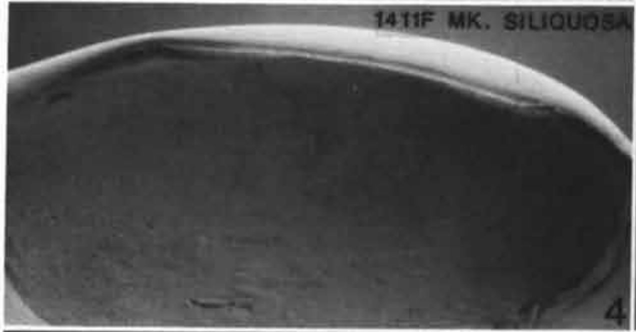
1411F MK. SILIQUOSA
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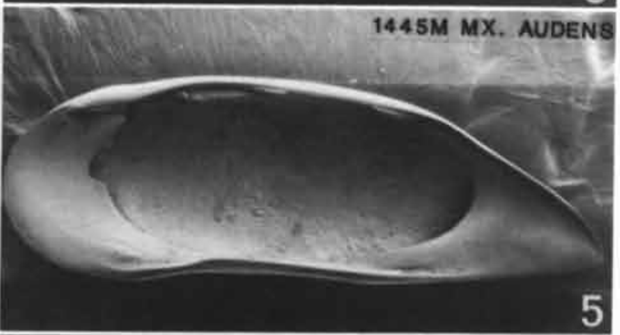
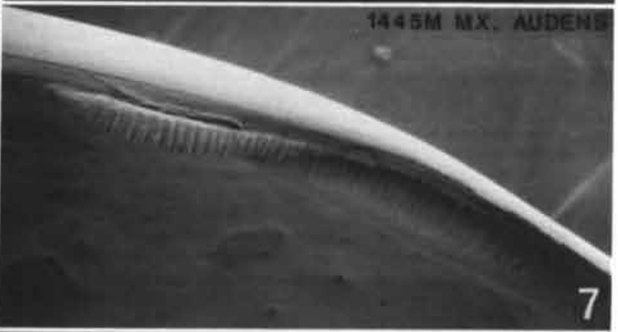

1445M MX. AUDENS
5


1445M MK. AUDENS
6


1445M MX. AUDENS
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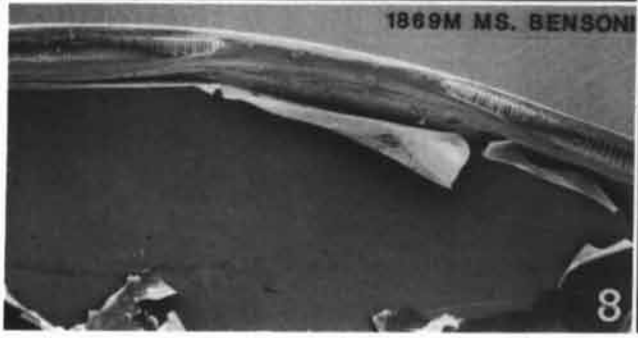

1869M MS. BENSONI
8

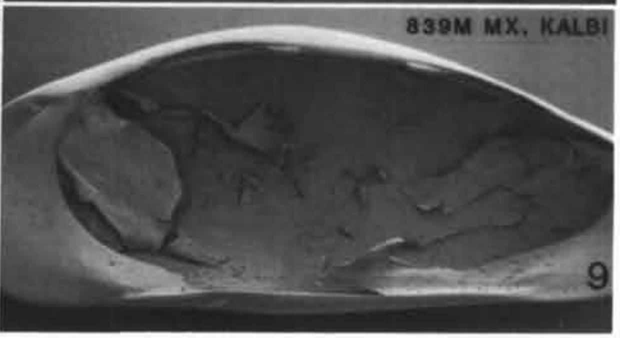
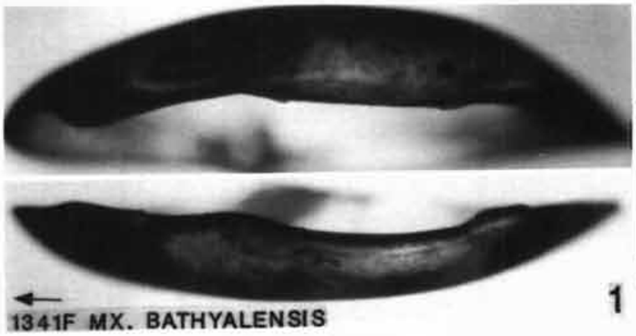

839M MX. KALBI
9

PLATE 62



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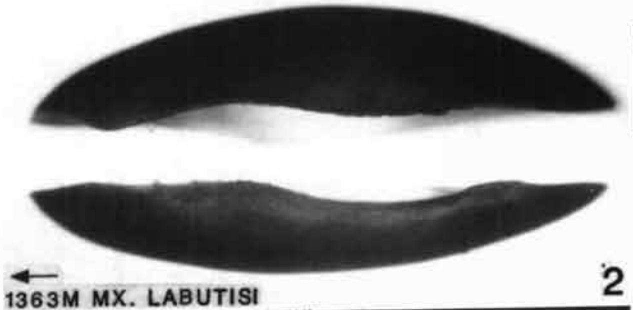

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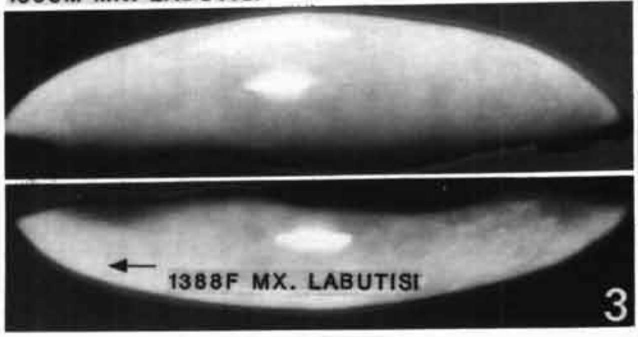

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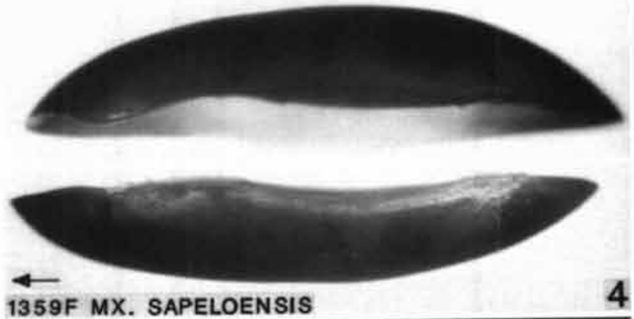

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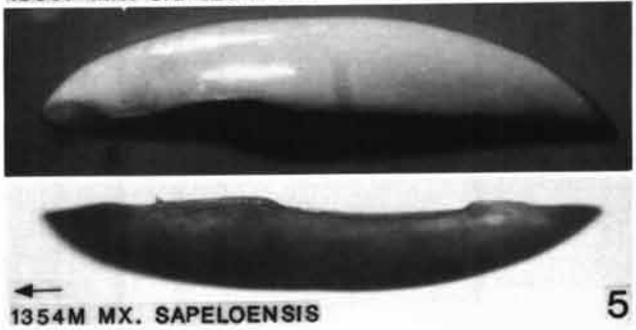

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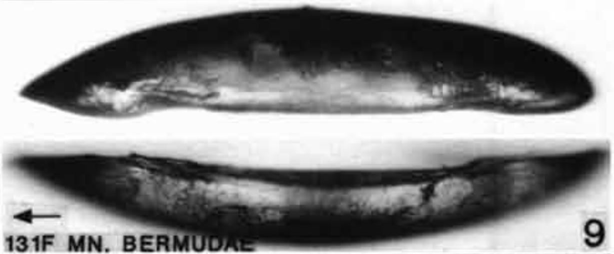
6

7

8



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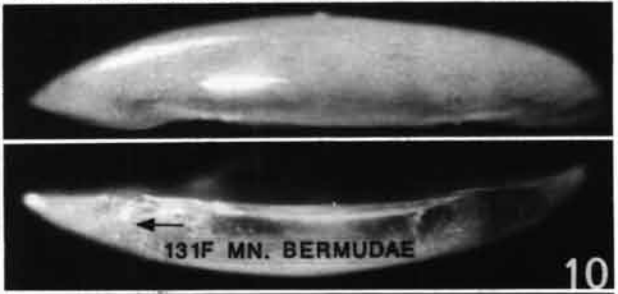

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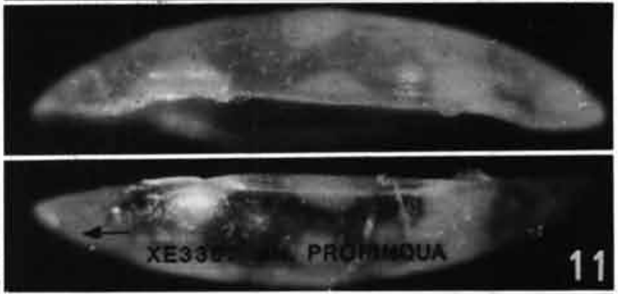

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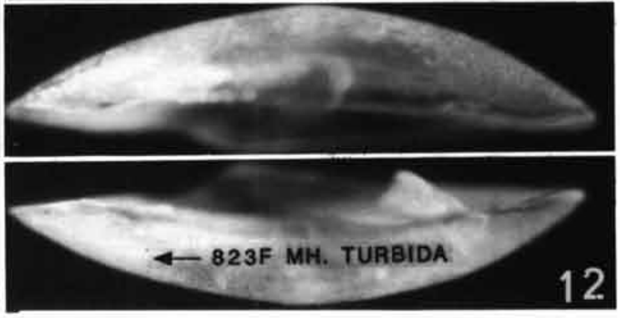

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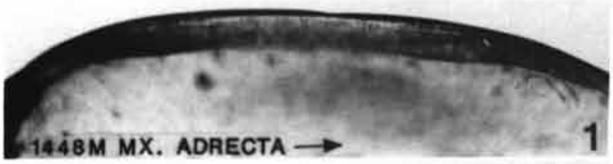

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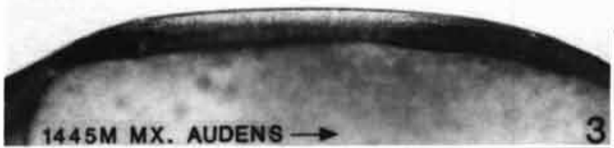


3

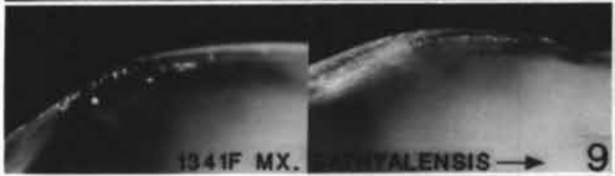
4

5

6

7

8



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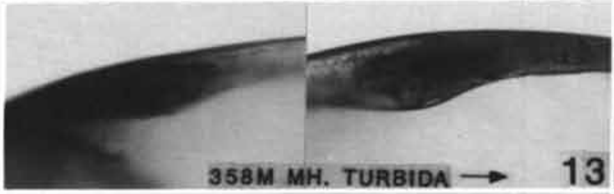
10

11

12



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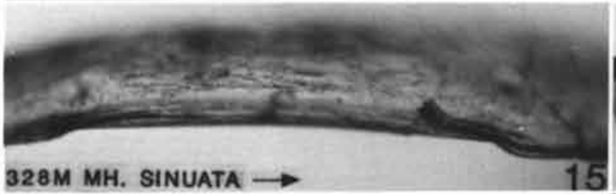


15

16

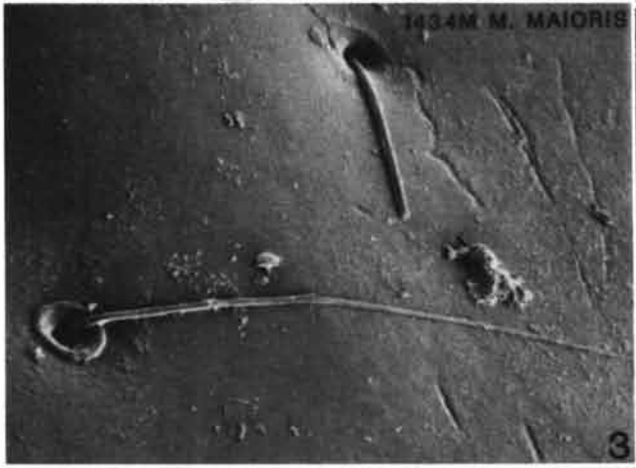
17

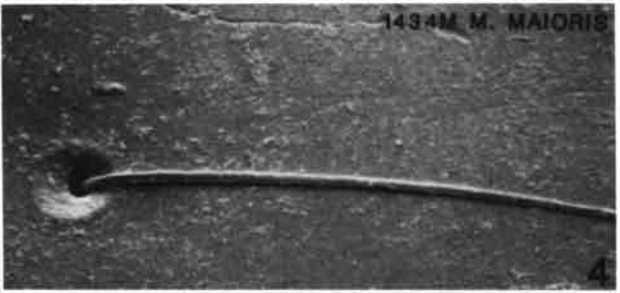
18

PLATE 64


1349 M. MINNA
1


1347 M. MINNA
2


1434M M. MAIORIS
3


1434M M. MAIORIS
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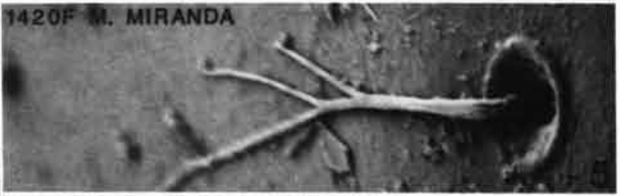
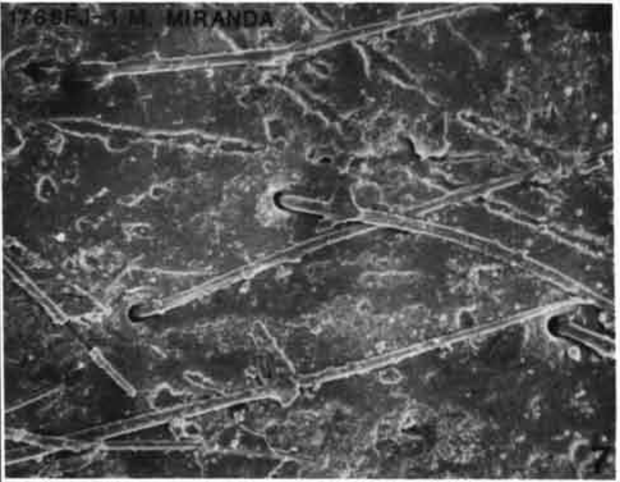
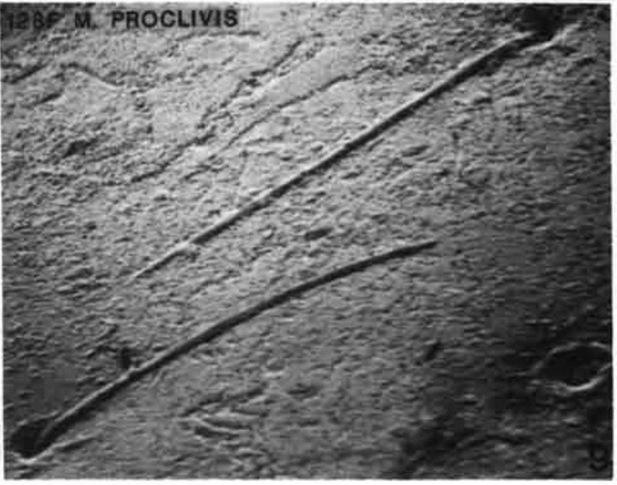

1420F M. MIRANDA
5

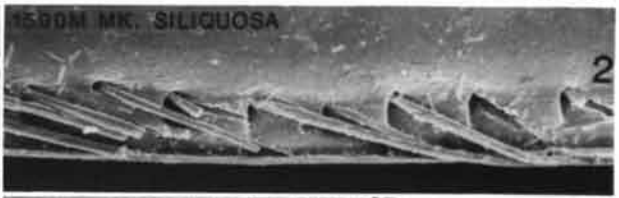

1420F M. MIRANDA
6


1768FJ-1 M. MIRANDA
7


1765FJ-1 M. MIRANDA
8

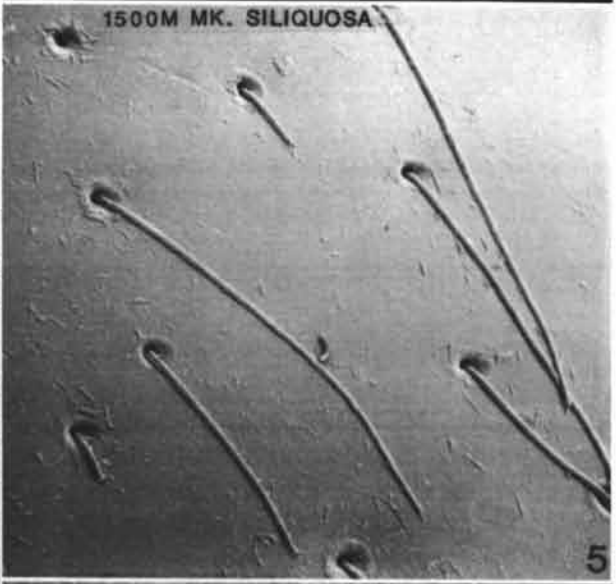

128F M. PROCLIVIS
9


1500M MK. SILIQUOSA
1


1500M MK. SILIQUOSA
2


1500M MK. SILIQUOSA
3


1500M MK. SILIQUOSA
4


1500M MK. SILIQUOSA
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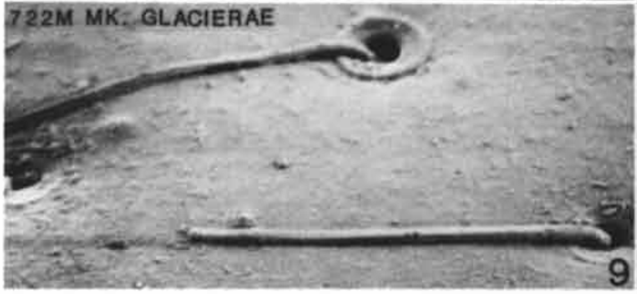
1411F MK. SILIQUOSA

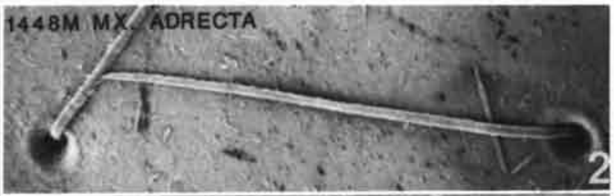

722M MK. GLACIERAE
7


725M MK. GLACIERAE
8

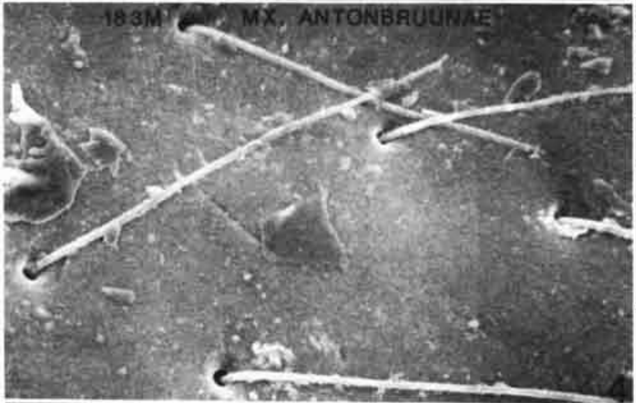

722M MK. GLACIERAE
9

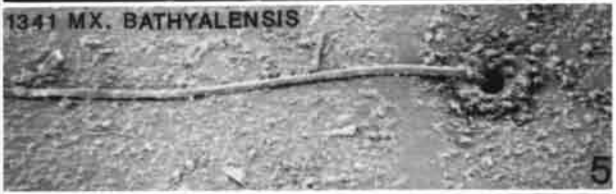

720M MK. GLACIERAE
10

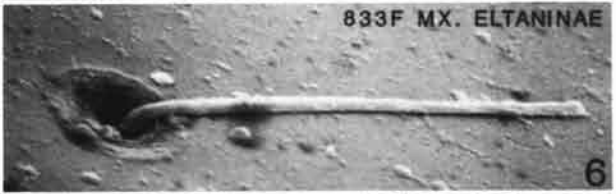

1448M MX. ADRECTA
1


1448M MX. ADRECTA
2

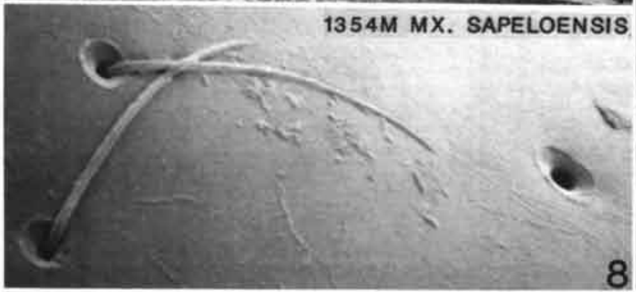

358M MX. ANTONBRUUNAE
3

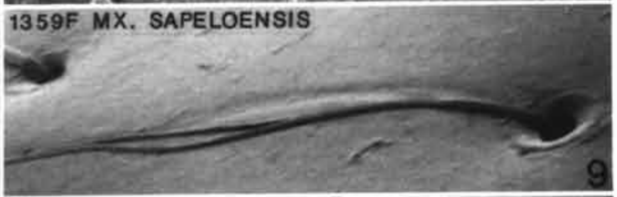

183M MX. ANTONBRUUNAE
4


1341 MX. BATHYALENSIS
5


833F MX. ELTANINAE
6


831M MX. ELTANINAE
7


1354M MX. SAPELOENSIS
8


1359F MX. SAPELOENSIS
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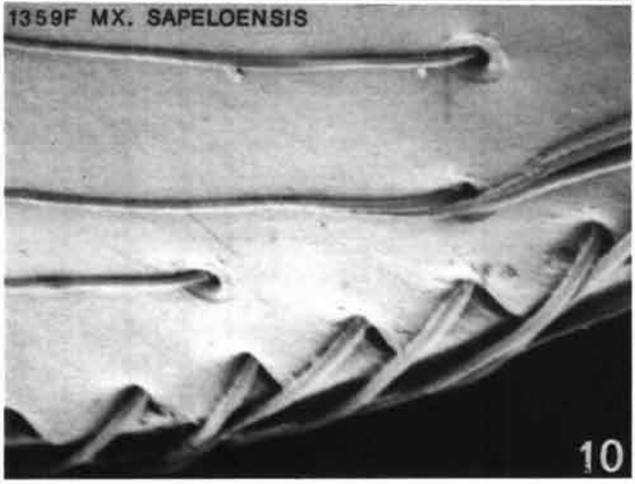
1359F MX. SAPELOENSIS
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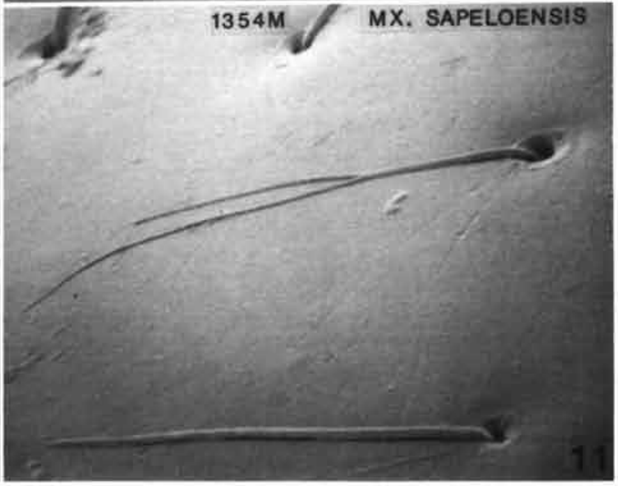
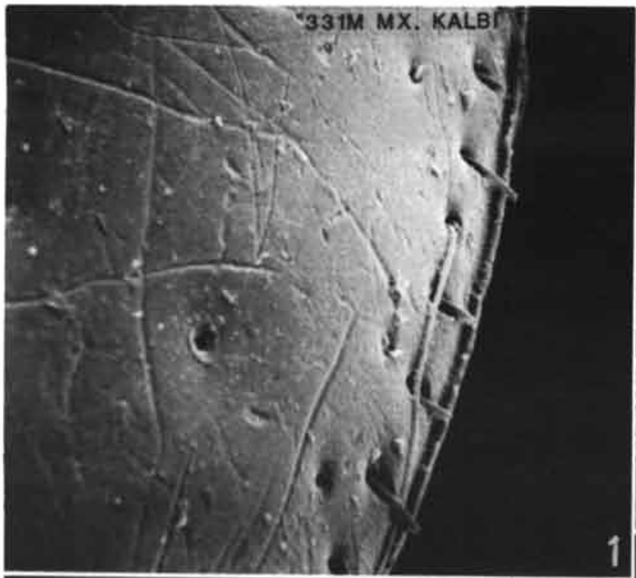

1354M MX. SAPELOENSIS
11

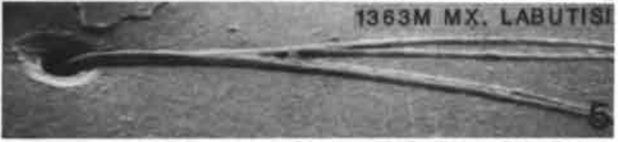
PLATE 67


331M MX. KALBI
1


335M MX. KALBI
2


331M MX. KALBI
3


839M MX. KALBI
4


1363M MX. LABUTISI
5

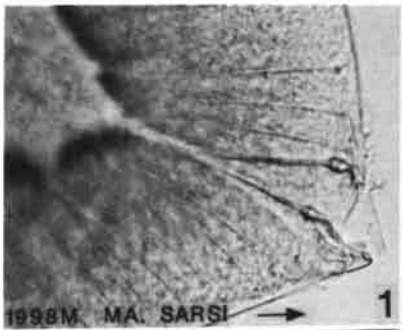

1363M MX. LABUTISI
6

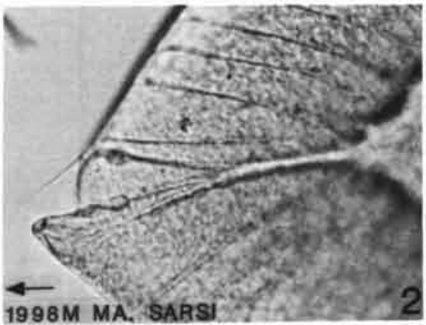

1363M MX. LABUTISI
7

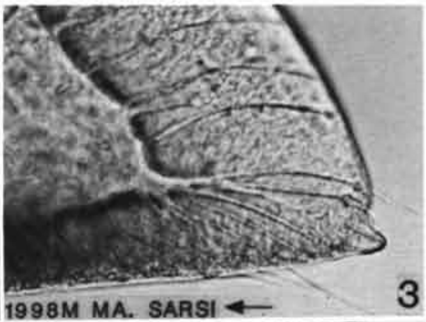

1531F MC. ARCUATA
8

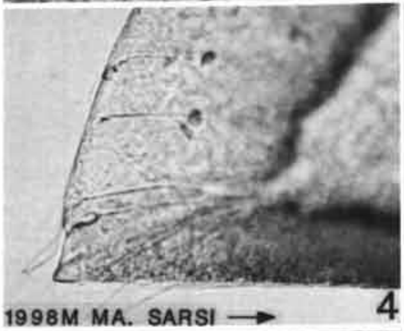

1531F MC. ARCUATA
9

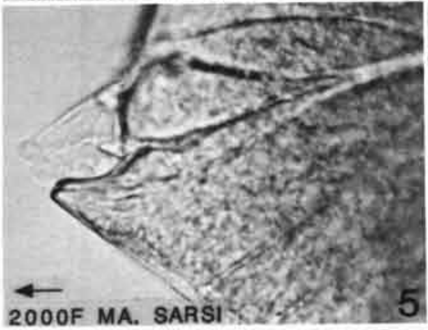
PLATE 68

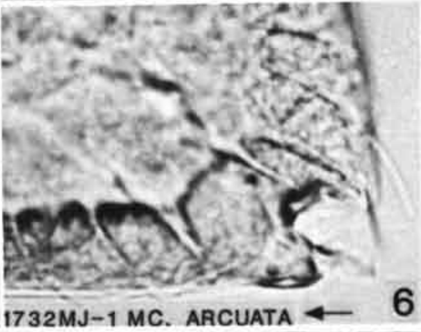

1998M MA. SARSI → 1

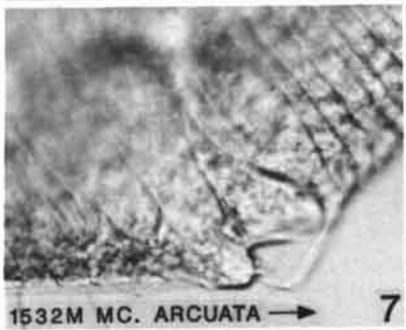

← 1998M MA. SARSI 2


1998M MA. SARSI ← 3

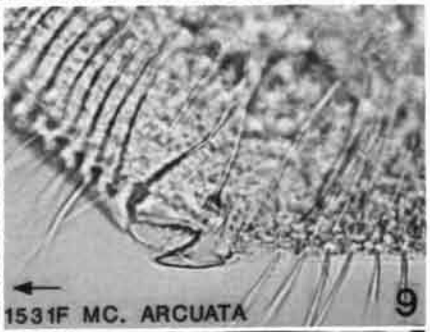

1998M MA. SARSI → 4

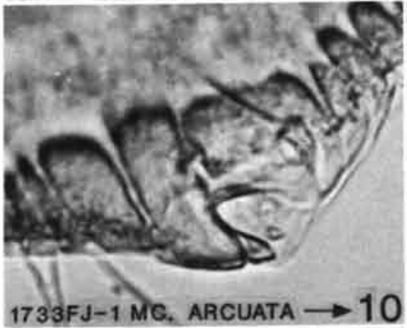

← 2000F MA. SARSI 5


1732MJ-1 MC. ARCUATA ← 6

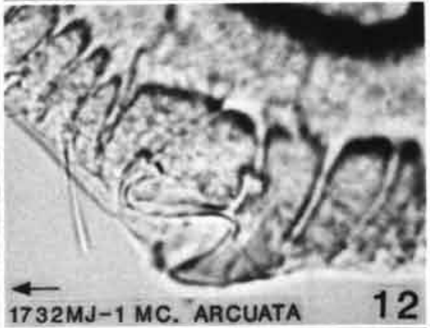

1532M MC. ARCUATA → 7

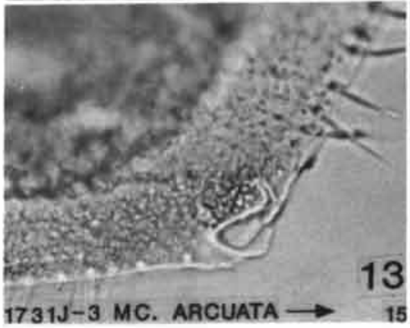

← 1532M MC. ARCUATA 8

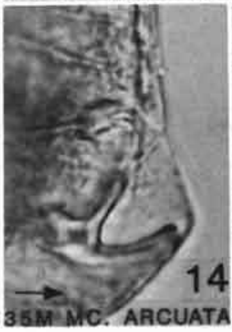

← 1531F MC. ARCUATA 9


1733FJ-1 MC. ARCUATA → 10


← 1733FJ-1 MC. ARCUATA 11


← 1732MJ-1 MC. ARCUATA 12

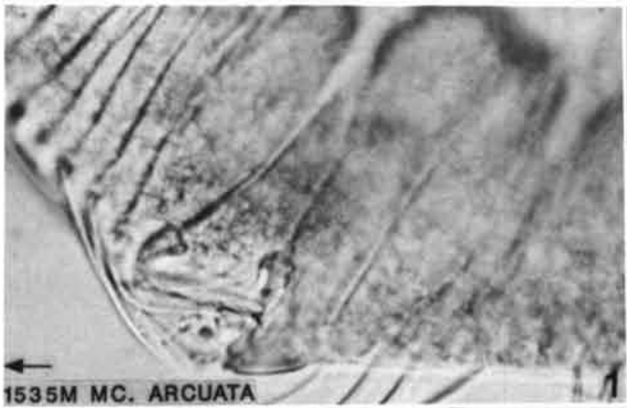

13 1731J-3 MC. ARCUATA →


14 → 1535M MC. ARCUATA


15 → 2163LV MS. BENSONI


← 827F MS. BENSONI 16

PLATE 69


1535M MC. ARCUATA
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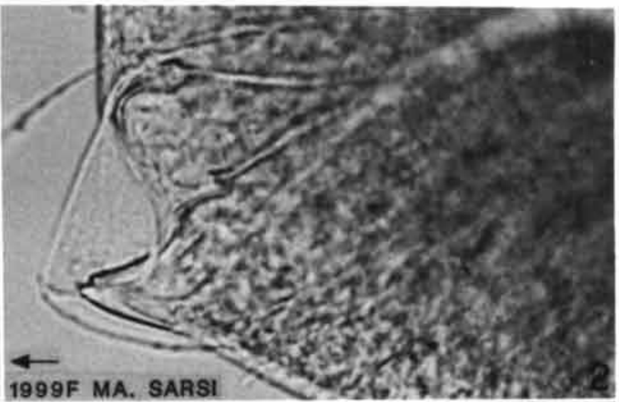
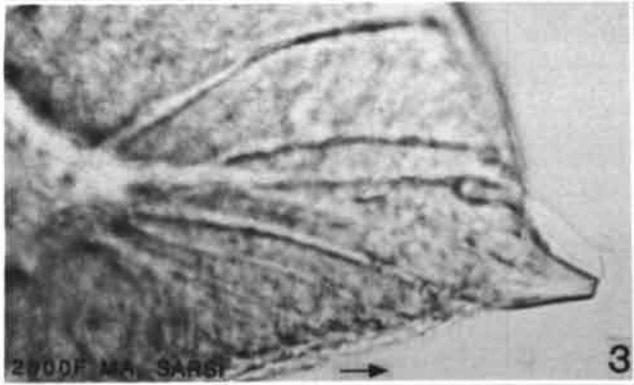
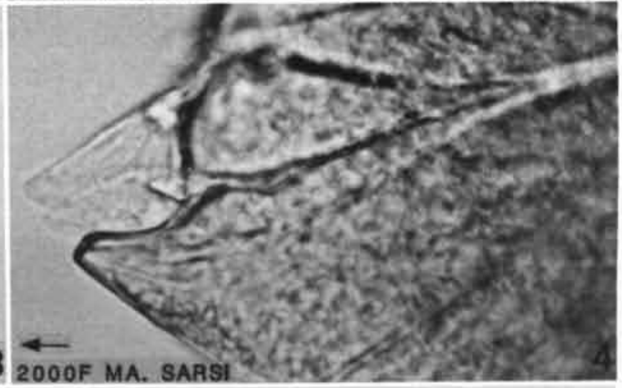

1999F MA. SARSI
2


2000F MA. SARSI
3


2000F MA. SARSI
4


2001J-1
MA. SARSI
5


2001J-1 MA. SARSI
6


1998M MA. SARSI
7


1998M MA. SARSI
8


857F MA. SEMESA
9

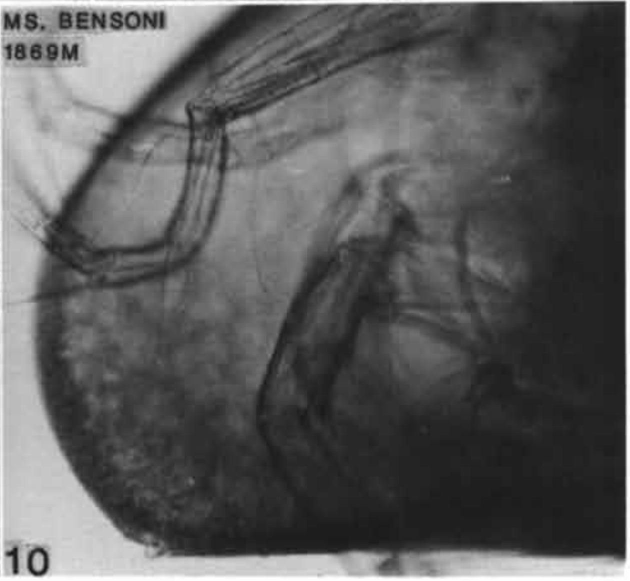
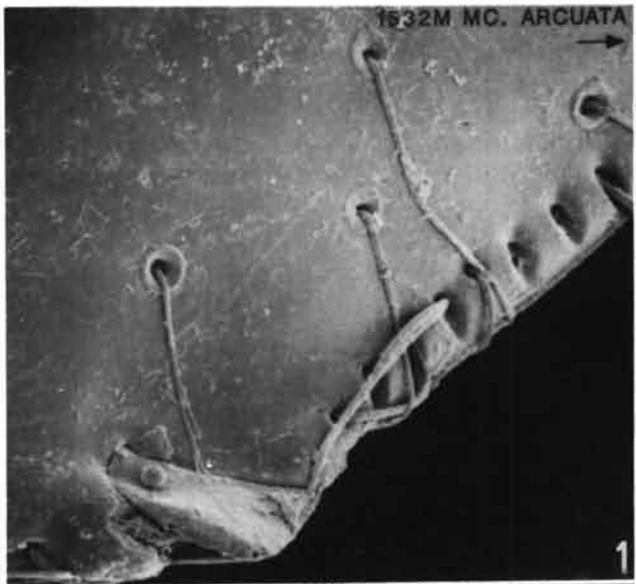
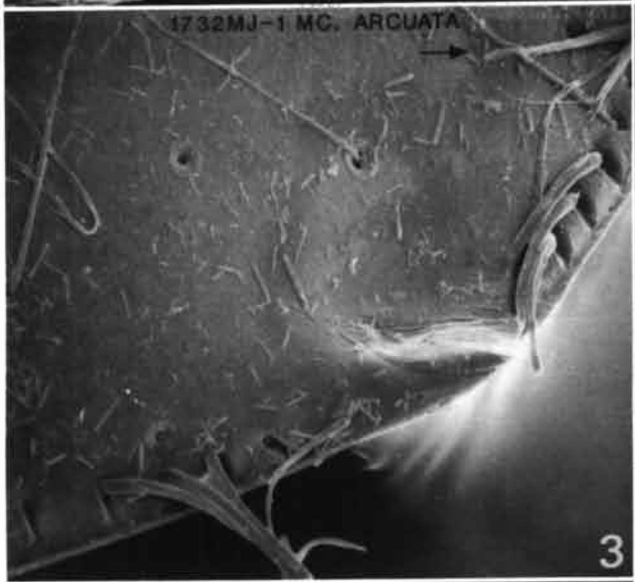
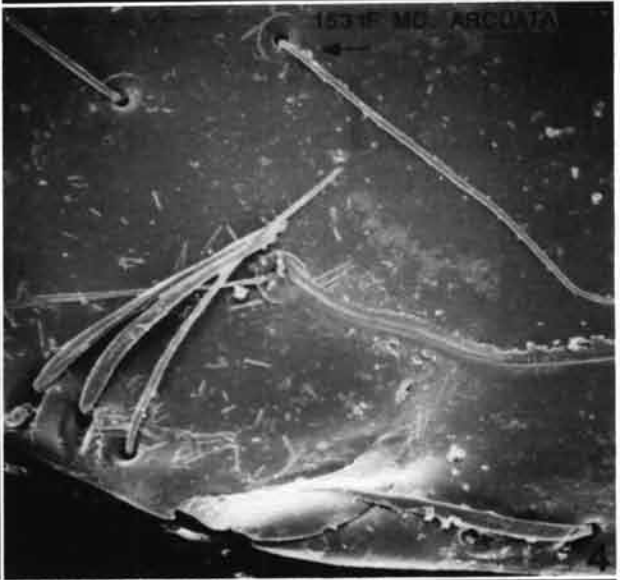

MS. BENSONI
1869M
10

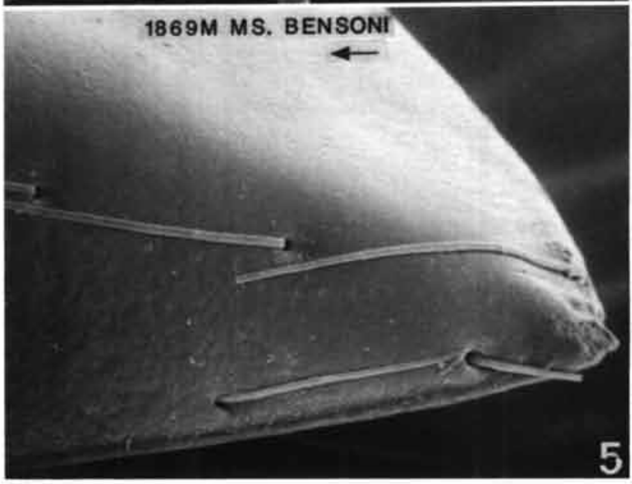
PLATE 70


1532M MC. ARCUATA
1


1532M MC. ARCUATA
2


1732MJ-1 MC. ARCUATA
3


1531F MC. ARCUATA
4


1869M MS. BENSONI
5

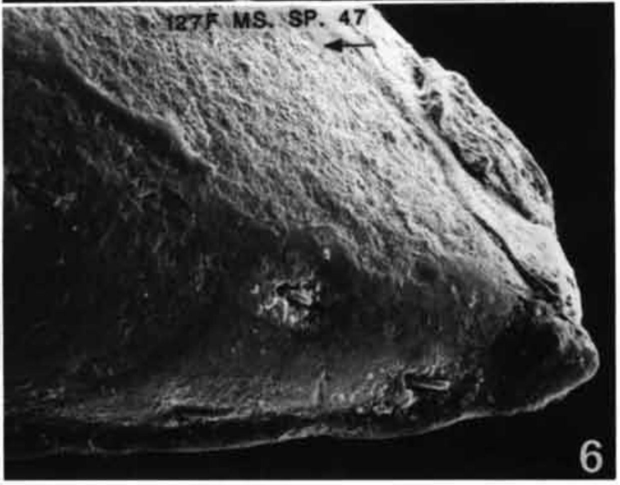
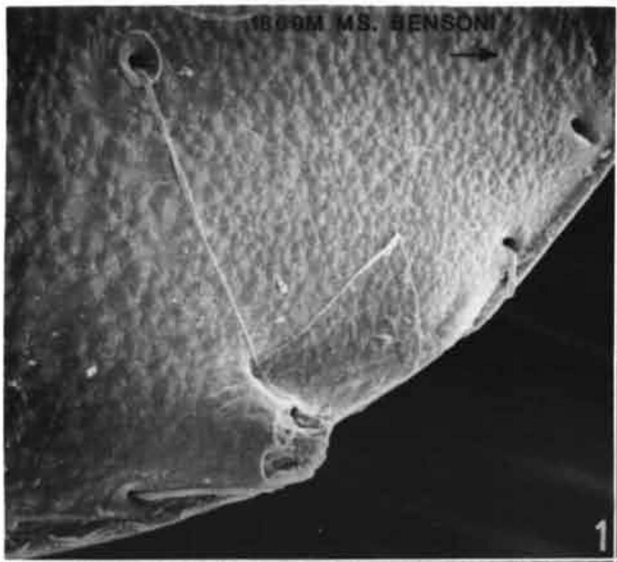
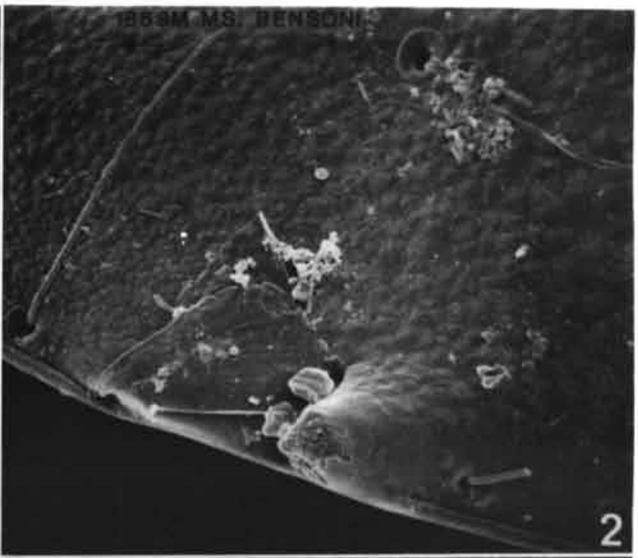

127F MS. SP. 47
6

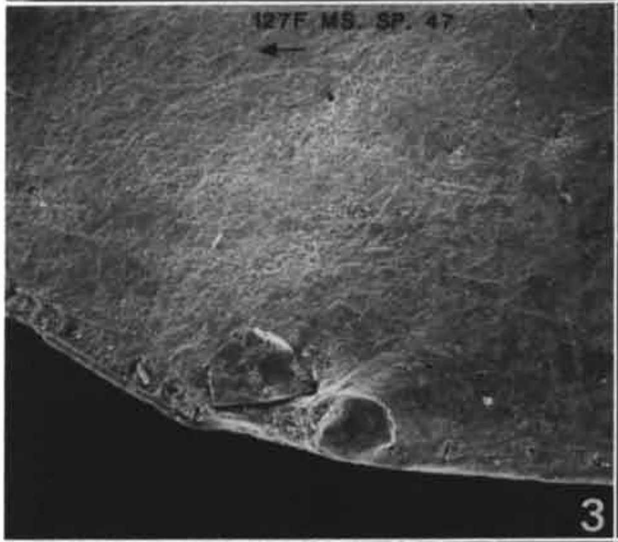
PLATE 71



1

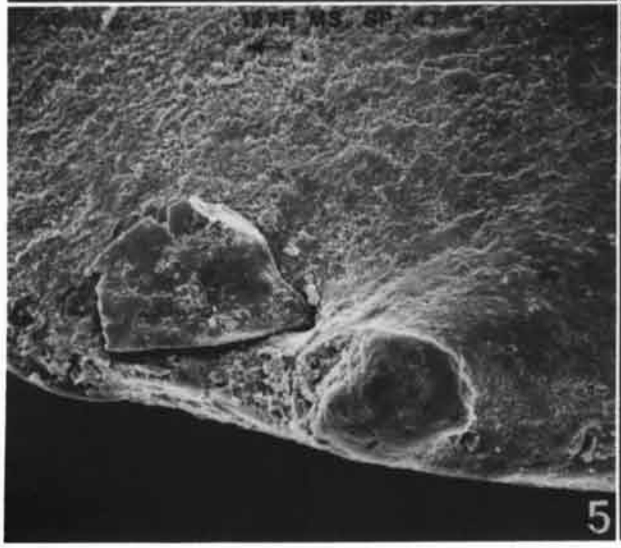


2

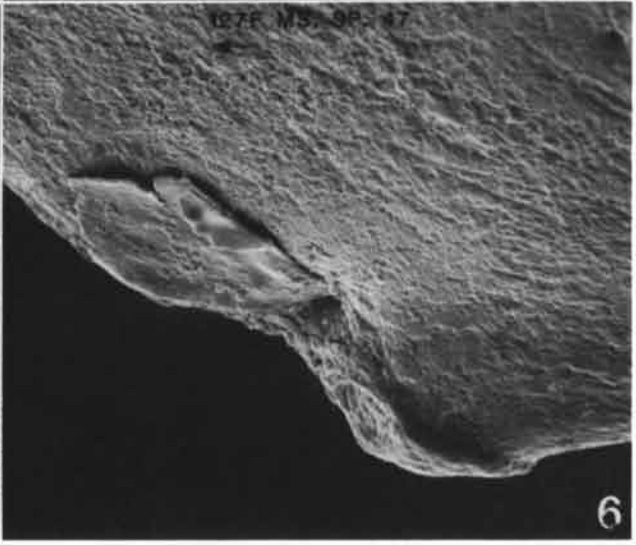


3

4

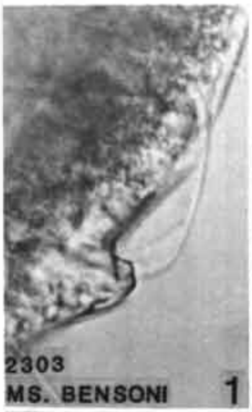


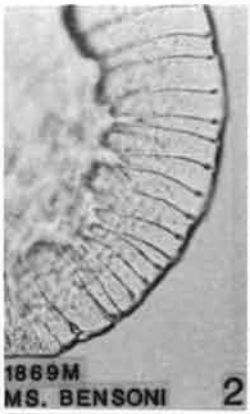
5



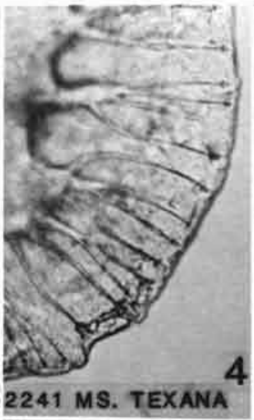
6

PLATE 72

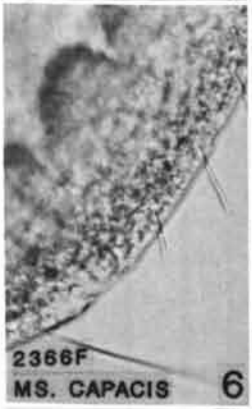

2303
MS. BENSONI 1


1869M
MS. BENSONI 2


2286
MS. TEXANA 3

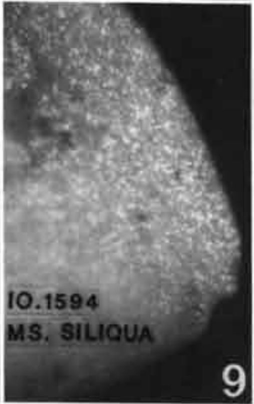

4
2241 MS. TEXANA


2307 5
MC. CYLINDRACEA

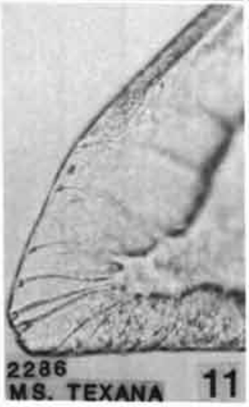

2366F
MS. CAPACIS 6


2361F
MS. CAPACIS 7


8
2356M MS. HIULCA


IO.1594
MS. SILIQUA
9


IO.1271
MS. EXQUISITA 10


2286
MS. TEXANA 11

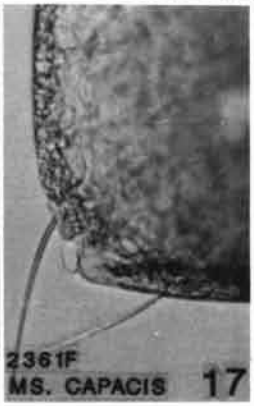

2307 12
MC. CYLINDRACEA


2358F
MS. HIULCA
13


2358F
MS. HIULCA
14


2357F
MS. HIULCA
15


2366F
MS. CAPACIS 16


2361F
MS. CAPACIS 17

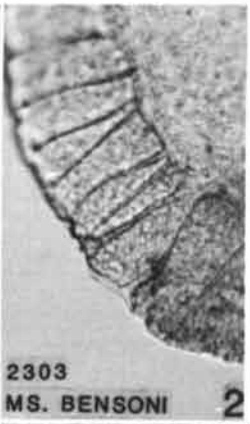

IO.1270
MS. EXQUISITA 18


2356M
MS. HIULCA 19

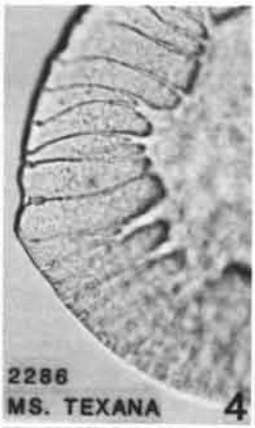

IN.51622
MS.
MUENSTERIANA
20

PLATE 73

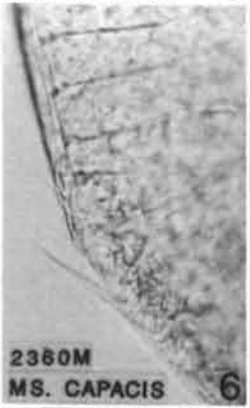

1869M
MS. BENSONI 1


2303
MS. BENSONI 2


1711J
MS. BENSONI 3

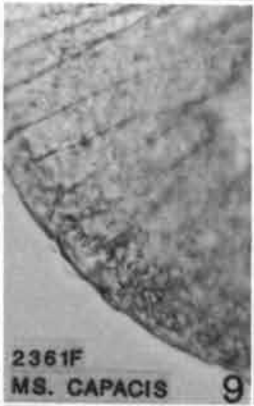

2286
MS. TEXANA 4

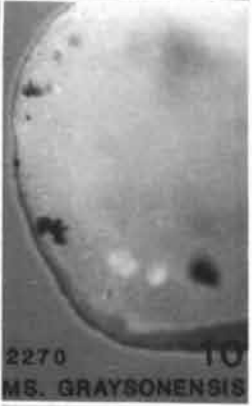

2242
MS. TEXANA 5


2360M
MS. CAPACIS 6


2363F
MS. CAPACIS 7


2366F
MS. CAPACIS 8

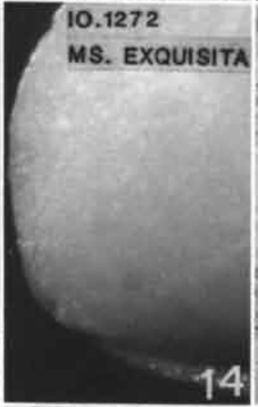

2361F
MS. CAPACIS 9

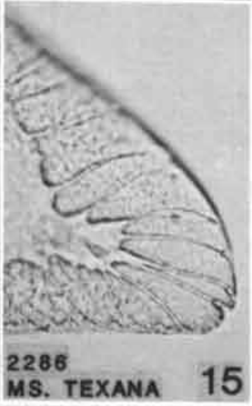

2270 10
MS. GRAYSONENSIS

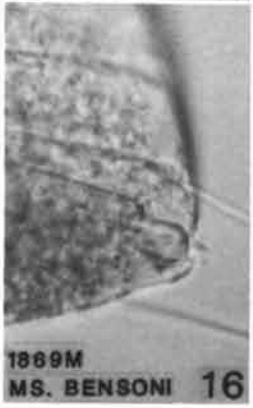

2356M
MS. HIULCA 11


2358F
MS. HIULCA
12

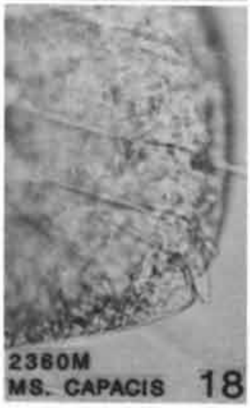

IO.1273
MS. EXQUISITA 13


IO.1272
MS. EXQUISITA
14


2286
MS. TEXANA 15


1869M
MS. BENSONI 16

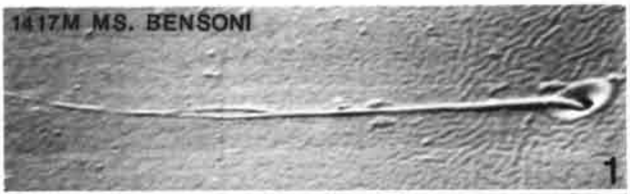

2363F
MS. CAPACIS 17


2360M
MS. CAPACIS 18

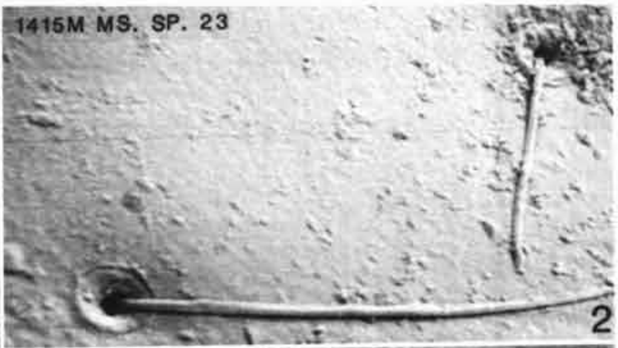

2366F
MS. CAPACIS 19


2356M
MS. HIULCA 20

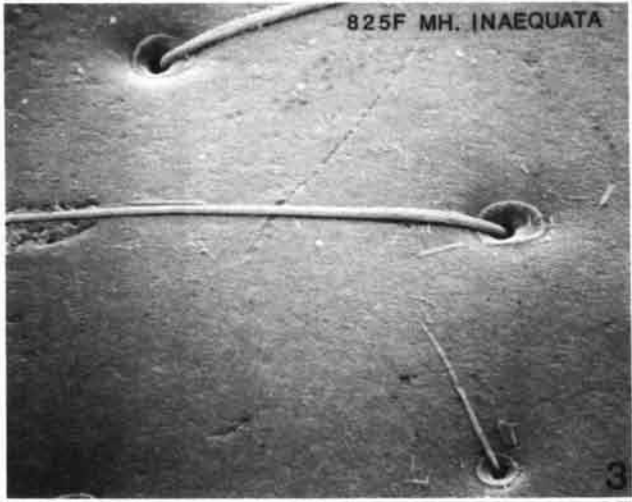
PLATE 74



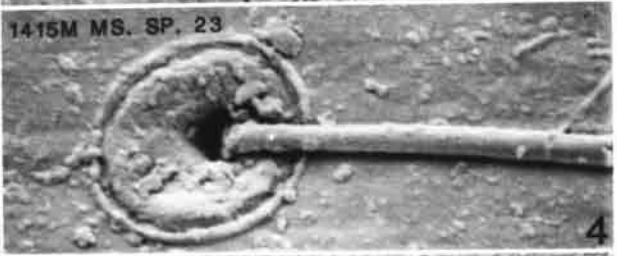
1



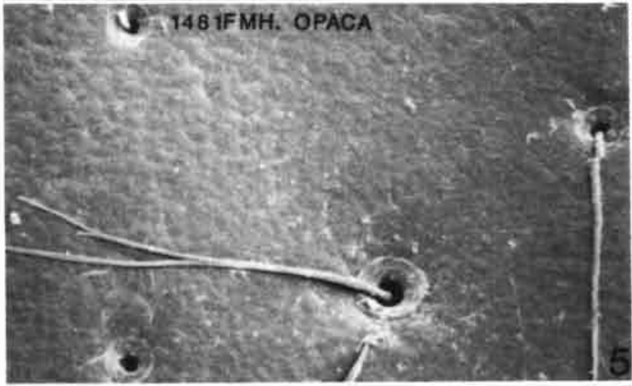
2



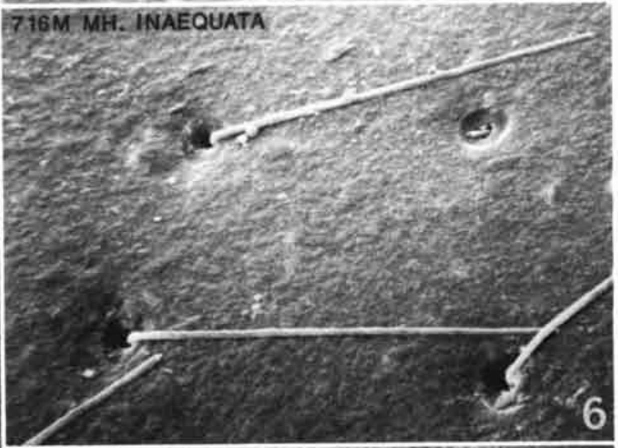
3



4



5



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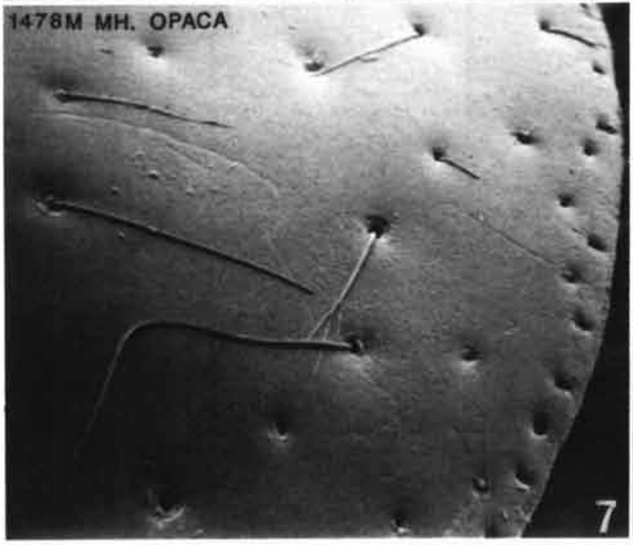
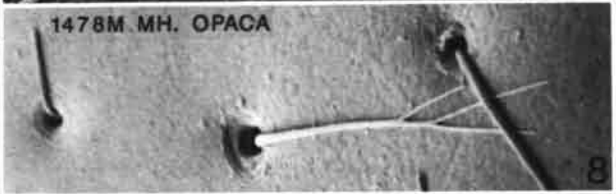


7

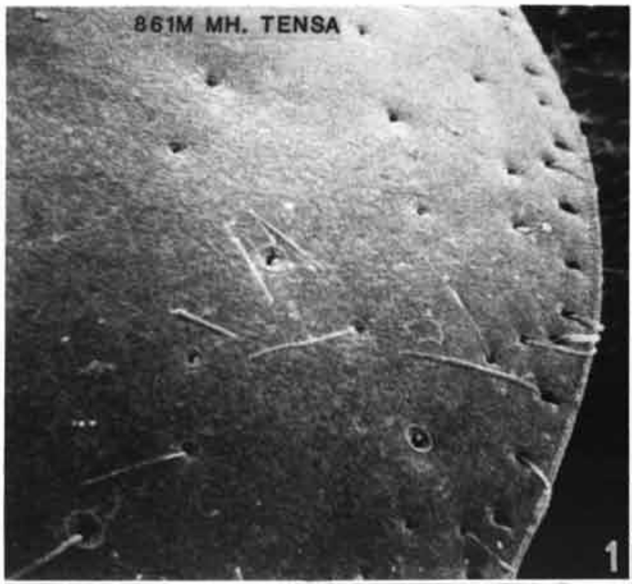


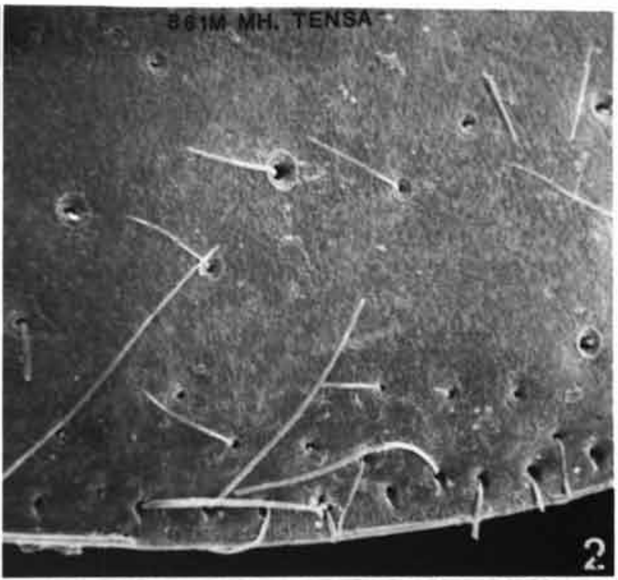
8

9

10

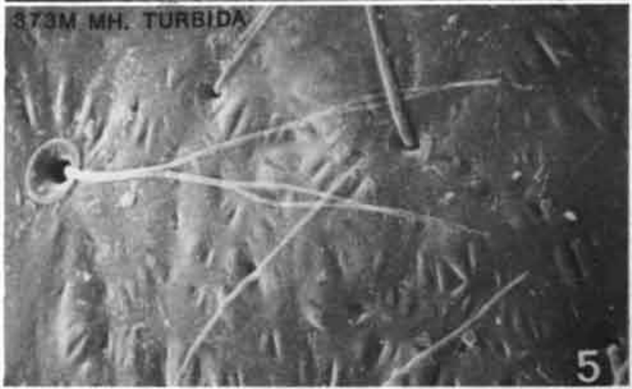
PLATE 75

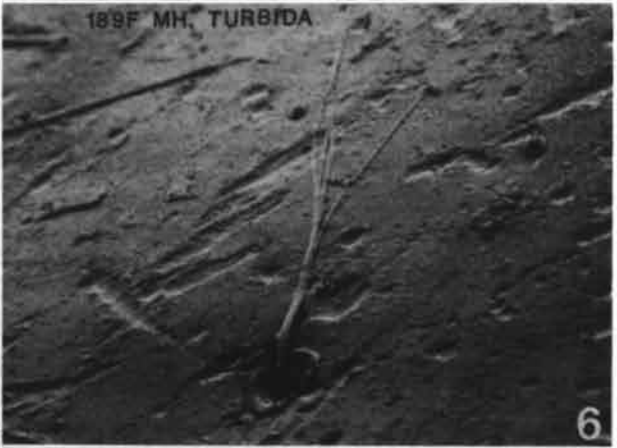

861M MH. TENSA
1

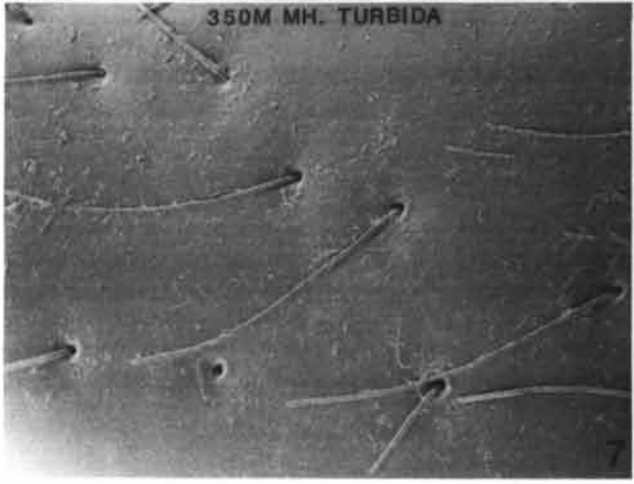

861M MH. TENSA
2


861M MH. TENSA
3


861M MH. TENSA
4


373M MH. TURBIDA
5

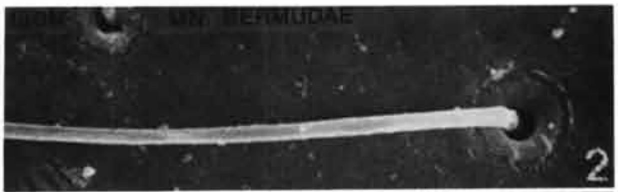

189F MH. TURBIDA
6

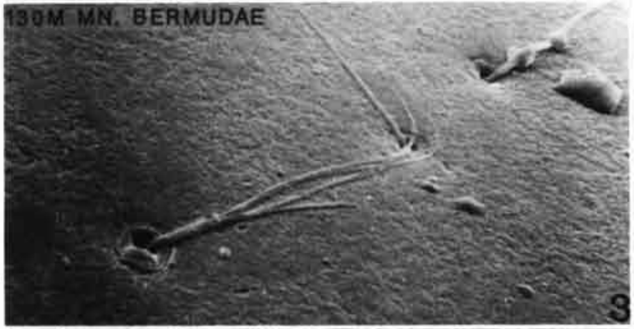

350M MH. TURBIDA
7


850F MH. SINUATA
8

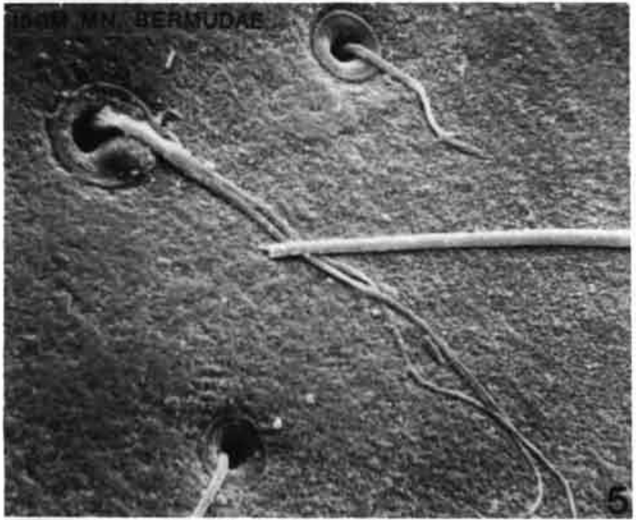
PLATE 76

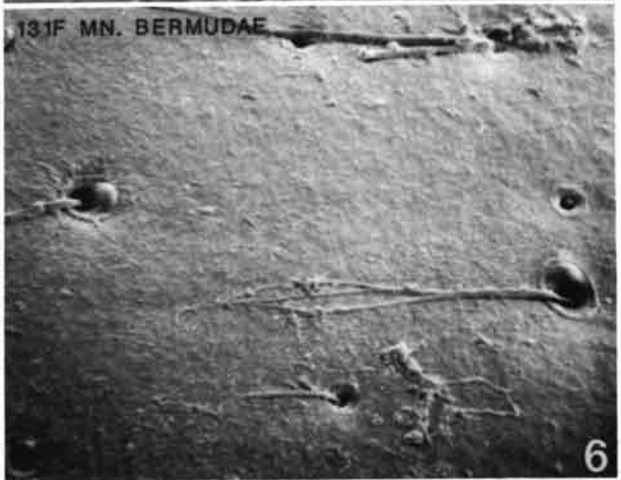

130M MN. BERMUDAE
1


MN. BERMUDAE
2


130M MN. BERMUDAE
3


130M MN. BERMUDAE
4


130M MN. BERMUDAE
5


131F MN. BERMUDAE
6


131F MN. BERMUDAE
7


131F MN. BERMUDAE
8

PLATE 77

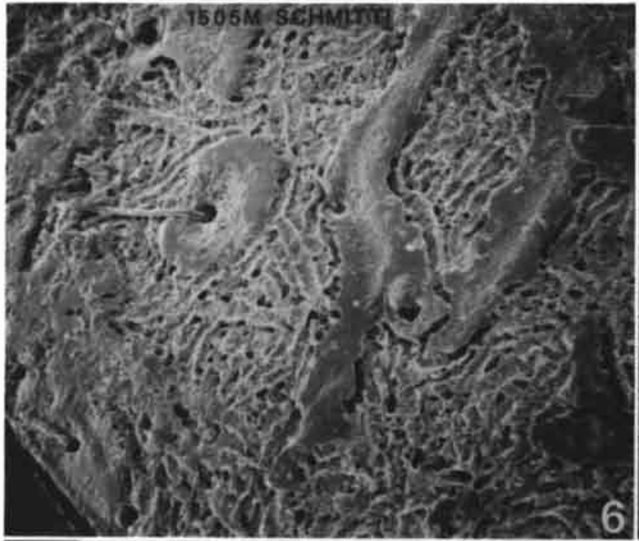

993M MN. HORTULI


MN. HORTULI


1344 MN. SP. 35
3


1507F MN. VARGATA


1507M MN. VARGATA


1505M SCHMITTI
6


83F MN. MADAGASCARENSIS
7


83F MN. MADAGASCARENSIS
8


83F MN. MADAGASCARENSIS

PLATE 78


M. MINNA
1347
1


M. MINNA
2002M
2


M. MAIORIS
1433M
3


M. MAIORIS
1434M
4


M. MAIORIS
1435F
5


M. METUENDA
1405M
6

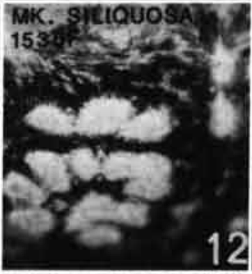

M. METUENDA
1501M
7


M. MIRANDA
1420F
8

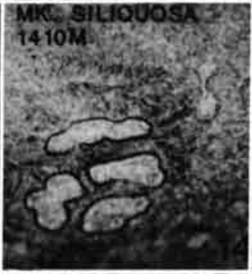

M. MIRANDA
1441M
9


M. MIRANDA
1442F
10


658F M. SP. 1
11


MK. SILIQUOSA
1530F
12


MK. SILIQUOSA
1414M
13


MK. SILIQUOSA
1410M
14

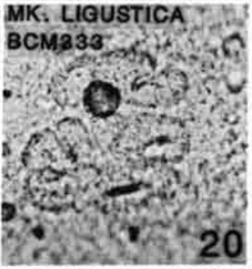

MK. AUSTRALIANA
HU.65.C.6
15


MK. GLACIERAE
721F
16


MK. GLACIERAE
1957F
17


MK. GREGALIS
2326
18

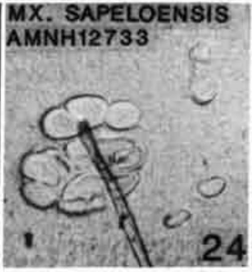

MK. LIGUSTICA
2276
19


MK. LIGUSTICA
BCM333
20


1995F MK. SP. 3
21


1460F MK. SP. 5
22


MK. SP.
23


MX. SAPELOENSIS
AMNH12733
24


MX. SAPELOENSIS
1355M
25


MX. SAPELOENSIS
1979M
26


MX. ADRECTA
1527F
27


MX. ADRECTA
1448M
28

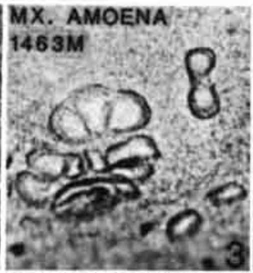

MX. ADUNCA
1521F
29


MX. ADRIATICA
2087
30

PLATE 79


MX. AMANDA
1429F


MX. AMANDA
1406M
2


MX. AMOENA
1463M
3


4


MX. 350M
ANTONBRUUNAE
5

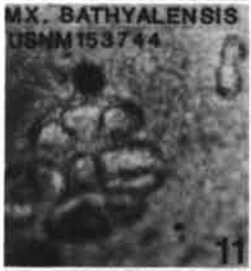

MX. ARTA
1456M
6


MX. ARTA
1451M
7


MX. AUDENS
1781F


MX. AUDENS
1445M
9

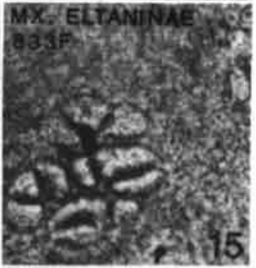

MX. AUDENS
1444F
10


MX. BATHYALENSIS
USNM153744
11

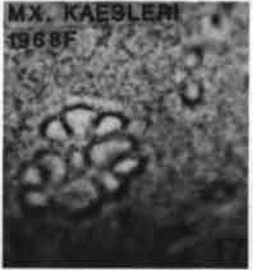

MX. BATHYALENSIS
2387M
12


MX. BATHYALENSIS
2386M
13


MX. ELTANINAE
834J
14


MX. ELTANINAE
833F
15


MX. KAESLERI
638F
16

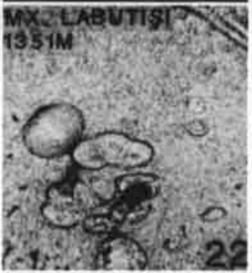

MX. KAESLERI
1968F
17


MX. KALBI
334F
18


MX. KALBI
1972F
19


MX. KALBI
331M
20


MX. KORNICKERI
2384M
21


MX. LABUTISI
1351M
22


MX. LABUTISI
1352F
23


MX. LONGANA
USNM563494
24


MX. RHODANA
USNM563497
25


MX. SIMILIS
2382M
26


MX. SIMILIS
2383F
27


2338 MX. SP. 9
29


327 MX. SP. 16
30

PLATE 80


MX. SP. 17
1


1443F MX. SP. 18
2


962F MX. SP. 21
3

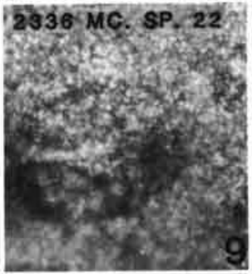

MA. SARSI
1998M
4


2305
MC. CYLINDRACEA
5


MC. CYLINDRACEA
2307
6

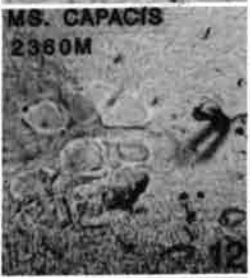

MC. ARCUATA
1533M
7


MC. VANDENBOLDI
2118
8


2336 MC. SP. 22
9


MS. CAPACIS
2361F
10


MS. CAPACIS
2364F
11


MS. CAPACIS
2360M
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MS. HIULCA
2357
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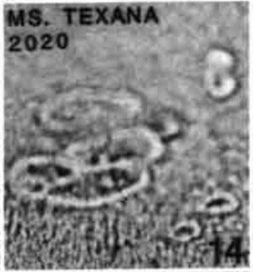
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2020
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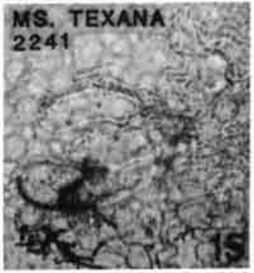
MS. TEXANA
2241
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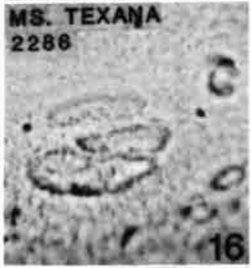
MS. TEXANA
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MH. ATLANTICA
1983F
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MH. ATLANTICA
1981M
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MH. GYREAE
1509
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MH. HEROICA
1461F
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MN. INAEQUATA
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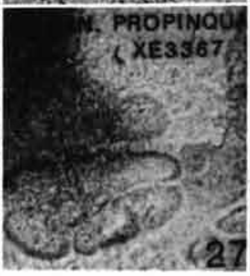
329M
MH. SINUATA
23


951M MH. TENSA
24


1934M
MH. TURBIDA
25


MH. TURBIDA
26


N. PROPINQU
XE3367
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1506J-2
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MH. BERMUDAE
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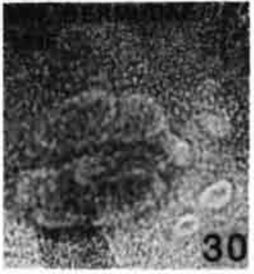
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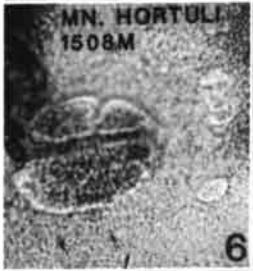

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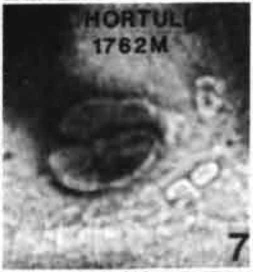

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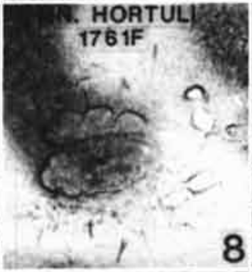

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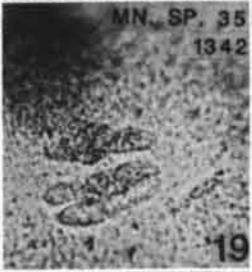

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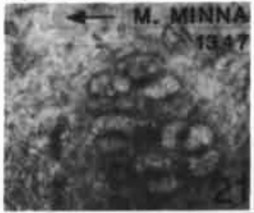

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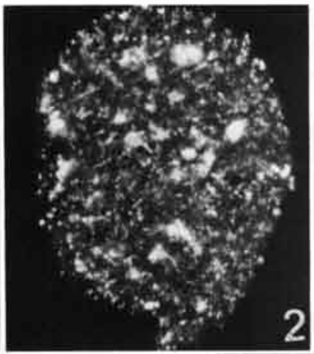
PLATE 82

1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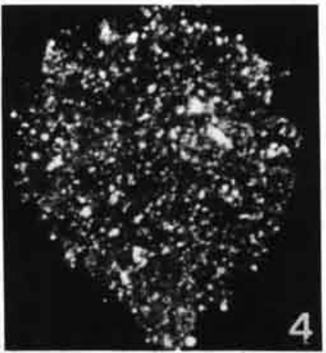
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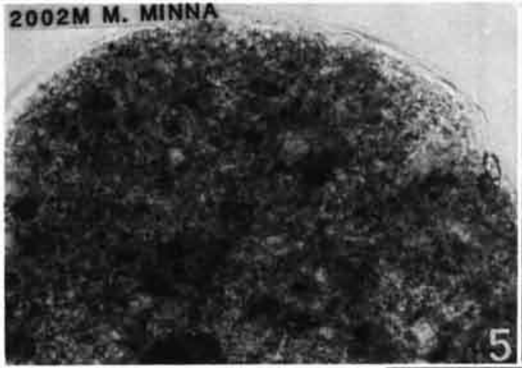

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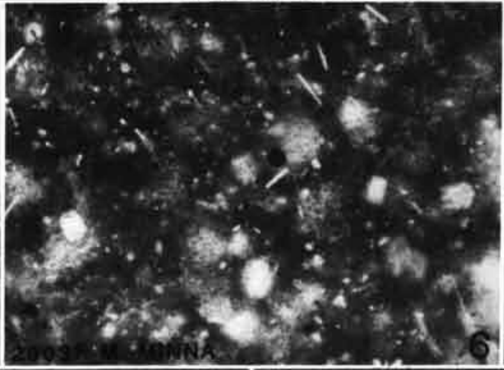

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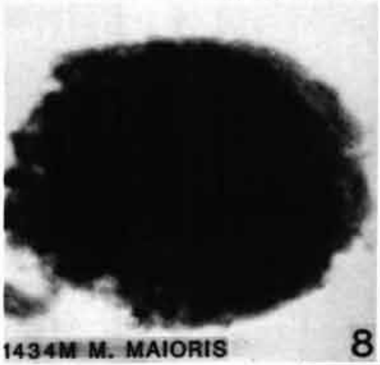

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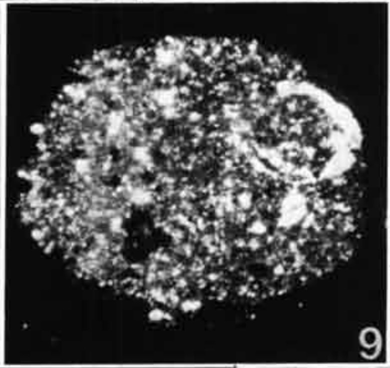
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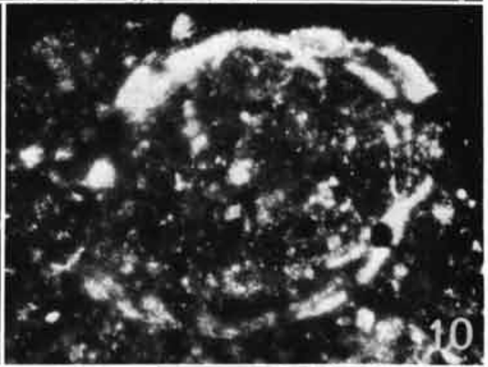
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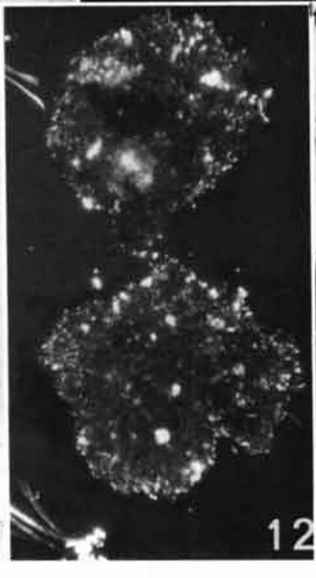
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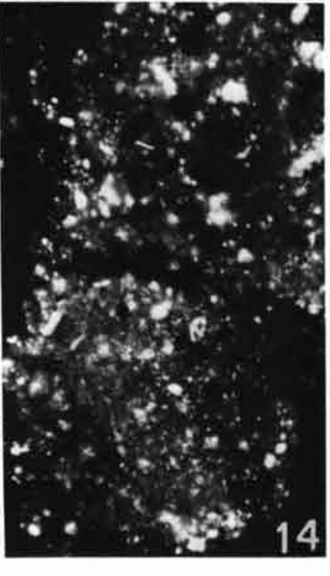
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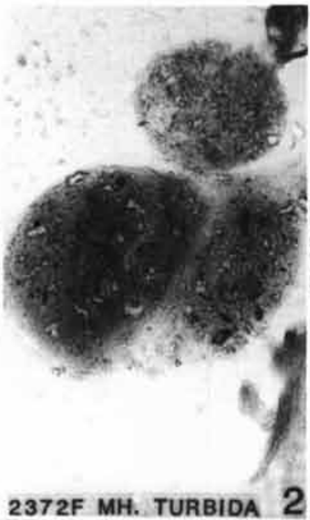
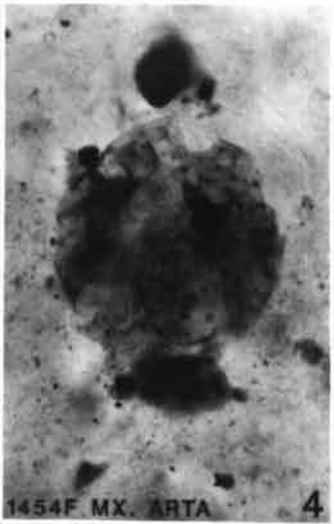
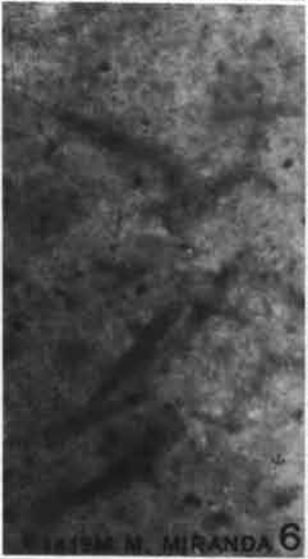
1792F MX. AMANDA 1

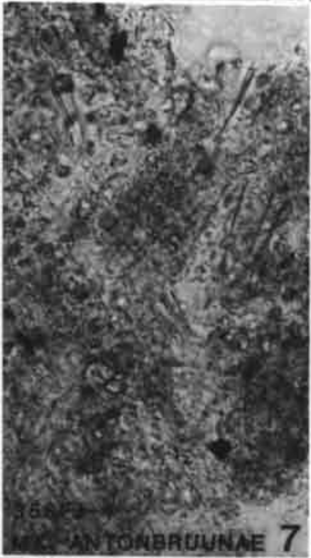

2372F MH. TURBIDA 2


721F MK. GLACIERAE 3


1454F MX. ARTA 4


1442F
M. MIRANDA 5


1419M M. MIRANDA 6


356F
MK. ANTONBRUUNAE 7


1451M MX. ARTA 8


1774M
M. MAIORIS 9


862F MH. TENSA 10


1952M M. METUENDA 11

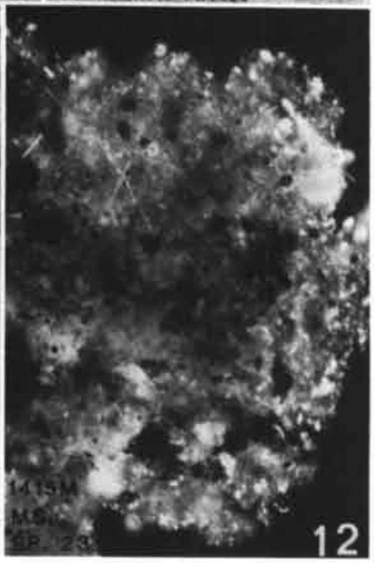
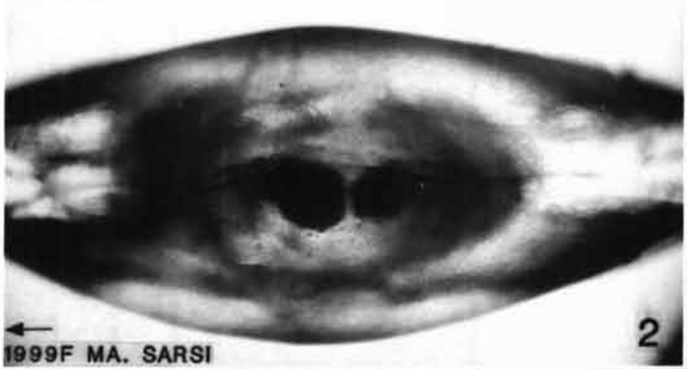

1415M
MS.
SP. 23 12

PLATE 84


1415M MS. SP. 23
1


1999F MA. SARSI
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1869M MS. BENSONI
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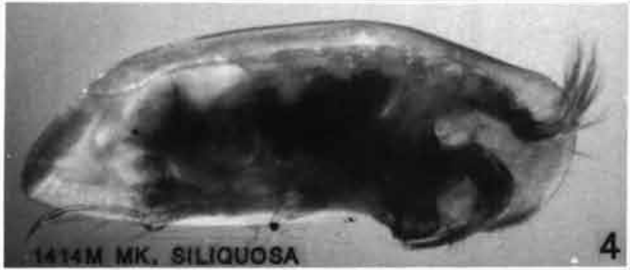

1414M MK. SILIQUOSA
4


2130M MN. HARTMANNI
5


1774M M. MAIORIS
6

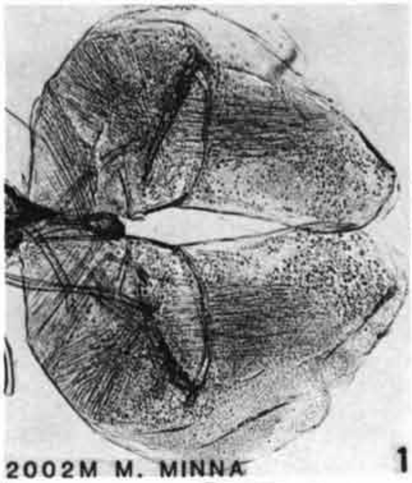

IO.1275 MS. SIMPLEX
7

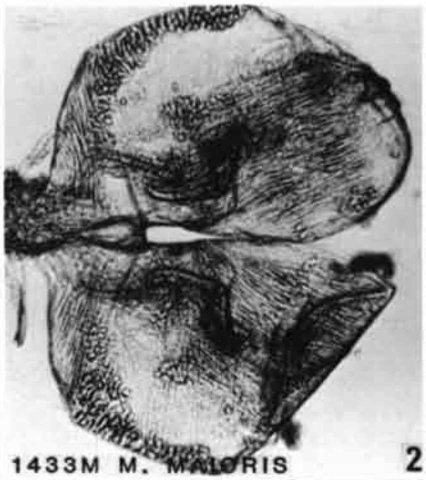

IO.1275 MS. SIMPLEX
8


2337 MX. SP. 10
9


2337 MX. SP. 10
10

PLATE 85


2002M M. MINNA 1


1433M M. MAIORIS 2


1434M M. MAIORIS 3

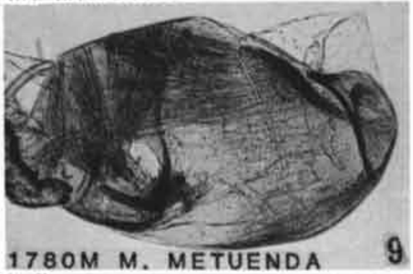

1404M M. METUENDA 4

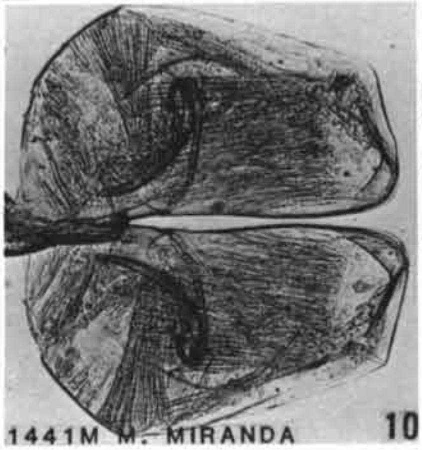

1405M M. METUENDA 5

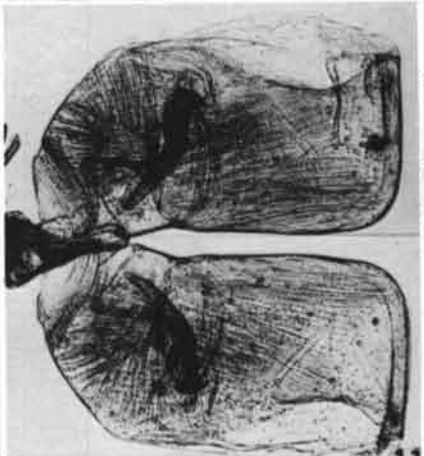

1774M M. MAIORIS 6


1439 M. METUENDA 7


1405M M. METUENDA 8


1780M M. METUENDA 9


1441M M. MIRANDA 10


1955M M. MIRANDA 11

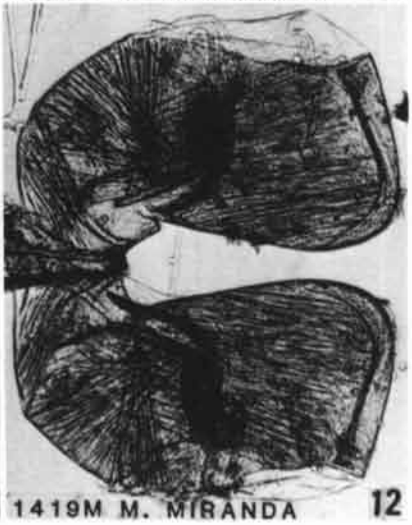
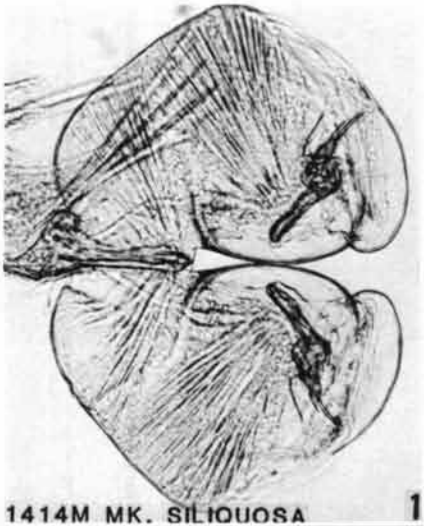
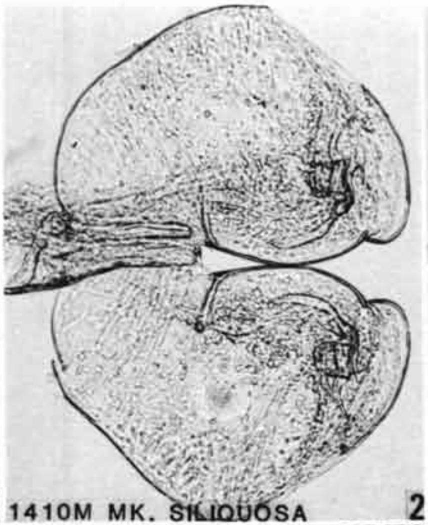

1419M M. MIRANDA 12

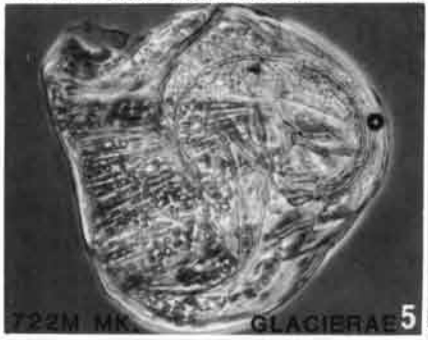
PLATE 86

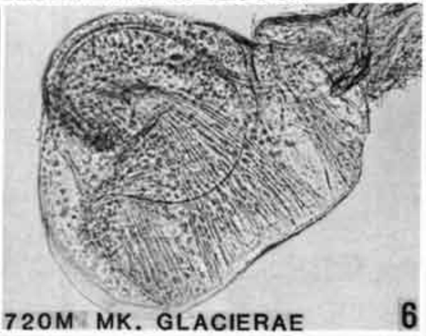

1414M MK. SILIQUOSA 1

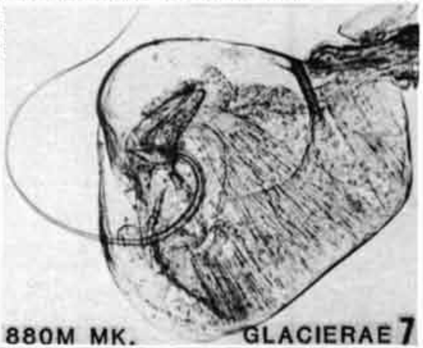

1410M MK. SILIQUOSA 2


1500M MK. SILIQUOSA 3


1500M MK. SILIQUOSA 4


722M MK. GLACIERAE 5


720M MK. GLACIERAE 6

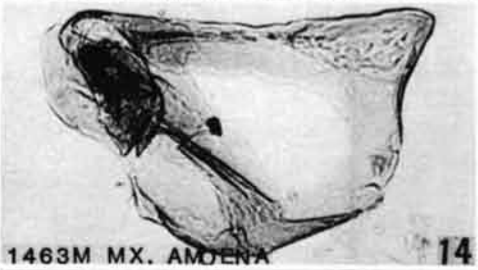

880M MK. GLACIERAE 7

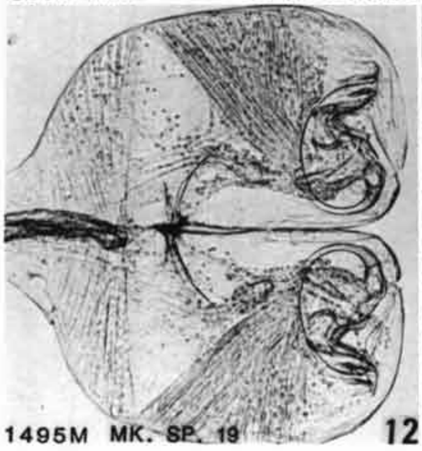

880M MK. GLACIERAE 8

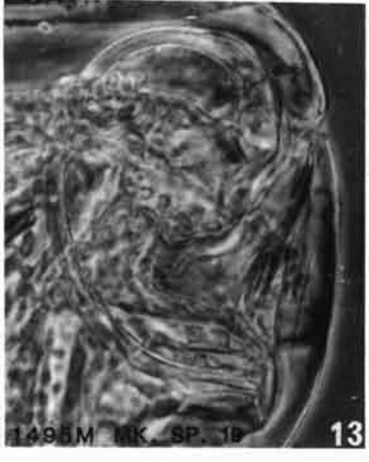

722M MK. GLACIERAE 9

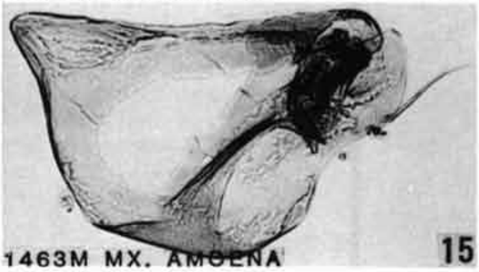

1414M MK. SILIQUOSA 10

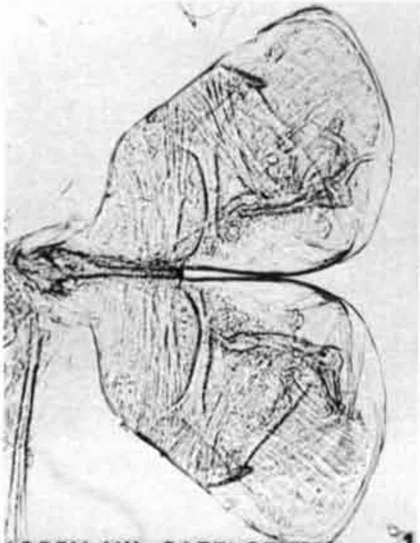

1410M MK. SILIQUOSA 11

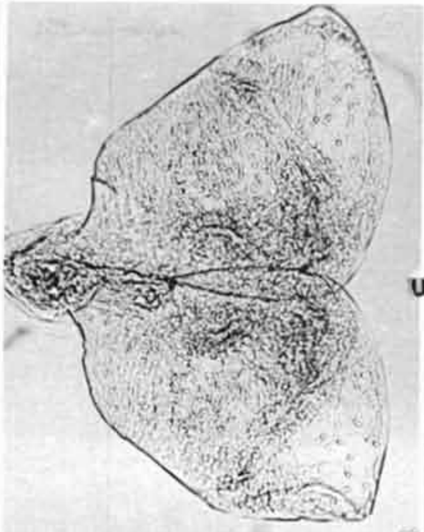

1463M MX. AMOENA 14


1495M MK. SP. 19 12

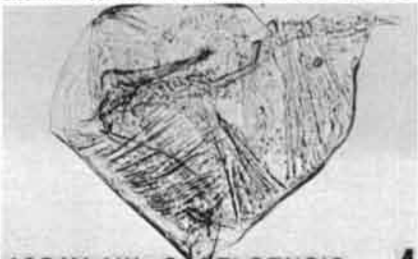

1495M MK. SP. 19 13


1463M MX. AMOENA 15

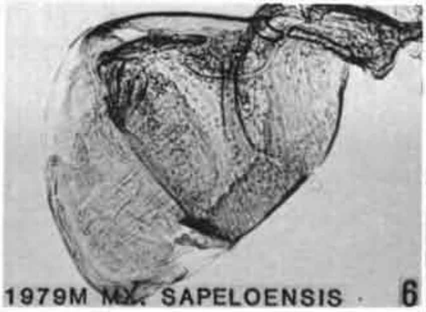

1355M MX. SAPELOENSIS 1

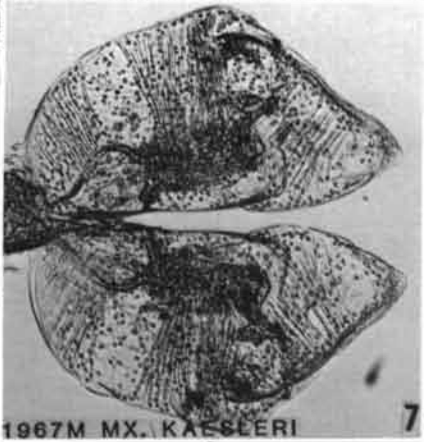

1391M MX. SAPELOENSIS 2

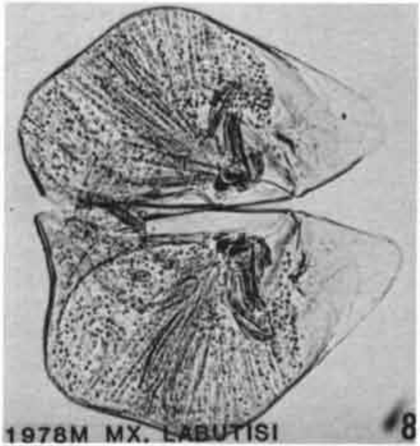

UMPM 48780 MX. SAPELOENSIS 3

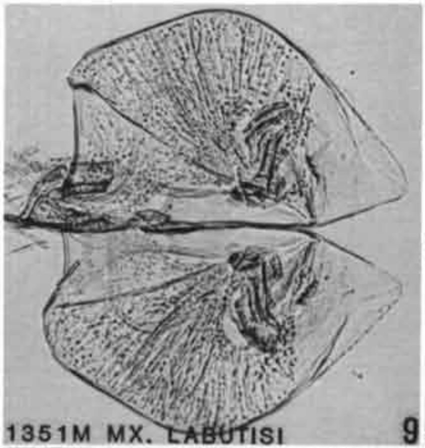

1354M MX. SAPELOENSIS 4

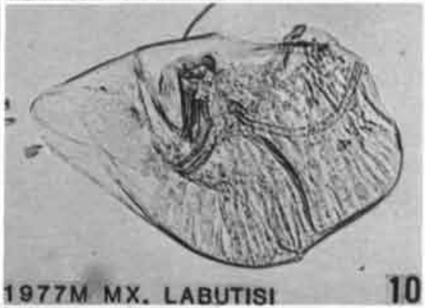

1979M MX. SAPELOENSIS 5


1979M MX. SAPELOENSIS 6

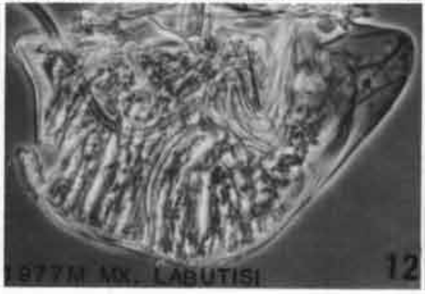

1967M MX. KAESLERI 7


1978M MX. LABUTISI 8


1351M MX. LABUTISI 9


1977M MX. LABUTISI 10


1350M MX. LABUTISI 11


1977M MX. LABUTISI 12

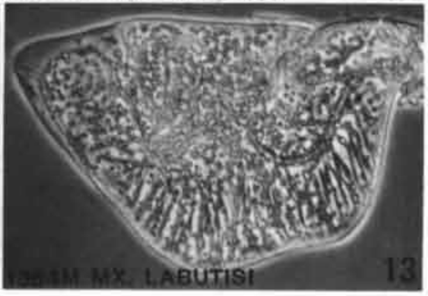
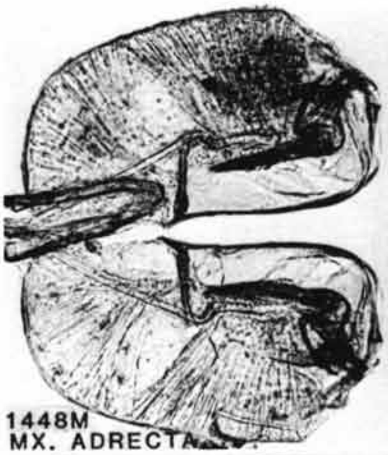

1354M MX. LABUTISI 13

PLATE 88



1448M
MX. ADRECTA

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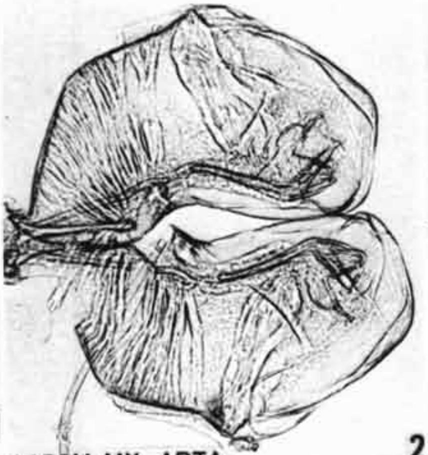

1456M MX. ARTA

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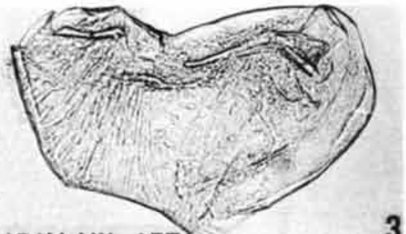

1451M MX. ARTA

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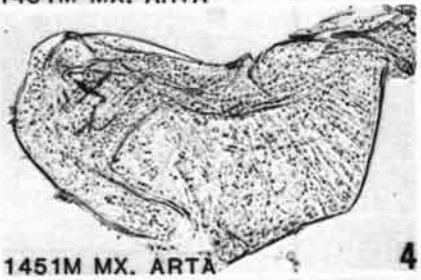


1451M MX. ARTA

4

1529M MX. AMANDA

5

1406M MX. AMANDA

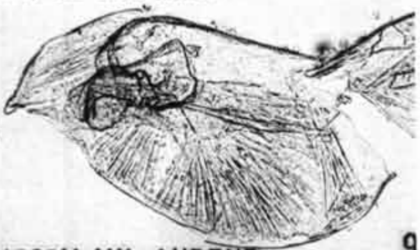
6

1406M MX. AMANDA

7

1525M MX. AUDENS

8



1525M MX. AUDENS

9

1446M MX. AUDENS

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1445M MX. AUDENS

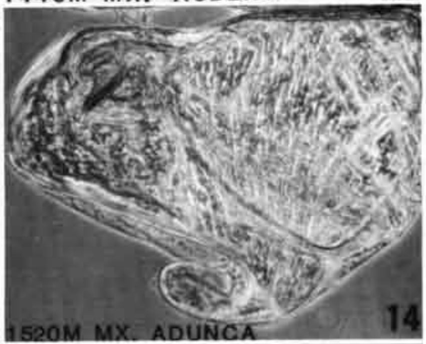
11

1445M MX. AUDENS

12

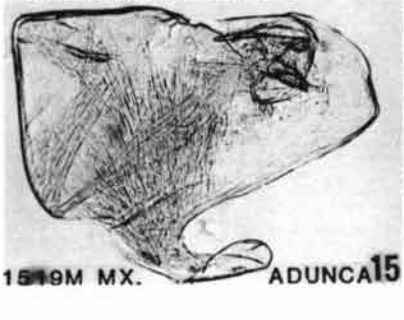
1519M MX. ADUNCA

13



1520M MX. ADUNCA

14



1519M MX. ADUNCA

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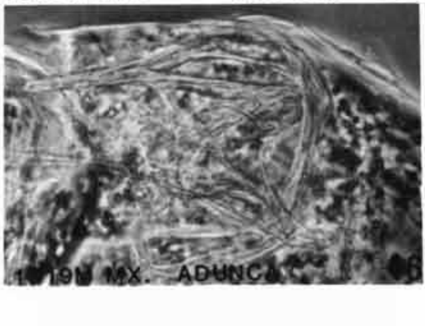
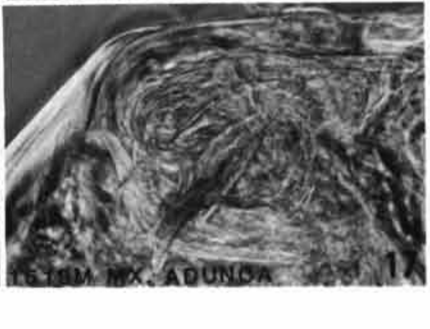


1519M MX. ADUNCA

16

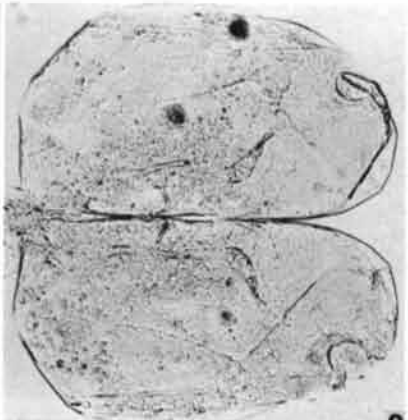


1519M MX. ADUNCA

17


183M MX. ANTONBRUUNAE 1

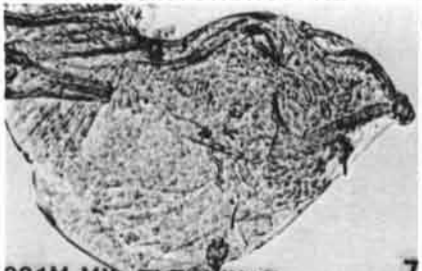

1966M MX. ANTONBRUUNAE 2


341M MX. ANTONBRUUNAE 3


358M MX. ANTONBRUUNAE 4

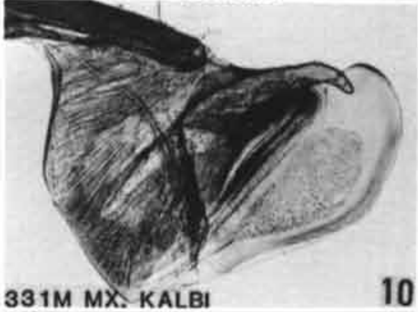

332M MX. ANTONBRUUNAE 5


332M MX. ANTONBRUUNAE 6


831M MX. ELTANINAE 7

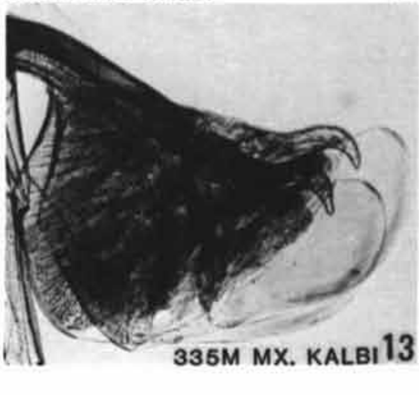

831M MX. ELTANINAE 8

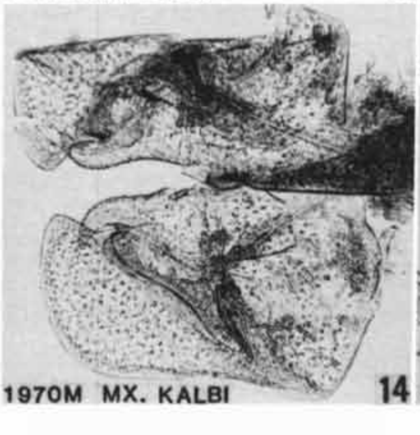

831M MX. ELTANINAE 9


331M MX. KALBI 10


331M MX. KALBI 11


351M MX. KALBI 12


335M MX. KALBI 13


1970M MX. KALBI 14

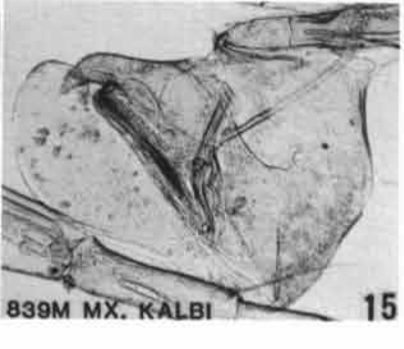
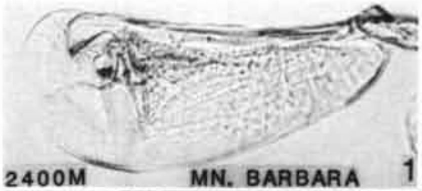
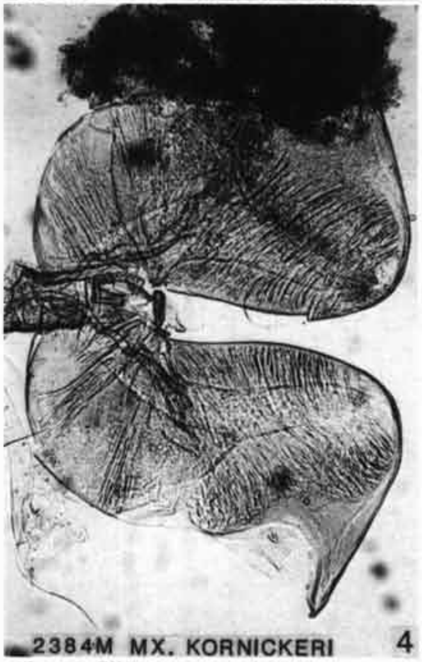

839M MX. KALBI 15

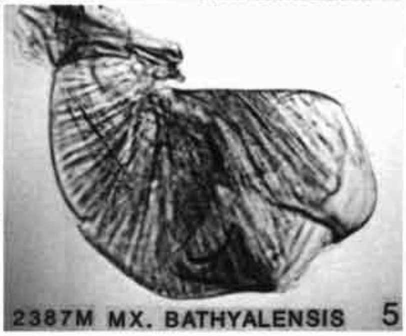
PLATE 90

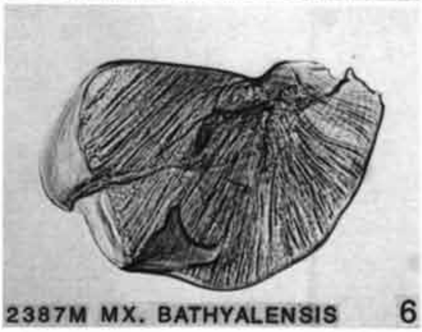

2400M MN. BARBARA 1


2400M MN. BARBARA 2

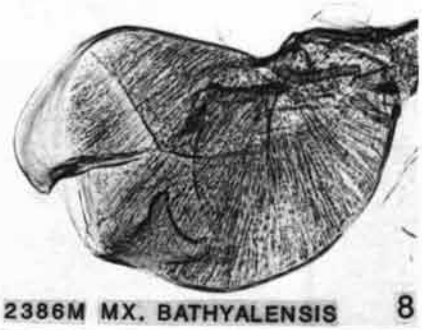

2400M MN. BARBARA 3

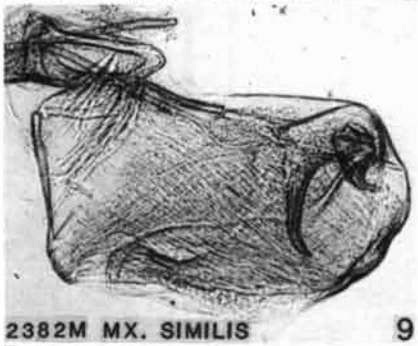

2384M MX. KORNICKERI 4

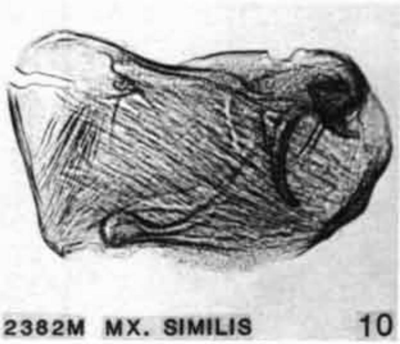

2387M MX. BATHYALENSIS 5

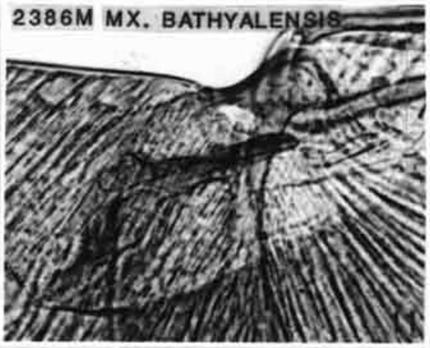

2387M MX. BATHYALENSIS 6


2386M MX. BATHYALENSIS 7


2386M MX. BATHYALENSIS 8

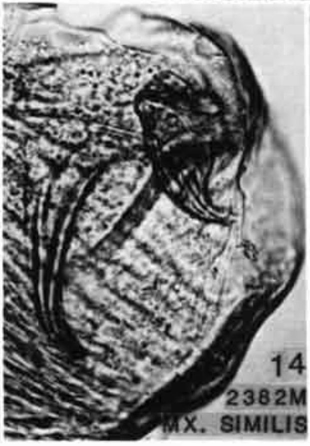

2382M MX. SIMILIS 9


2382M MX. SIMILIS 10


2386M MX. BATHYALENSIS


2384M MX. KORNICKERI 12


2386M MX. BATHYALENSIS 13


14 2382M MX. SIMILIS

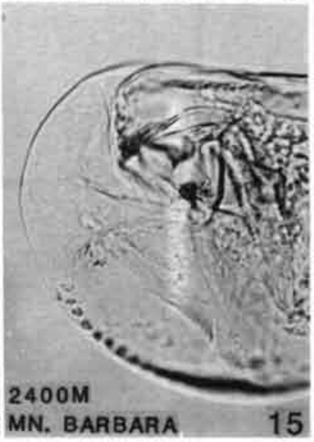
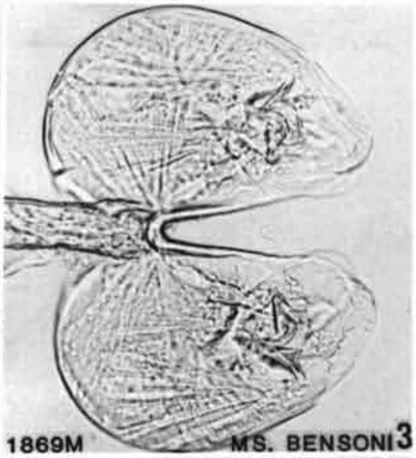
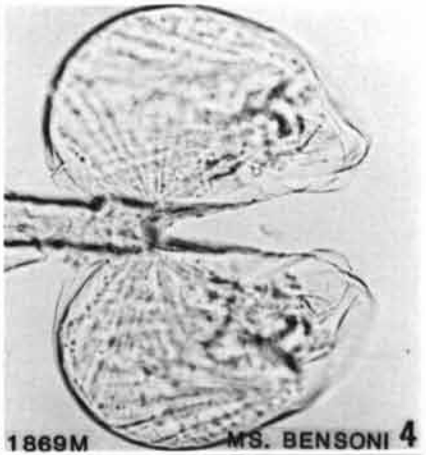

2400M MN. BARBARA 15

PLATE 91

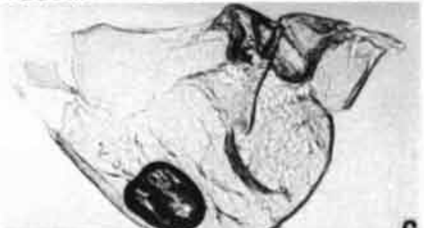

1998M MA. SARSI 1

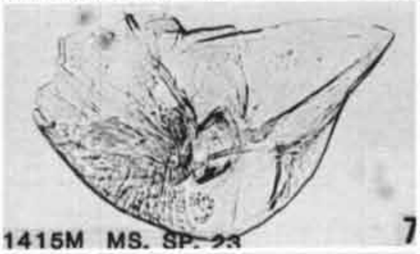

1998M MA.SARSI 2

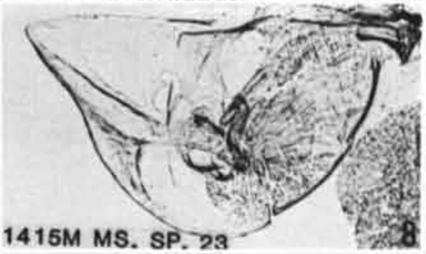

1869M MS. BENSONI 3

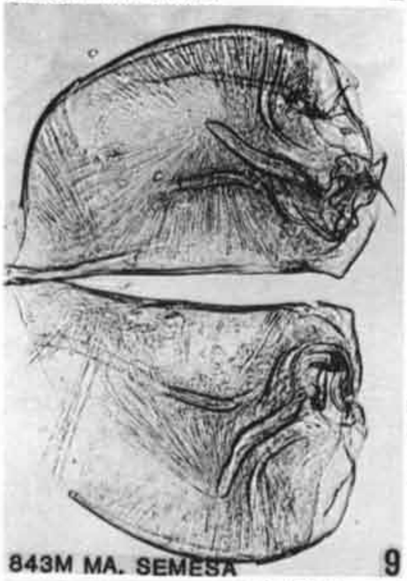

1869M MS. BENSONI 4


2356 MS. HIULCA 5

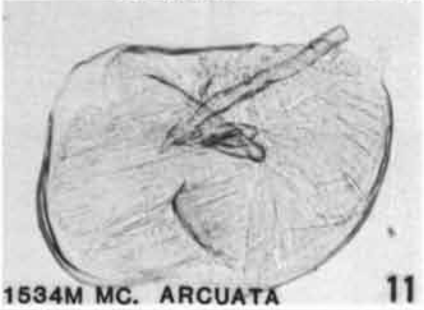

2356M MS. HIULCA 6

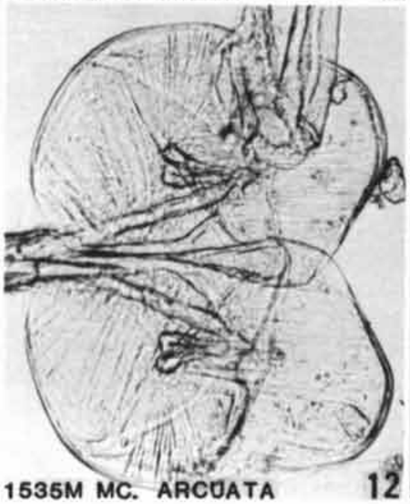

1415M MS. SP. 23 7

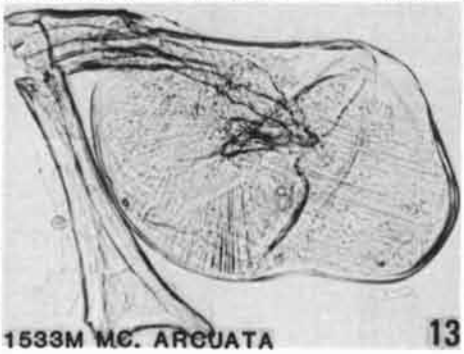

1415M MS. SP. 23 8


843M MA. SEMESA 9


1534M MC. ARCUATA 10


1534M MC. ARCUATA 11


1535M MC. ARCUATA 12


1533M MC. ARCUATA 13

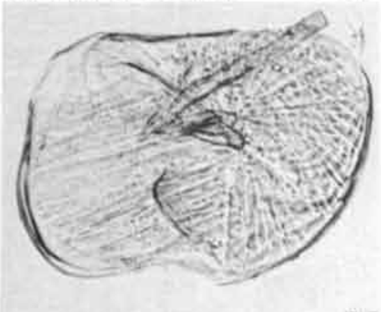
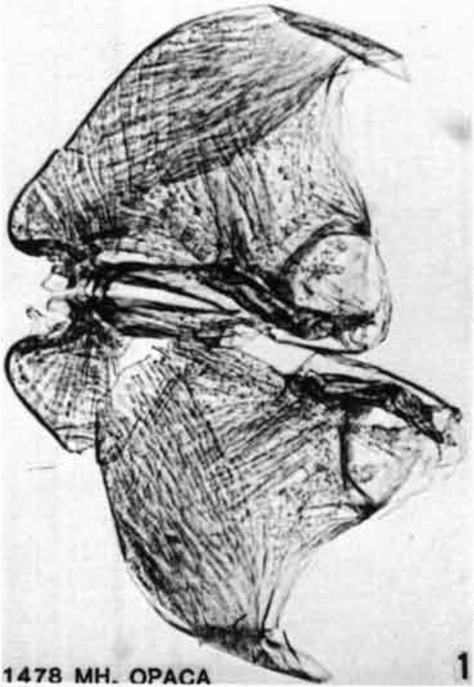
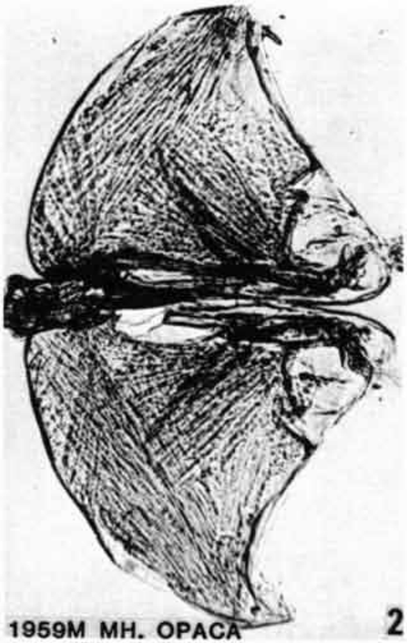
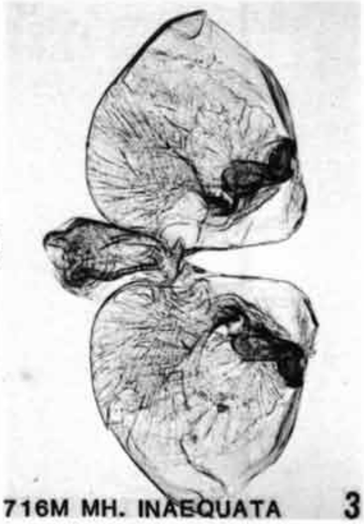

1533M MC. ARCUATA 14

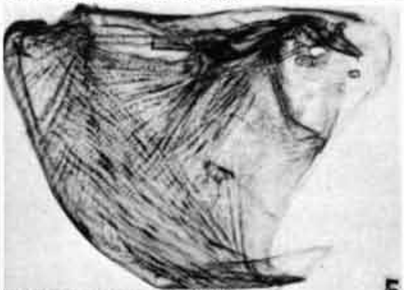
PLATE 92

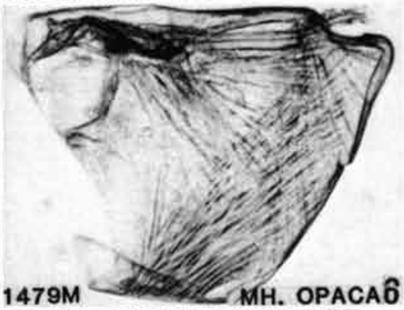

1478 MH. OPACA 1

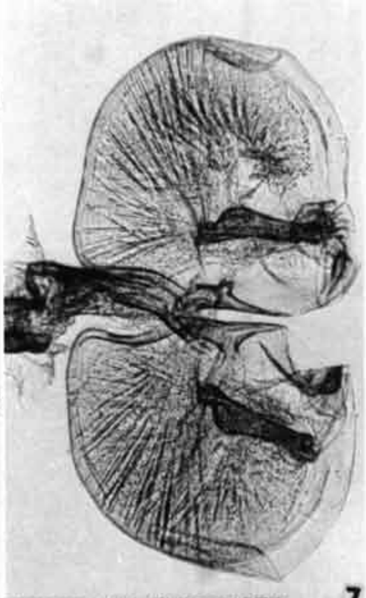

1959M MH. OPACA 2


716M MH. INAEQUATA 3

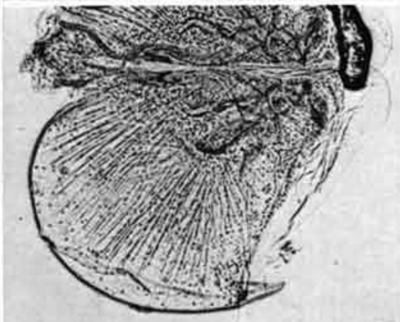

1478M MH. OPACA 4

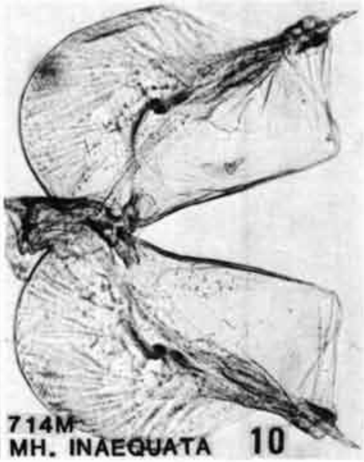

1479M MH. OPACA 5

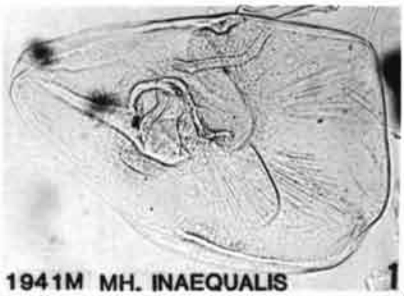

1479M MH. OPACA 6

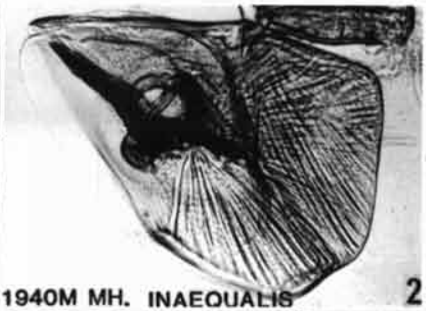

2380M MH. INAEQUATA 7

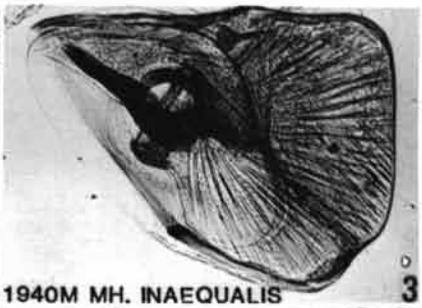

198M MH. SP. 25 8

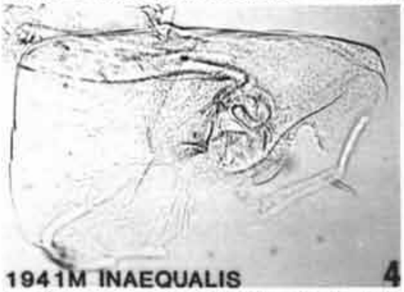

198M MH. SP. 25 9

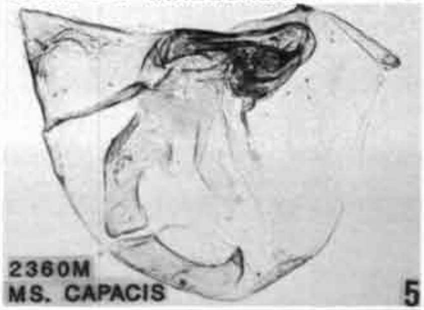

714M MH. INAEQUATA 10

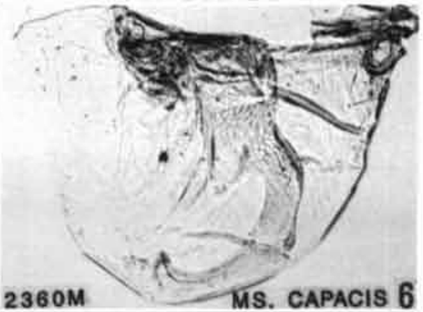

1941M MH. INAEQUALIS 1

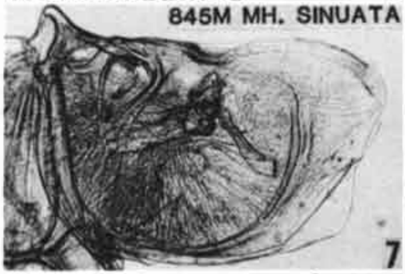

1940M MH. INAEQUALIS 2


1940M MH. INAEQUALIS 3

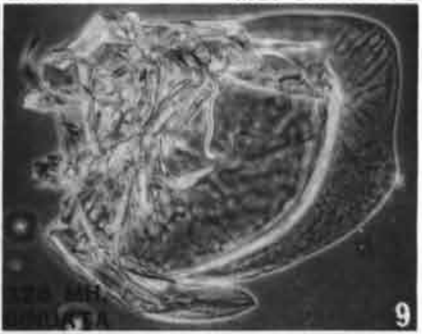

1941M INAEQUALIS 4

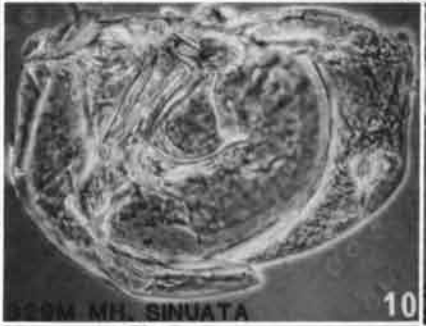

2360M MS. CAPACIS 5

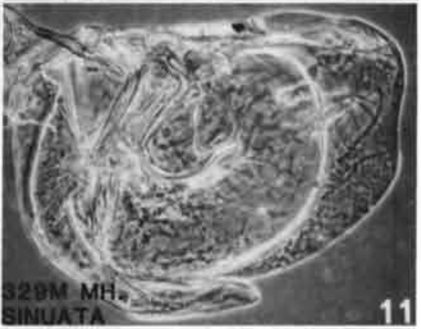

2360M MS. CAPACIS 6

845M MH. SINUATA

7


329M MH. SINUATA 8


329 MH. SINUATA 9

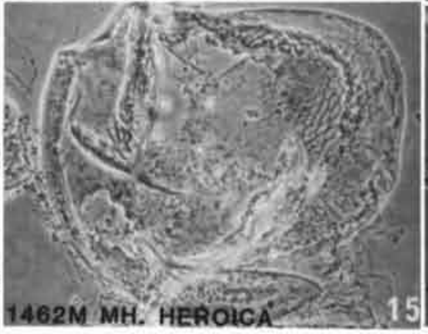

329M MH. SINUATA 10


329M MH. SINUATA 11


1462M MH. HEROICA 12


1462M MH. HEROICA 13


1462M MH. HEROICA 14


1462M MH. HEROICA 15

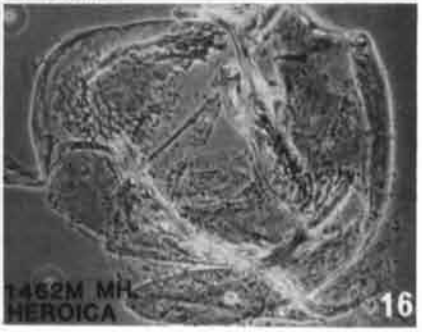
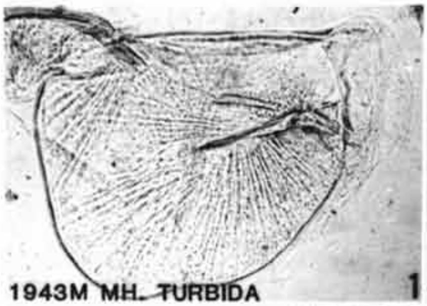
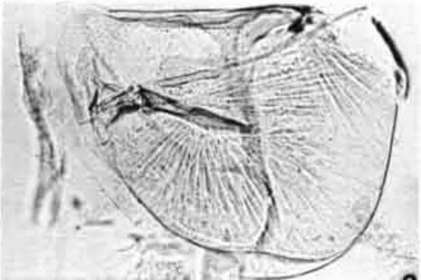
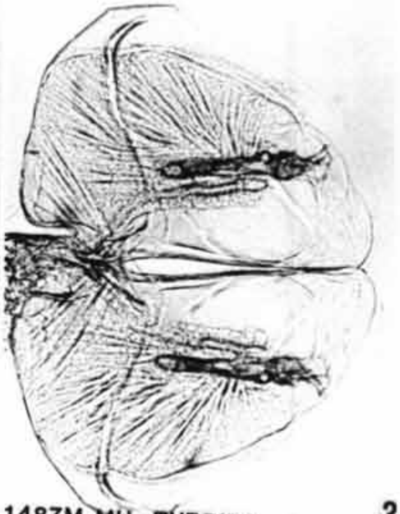
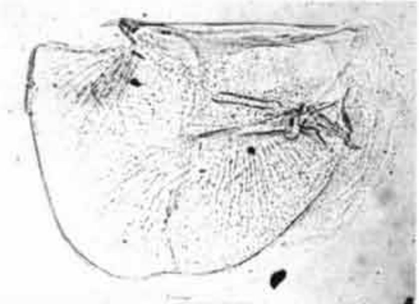

1462M MH. HEROICA 16

PLATE 94

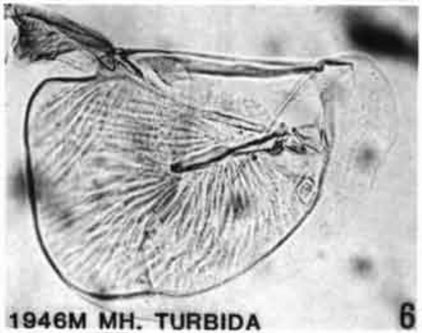

1943M MH. TURBIDA 1


1944M MH. TURBIDA 2

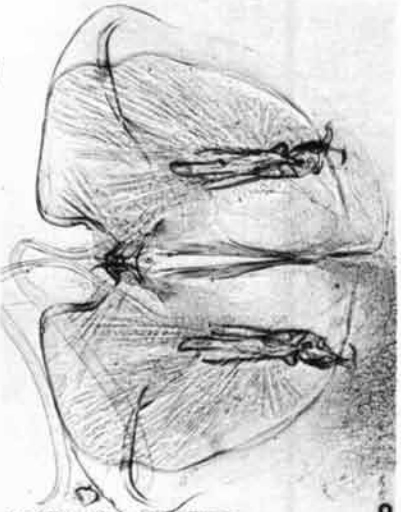

1487M MH. TURBIDA 3

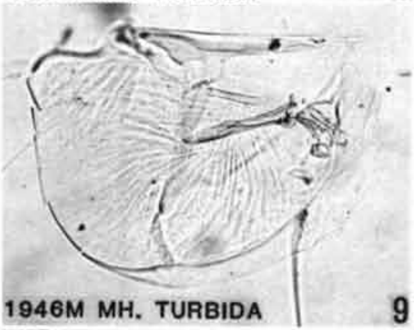

1943M MH. TURBIDA 4


197M MH. TURBIDA 5

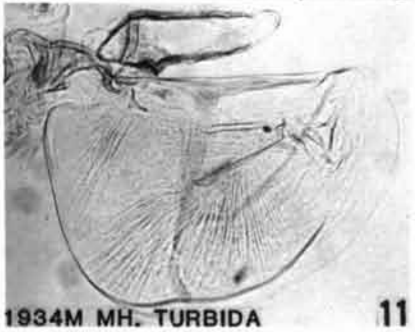

1946M MH. TURBIDA 6


1475M MH. TURBIDA 7


821M MH. TURBIDA 8


1946M MH. TURBIDA 9


1475M MH. TURBIDA 10


1934M MH. TURBIDA 11

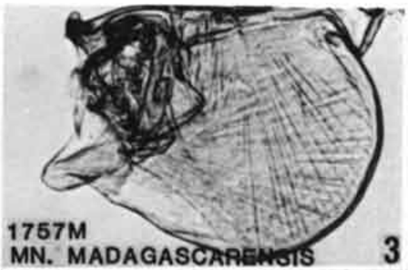

375M MH. TURBIDA 12

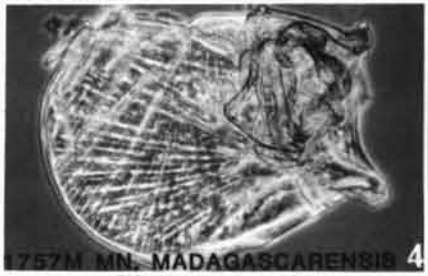

827M MH. TURBIDA 13

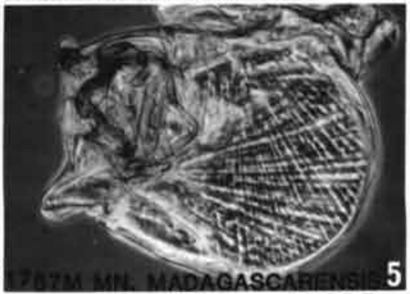
PLATE 95


19M MN. MADAGASCARENSIS 1


1757M MN. MADAGASCARENSIS 2

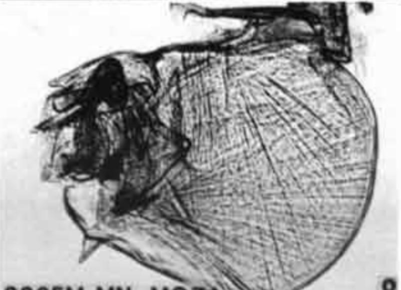

1757M MN. MADAGASCARENSIS 3

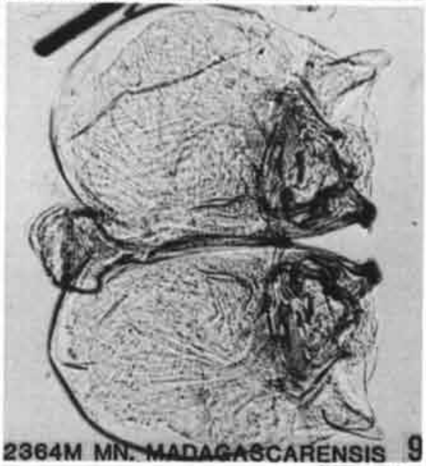

1757M MN. MADAGASCARENSIS 4


1757M MN. MADAGASCARENSIS 5


668M MN. MADAGASCARENSIS 6


2365M MN. MOZA 7


2365M MN. MOZA 8


2364M MN. MADAGASCARENSIS 9


MH. ATLANTICA
1982M
10


MH. ATLANTICA
1982M
11

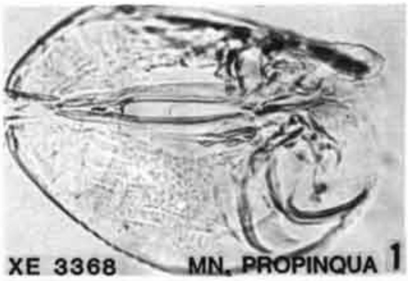

1981M MH. ATLANTICA 12


1981M MH. ATLANTICA 13

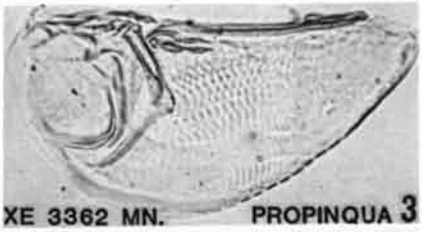

1980M MH. ATLANTICA 14


1980M MH. ATLANTICA 15

PLATE 96

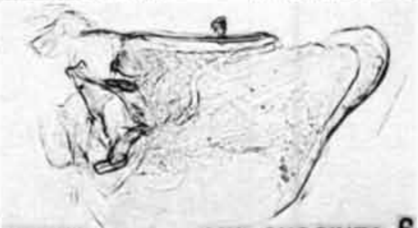

XE 3368 MN. PROPINQUA 1


XE 3362 MN. PROPINQUA 2

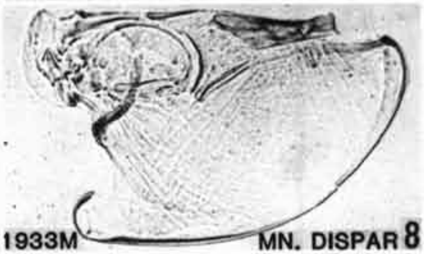

XE 3362 MN. PROPINQUA 3


1904M MN. SUCCINEA 4


1905M MN. SUCCINEA 5

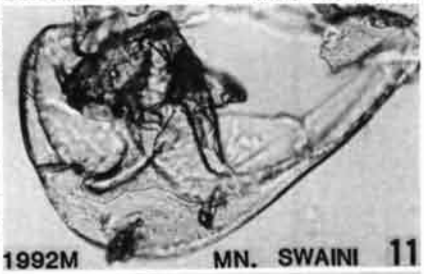

1905M MN. SUCCINEA 6


1933M MN. DISPAR 7

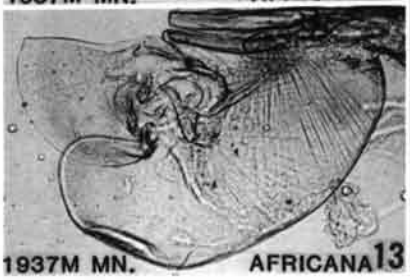

1933M MN. DISPAR 8

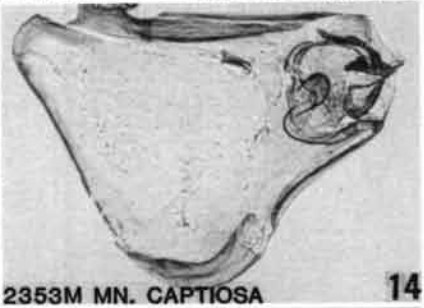

2130M MN. HARTMANNI 9

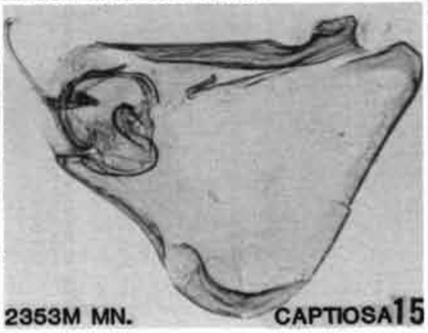

2130M MN. HARTMANNI 10

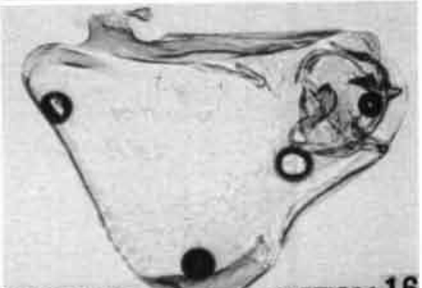

1992M MN. SWAINI 11

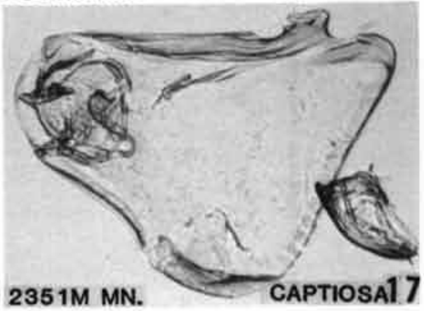

1937M MN. AFRICANA 12


1937M MN. AFRICANA 13

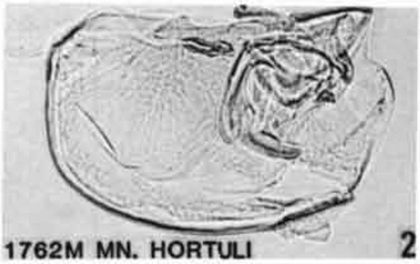

2353M MN. CAPTIOSA 14

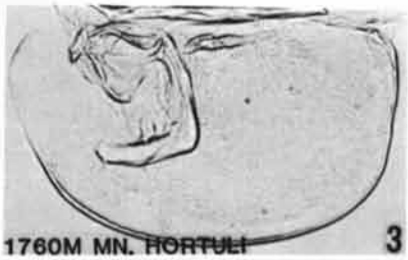

2353M MN. CAPTIOSA 15


2351M MN. CAPTIOSA 16

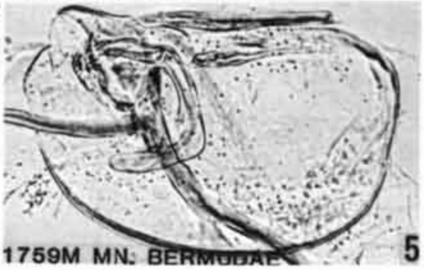

2351M MN. CAPTIOSA 17

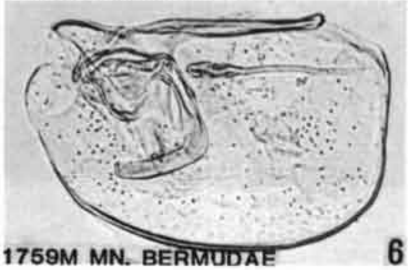

1762M MN. HORTULI 1

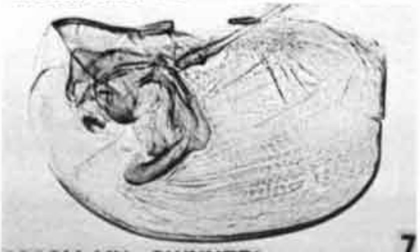

1762M MN. HORTULI 2

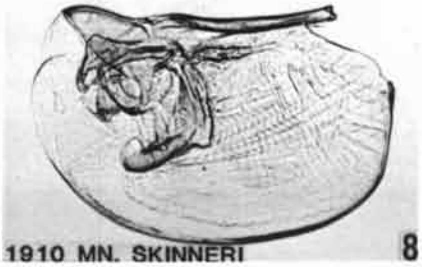

1760M MN. HORTULI 3


1760M MN. HORTULI 4

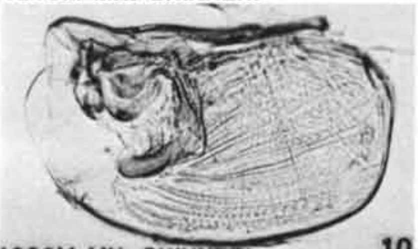

1759M MN. BERMUDAE 5

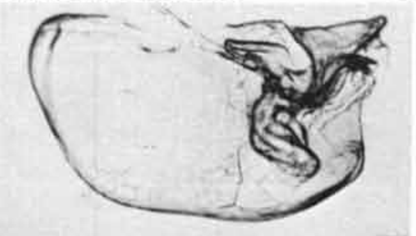

1759M MN. BERMUDAE 6

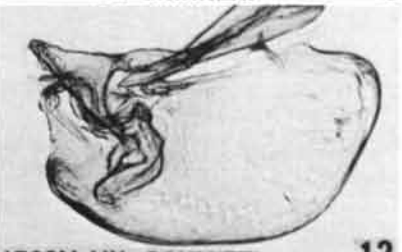

1910M MN. SKINNERI 7

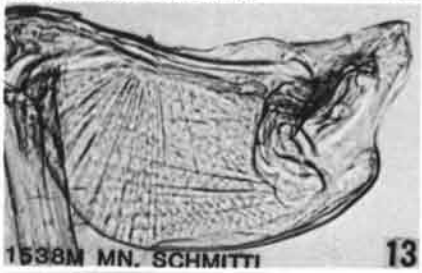

1910 MN. SKINNERI 8

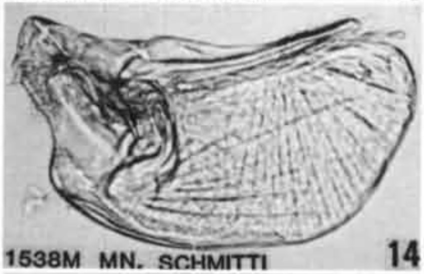

1909M MN. SKINNERI 9


1909M MN. SKINNERI 10


1763M MN. SCHMITTI 11

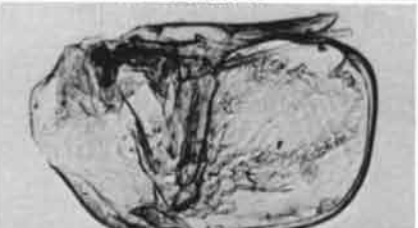

1763M MN. SCHMITTI 12


1538M MN. SCHMITTI 13


1538M MN. SCHMITTI 14


1852M MN. HAWKAE 15

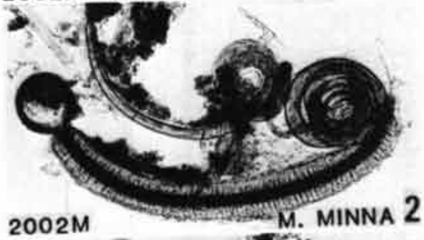

1852M MN. HAWKAE 16


1853M MN. HAWKAE 17


1853M MN. HAWKAE 18

PLATE 98

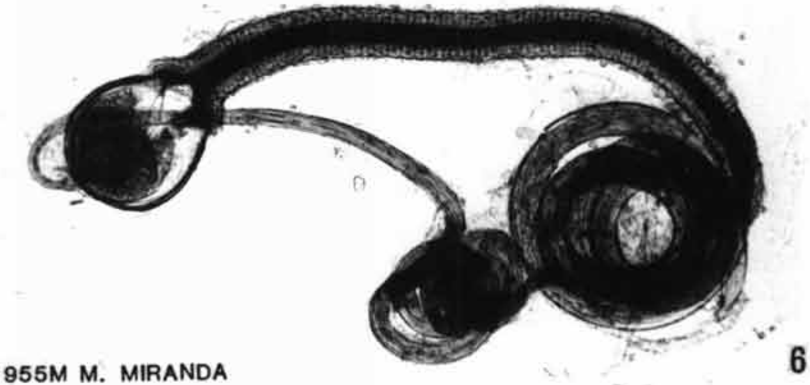

2002M M. MINNA 1

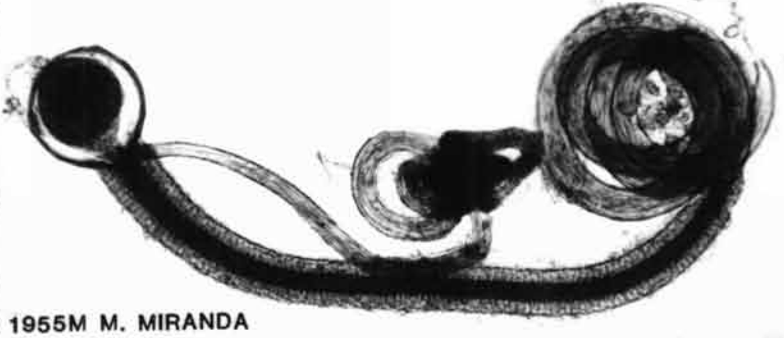

2002M M. MINNA 2


1441M M. MIRANDA 3


1419M M. MIRANDA 4

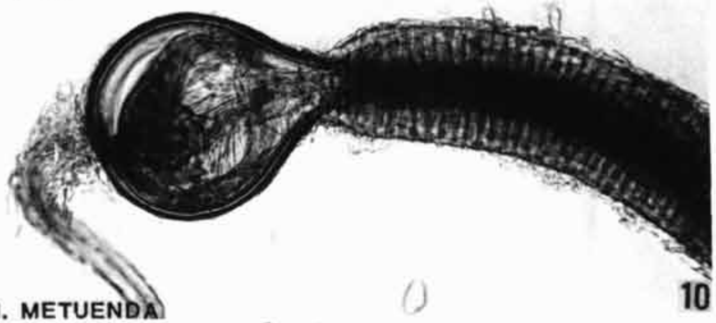

1419M M. MIRANDA 5


1955M M. MIRANDA 6


1955M M. MIRANDA 7


1780M M. METUENDA 8


1952M M. METUENDA 9


1952M M. METUENDA 10


1952M M. METUENDA 11

1404M M. METUENDA 1

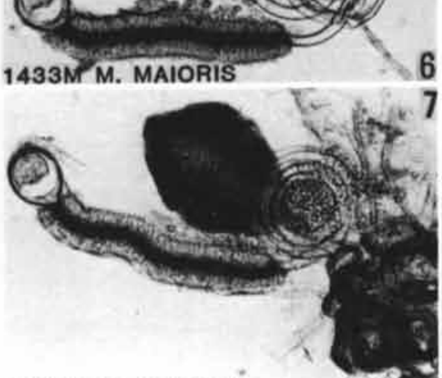
1404M M. METUENDA 2

1405M M. METUENDA 3

1405M M. METUENDA 4

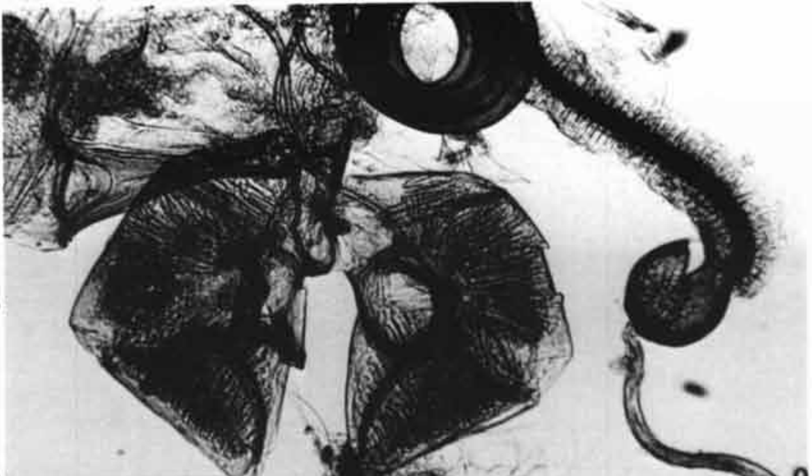
1431M
M. MAIORIS 5

1433M M. MAIORIS 6

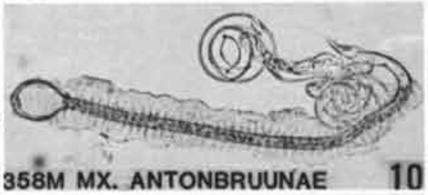


1433M M. MAIORIS 7

1434M M. MAIORIS 8



1434M M. MAIORIS 9

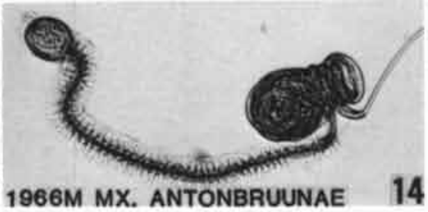


358M MX. ANTONBRUUNAE 10

332M MX.
ANTONBRUUNAE 11

183M MX. ANTONBRUUNAE 12

332M MX.
ANTONBRUUNAE 13



1966M MX. ANTONBRUUNAE 14

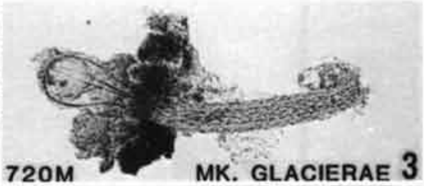
MX. ANTONBRUUNAE
1966M

15

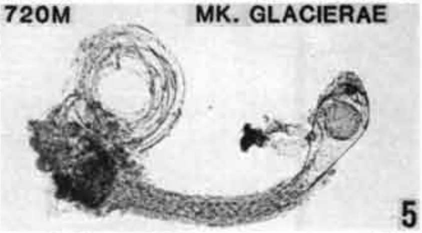
PLATE 100


720M MK. GLACIERAE 1


MK. GLACIERAE 722M 2


720M MK. GLACIERAE 3


880M MK. GLACIERAE 4

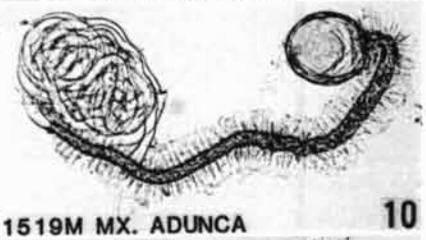

720M MK. GLACIERAE 5


880M MK. GLACIERAE 6


1410M MK. SILIQUOSA 7

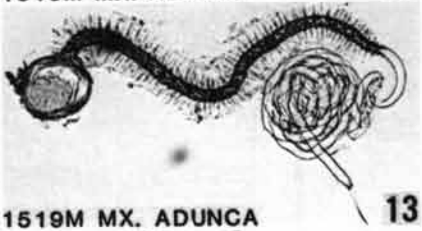

1500M MK. SILIQUOSA 8


1500M MK. SILIQUOSA 9


1519M MX. ADUNCA 10

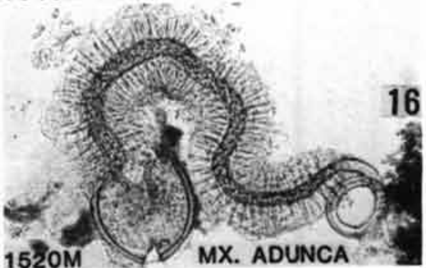

1414M MK. SILIQUOSA 11


1414M MK. SILIQUOSA 12


1519M MX. ADUNCA 13


1410M MK. SILIQUOSA 14


1520M MX. ADUNCA 15

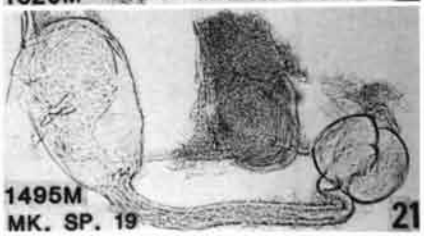

1520M MX. ADUNCA 16


1520M MX. ADUNCA 17

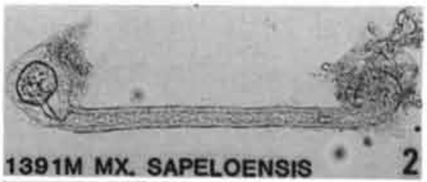

1520M MX. ADUNCA 18


1520M MX. ADUNCA 19


1495M MK. SP. 19 20


1495M MK. SP. 19 21


UMPM 48780 MX. SAPELOENSIS 1


1391M MX. SAPELOENSIS 2


1355M MX. SAPELOENSIS 3

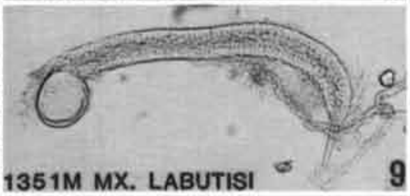

1355M MX. SAPELOENSIS 4

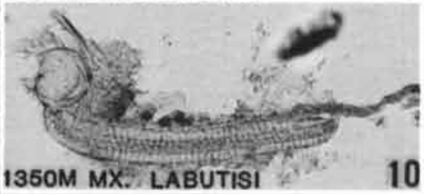

1367M MX. LABUTISI 5

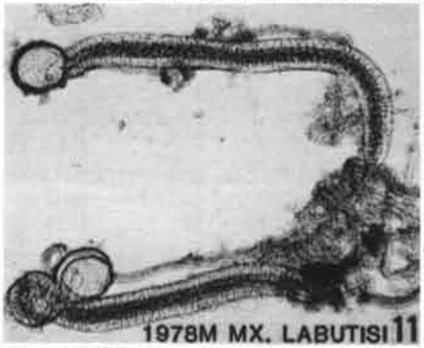

1367M MX. LABUTISI 6

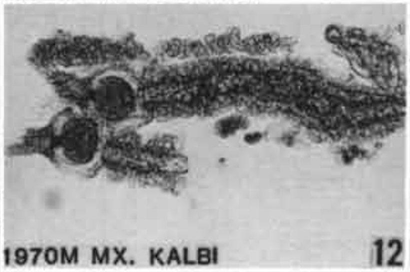

1351M MX. LABUTISI 7


1977M MX. LABUTISI 8

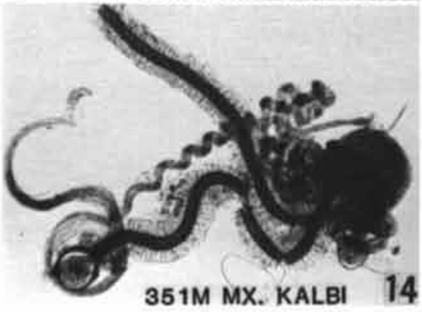

1351M MX. LABUTISI 9


1350M MX. LABUTISI 10


1978M MX. LABUTISI 11


1970M MX. KALBI 12


335M MX. KALBI 13


351M MX. KALBI 14

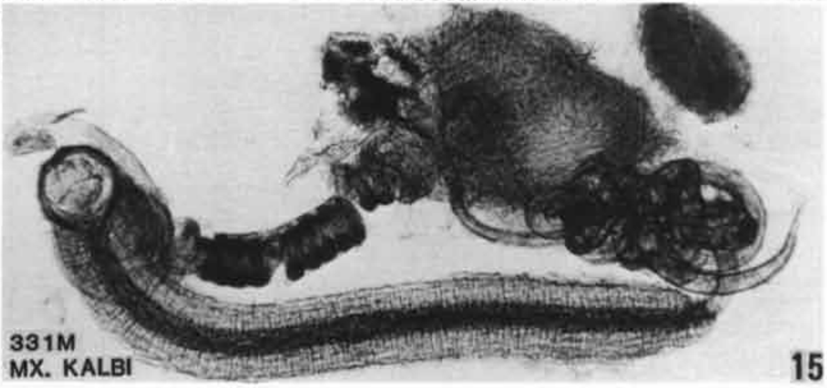
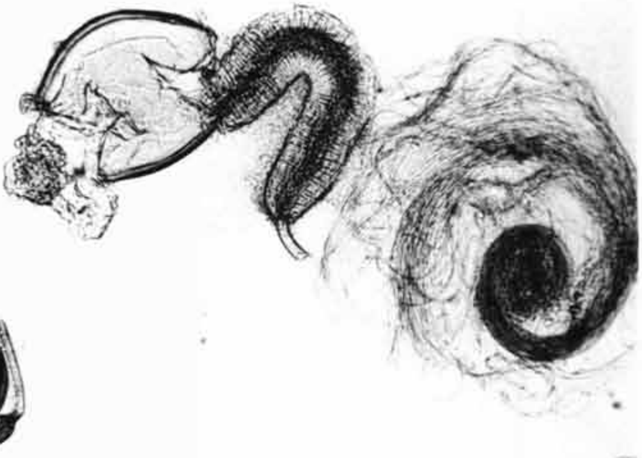
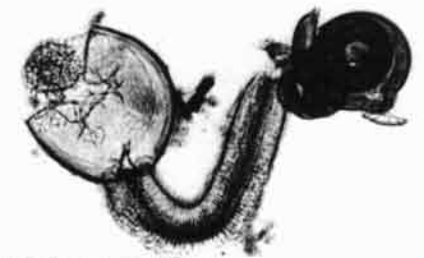

331M
MX. KALBI 15

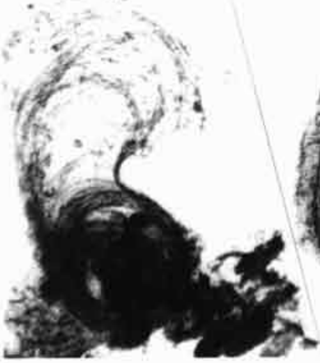
PLATE 102


1406M MX. AMANDA

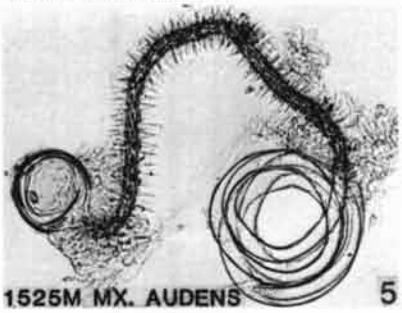

1

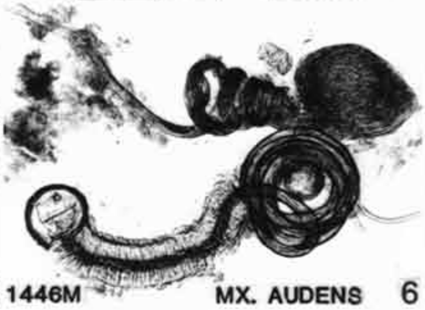

1406M MX. AMANDA 2

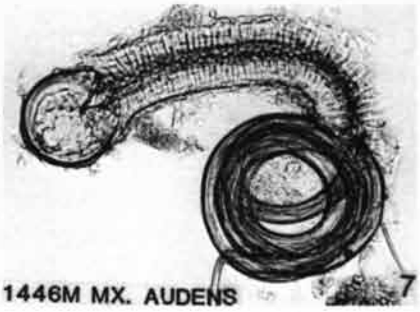

1407M MX. AMAÑDA


3


1407M MX. AMANDA 4


1525M MX. AUDENS 5


1446M MX. AUDENS 6


1446M MX. AUDENS 7


1525M MX. AUDENS 8


1525M MX. AUDENS 9


1448M MX. ADRECTA 10


2386M MX. BATHYALENSIS 11


2387M MX. BATHYALENSIS 12

1448M MX. ADRECTA

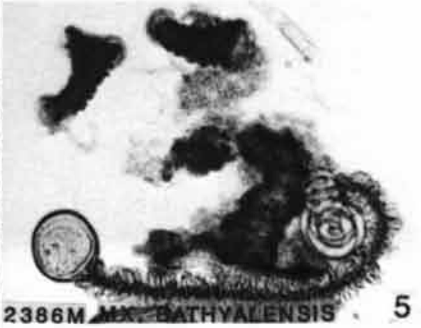

13


2384M MX. KORNICKERI 1


2384M MX. KORNICKERI 2


2384M MX. KORNICKERI 3


2386M MX. BATHYALENSIS 4

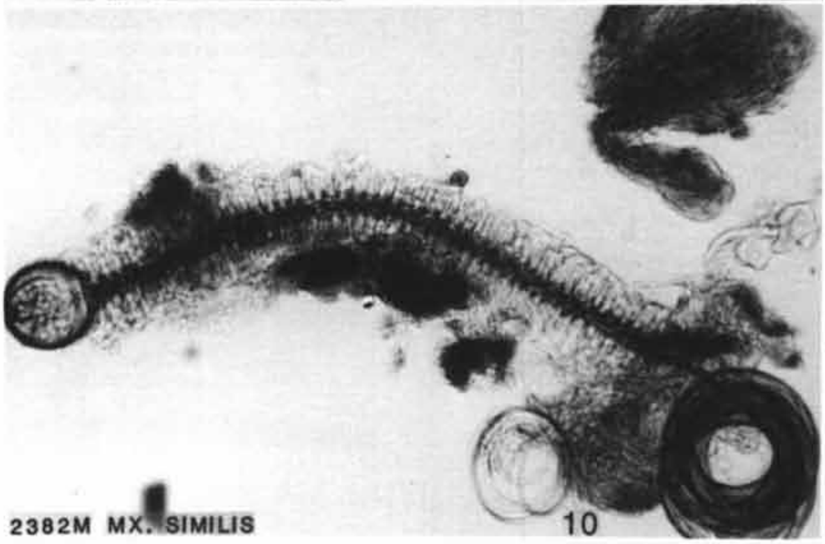

2386M MX. BATHYALENSIS 5


2387M MX. BATHYALENSIS 6


2387M MX. BATHYALENSIS 7


2389M MX. BATHYALENSIS 8


2389M MX. BATHYALENSIS 9


2382M MX. SIMILIS 10


2382M MX. SIMILIS 11

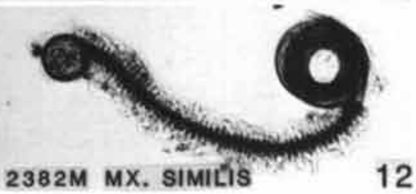
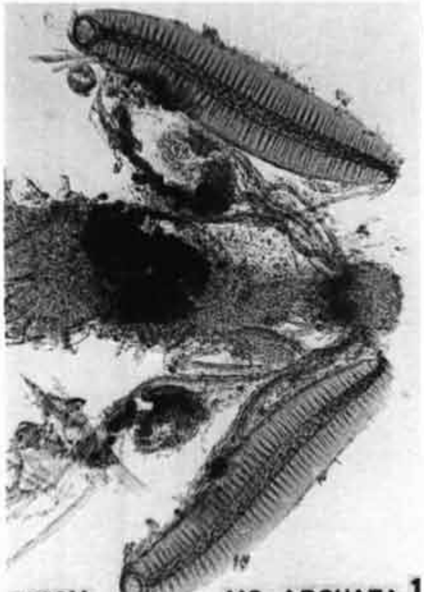
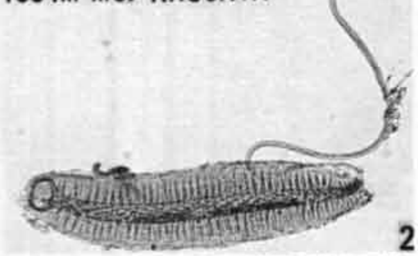
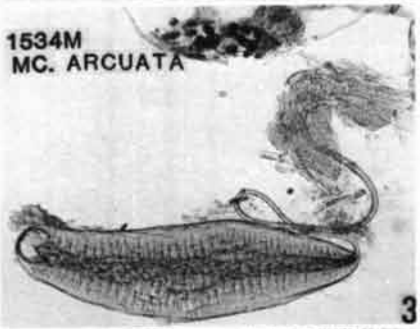
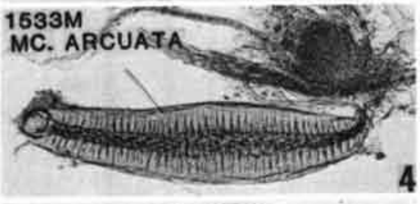

2382M MX. SIMILIS 12

PLATE 104

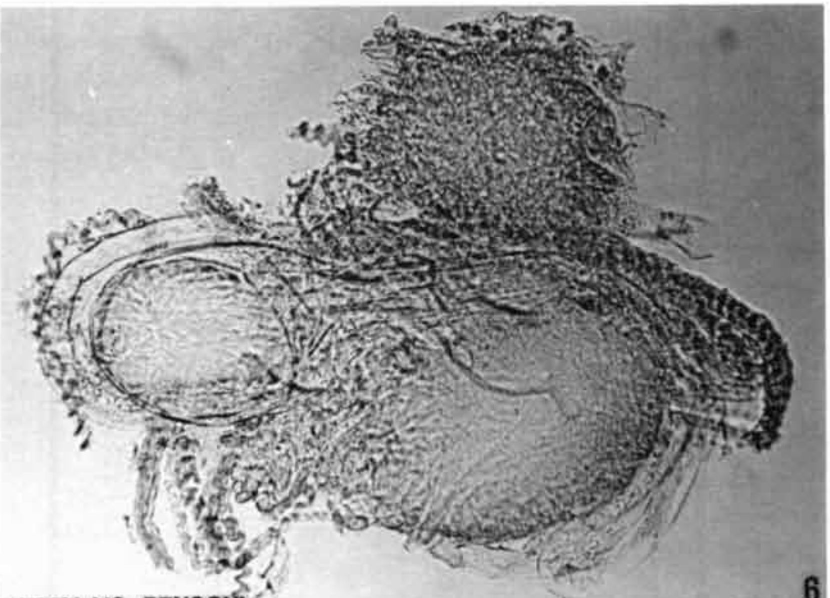

1532M MC. ARCUATA 1

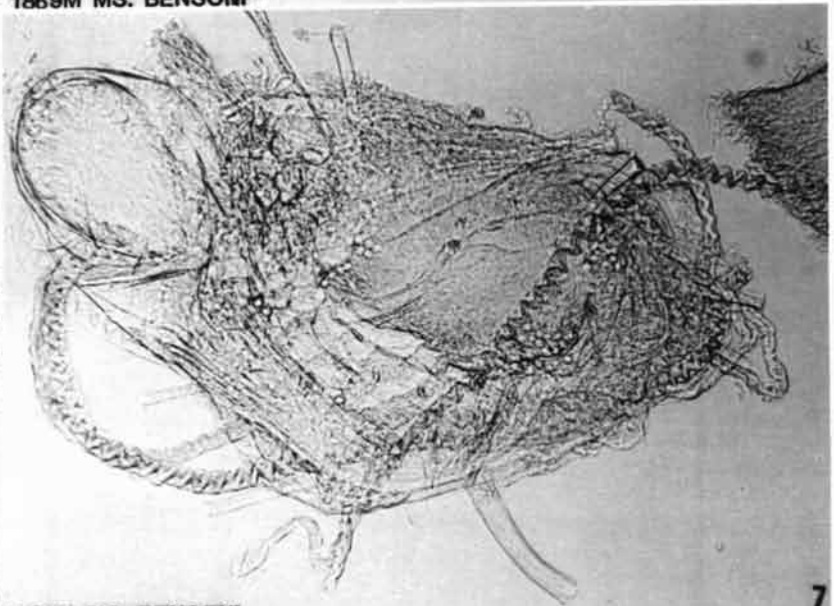

1534M MC. ARCUATA 2

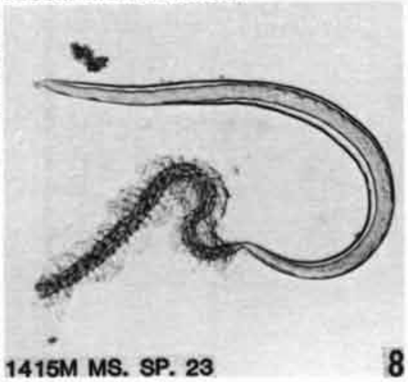

1534M MC. ARCUATA 3

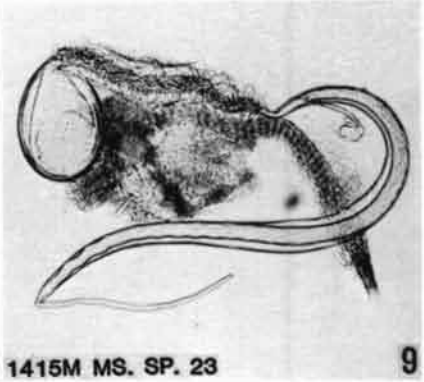

1533M MC. ARCUATA 4


1533M MC. ARCUATA 5


1869M MS. BENSONI 6


1869M MS. BENSONI 7

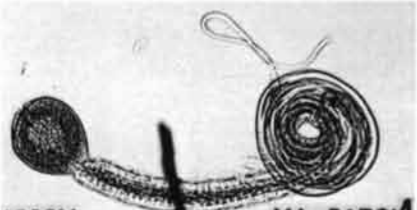

1415M MS. SP. 23 8

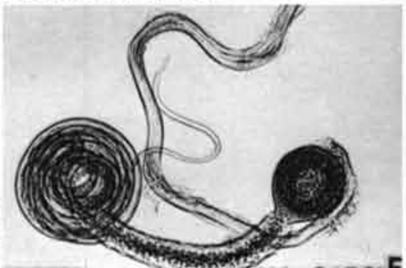

1415M MS. SP. 23 9

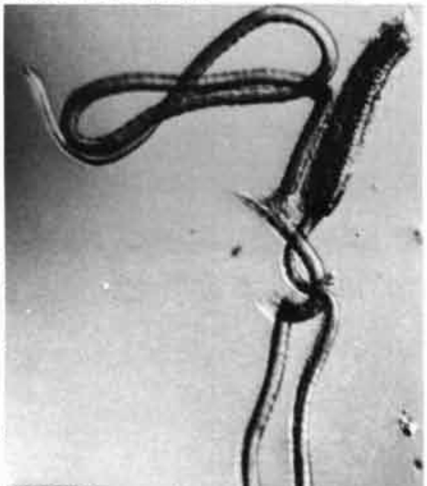

2356M MS. HIULCA 1


2356M MS. HIULCA 2


198M MH. SP. 25 3


1998M MA. SARSI 4

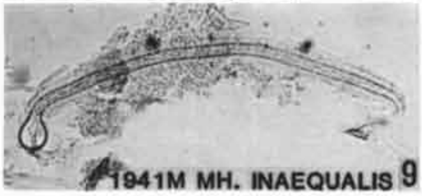

1998M MA. SARSI 5

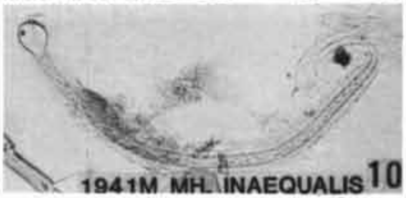

K27321 MH. MARCHILENSIS 8

843M MA. SEMESA

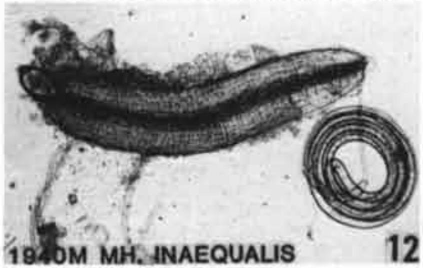

6


K27321 MH. MARCHILENSIS 7


1941M MH. INAEQUALIS 9


1941M MH. INAEQUALIS 10

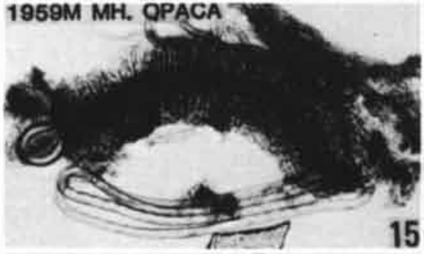

1940M MH. INAEQUALIS 11


1940M MH. INAEQUALIS 12


1940M MH. INAEQUALIS 13


1479M MH. OPACA 14

1959M MH. OPACA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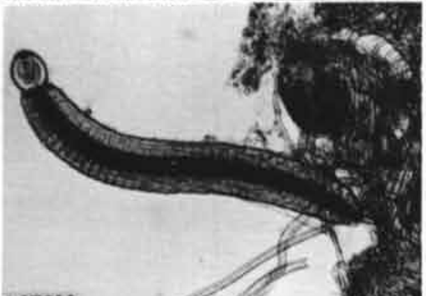
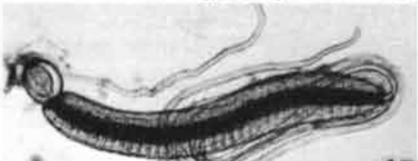
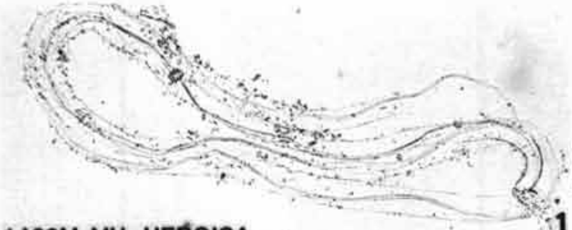
1959M MH. OPACA 16


1478M MH. OPACA 19


1479M MH. OPACA 17


1478M MH. OPACA 18

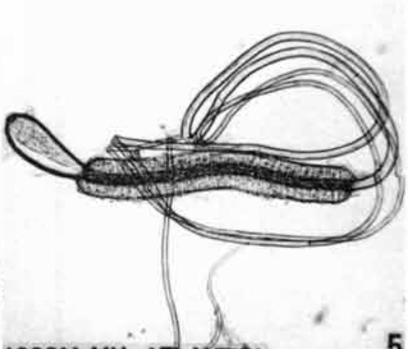
PLATE 106


1462M MH. HEROICA 1

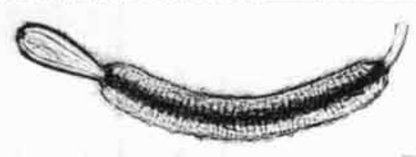

1462M MH. HEROICA 2

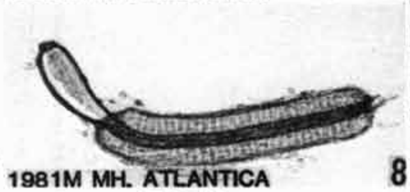

1981M MH. ATLANTICA 3


1980M MH. ATLANTICA 4


1980M MH. ATLANTICA 5

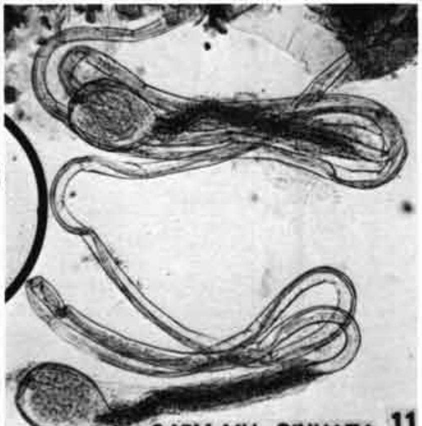

1982M MH. ATLANTICA 6

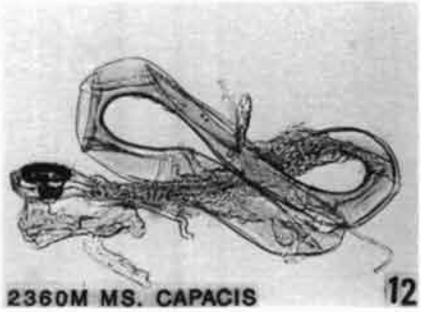

1982M MH. ATLANTICA 7

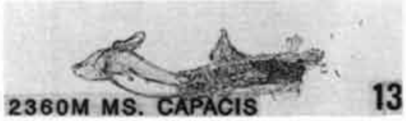

1981M MH. ATLANTICA 8

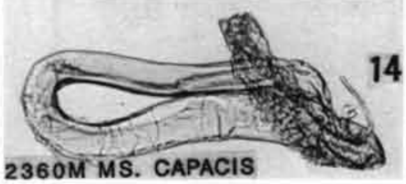

846M MH. SINUATA 9

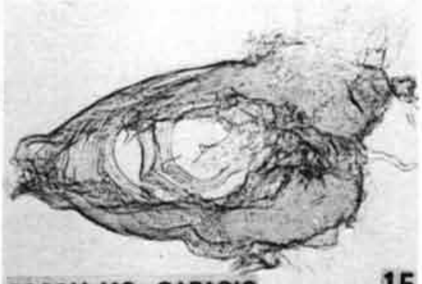

846M MH. SINUATA 10


845M MH. SINUATA 11

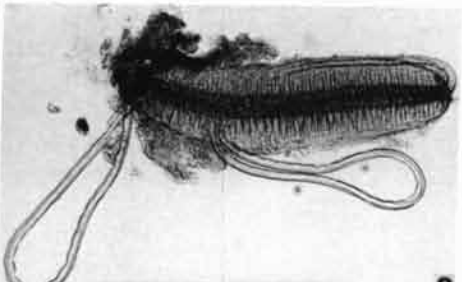

2360M MS. CAPACIS 12

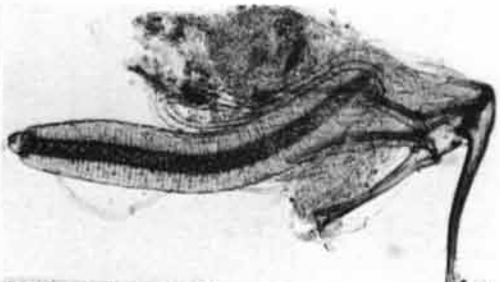

2360M MS. CAPACIS 13

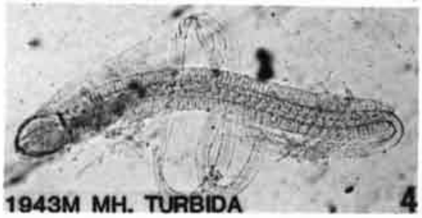

2360M MS. CAPACIS 14


2360M MS. CAPACIS 15

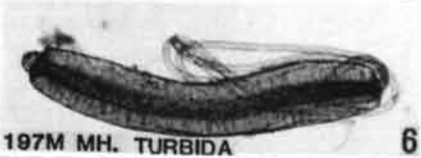

1944M MH. TURBIDA 1

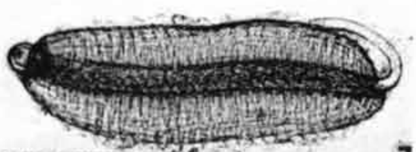

1487M MH. TURBIDA 2

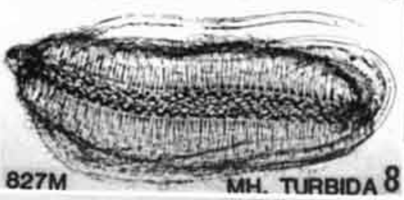

197M MH. TURBIDA 3

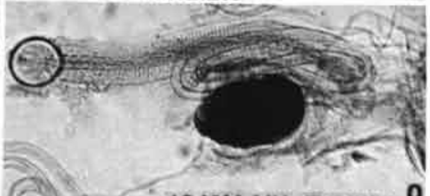

1943M MH. TURBIDA 4

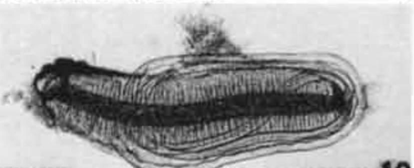

1948M MH. TURBIDA 5


197M MH. TURBIDA 6

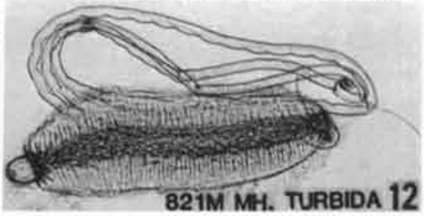

827M MH. TURBIDA 7


827M MH. TURBIDA 8


1948M MH. TURBIDA 9

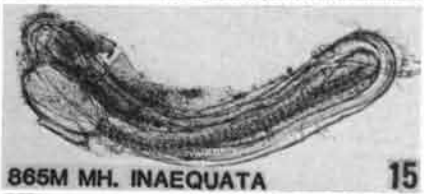

1487M MH. TURBIDA 10


375M MH. TURBIDA 11


821M MH. TURBIDA 12

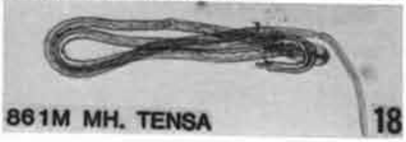

MH. TURBIDA 1475M 13


821M MH. TURBIDA 14


865M MH. INAEQUATA 15


865M MH. INAEQUATA 16


861M MH. TENSA 17


861M MH. TENSA 18

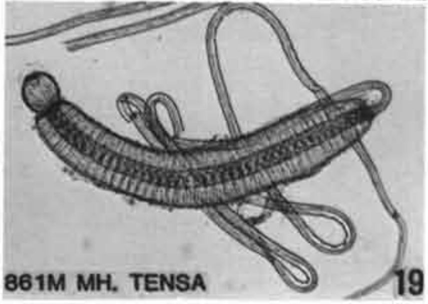
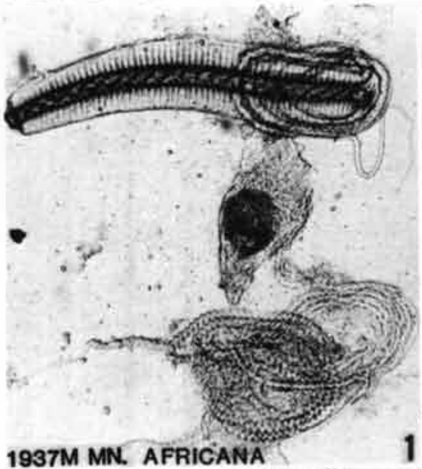
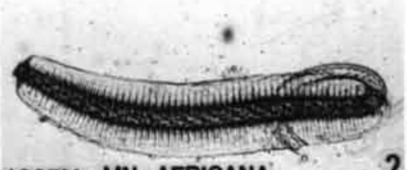
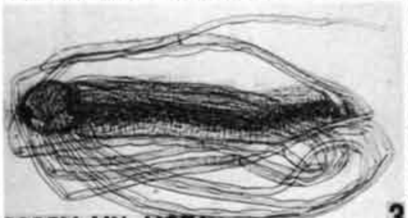
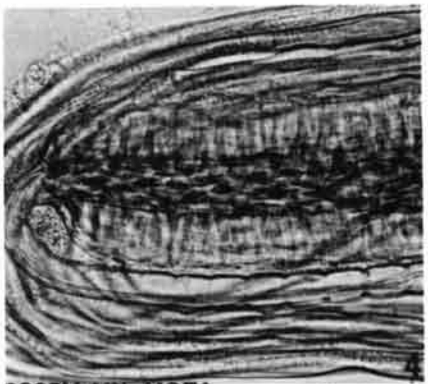

861M MH. TENSA 19

PLATE 108


1937M MN. AFRICANA 1

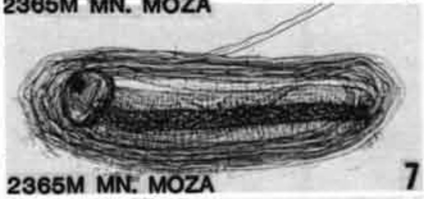

1937M MN. AFRICANA 2

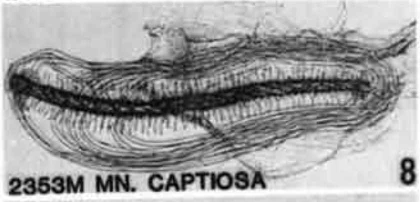

2365M MN. MOZA 3

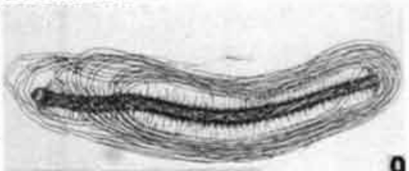

2365M MN. MOZA 4

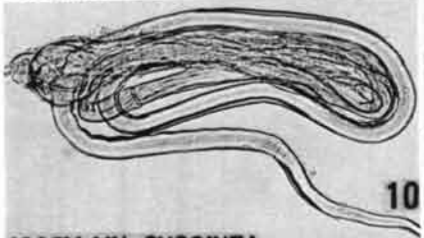

2351M MN. CAPTIOSA 5

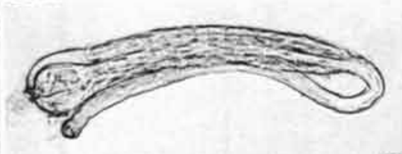

2351M MN. CAPTIOSA 6

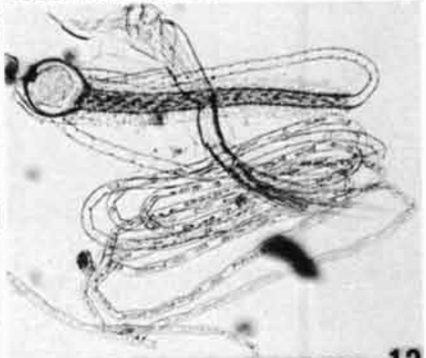

2365M MN. MOZA 7

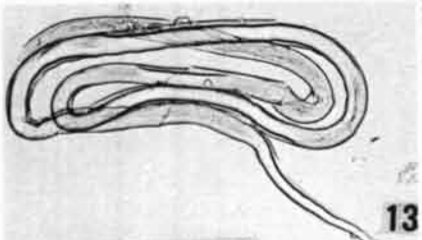

2353M MN. CAPTIOSA 8

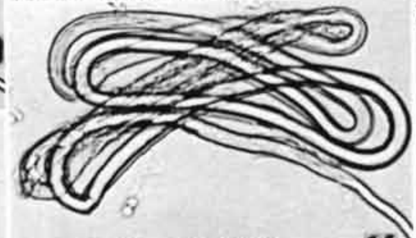

2353M MN. CAPTIOSA 9


1905M MN. SUCCINEA 10

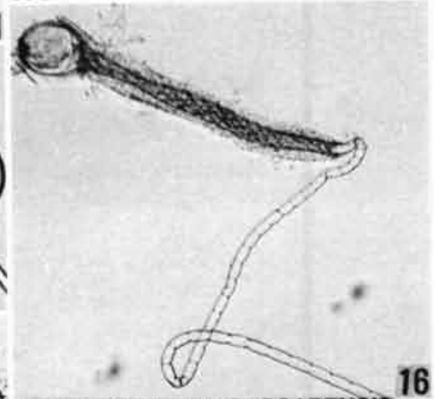

1905M MN. SUCCINEA 11


1757 MN. MADAGASCARENSIS 12


1905M MN. SUCCINEA 13


1904M MN. SUCCINEA 14


1904M MN. SUCCINEA 15


1757M MN. MADAGASCARENSIS 16

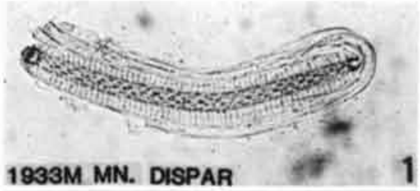

2364M MN. MADAGASCARENSIS 17


2364M MN. MADAGASCARENSIS 18

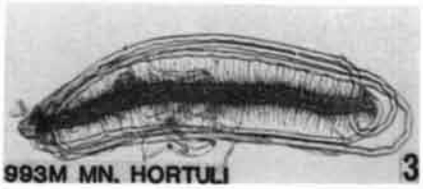

668M MN. MADAGASCARENSIS 19

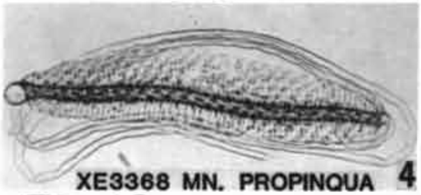

1757M MN. MADAGASCARENSIS 20

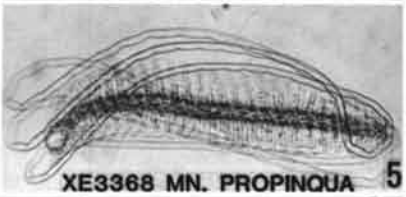
PLATE 109

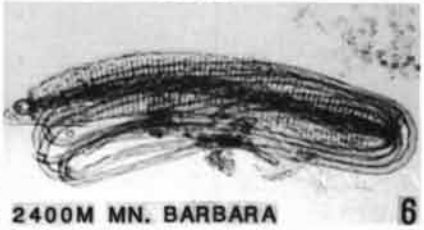

1933M MN. DISPAR 1


1933M MN. DISPAR 2

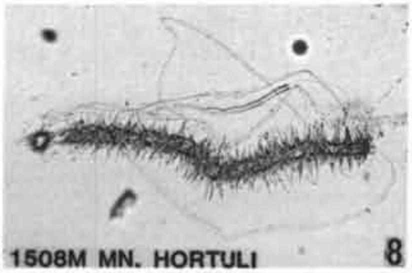

993M MN. HORTULI 3

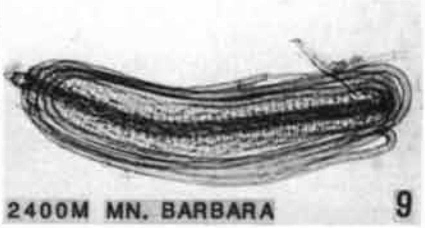

XE3368 MN. PROPINQUA 4


XE3368 MN. PROPINQUA 5


2400M MN. BARBARA 6

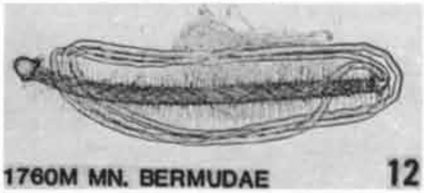

1508M MN. HORTULI 7

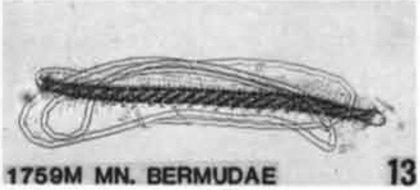

1508M MN. HORTULI 8


2400M MN. BARBARA 9

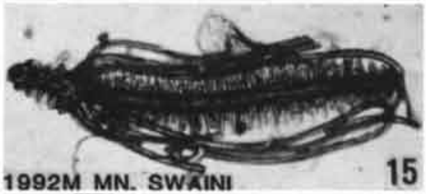

1910M MN. SKINNERI 10


1909M MN. SKINNERI 11


1760M MN. BERMUDAE 12

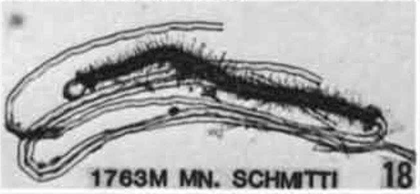

1759M MN. BERMUDAE 13


1759M MN. BERMUDAE 14


1992M MN. SWAINI 15


1852M MN. HAWKAE 16


1852M MN. HAWKAE 17


1763M MN. SCHMITTI 18


1538M MN. SCHMITTI 19


2130M MN. HARTMANNI 20


2130M MN. HARTMANNI 21

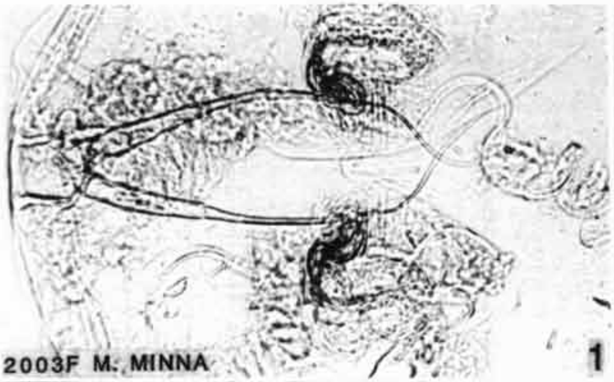

22

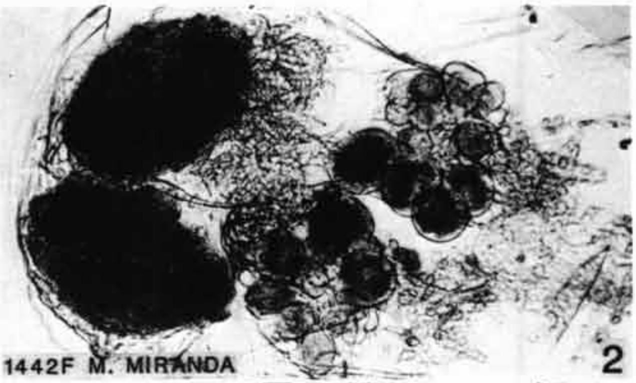

23

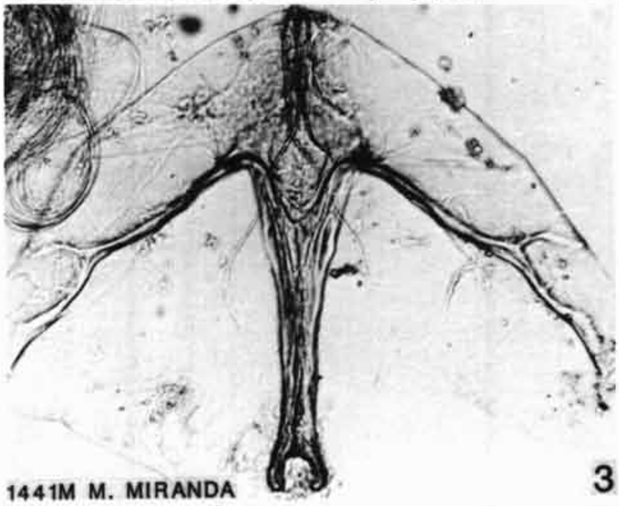
2130M MN. HARTMANNI

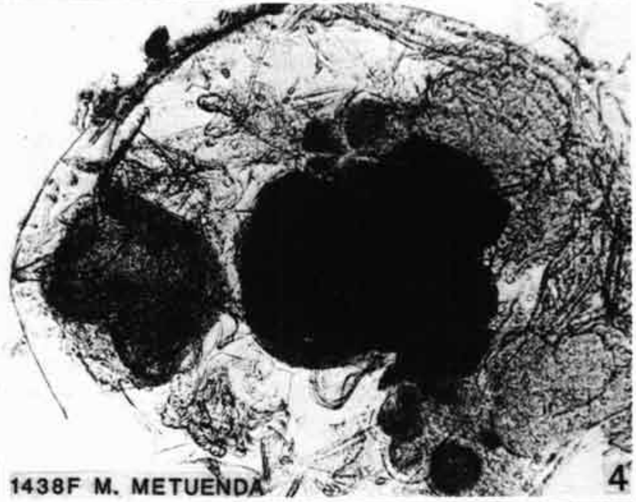

2130M MN. HARTMANNI 24

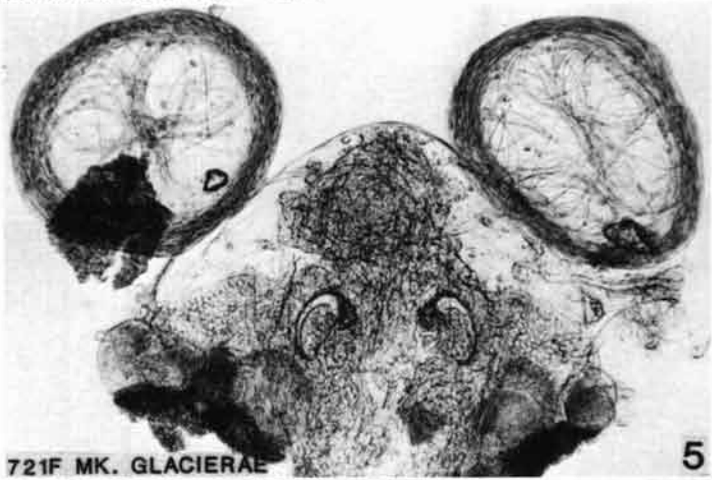
PLATE 110

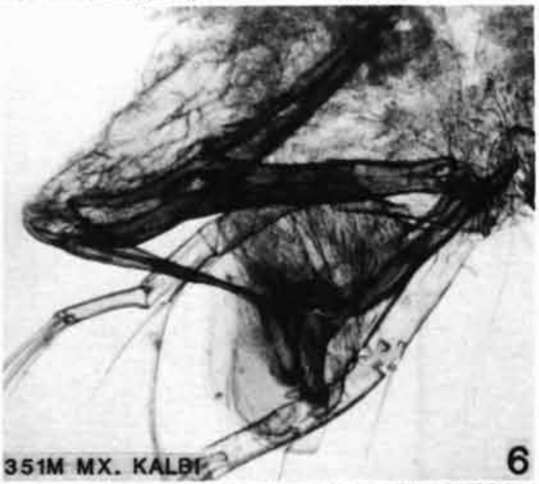

2003F M. MINNA 1


1442F M. MIRANDA 2

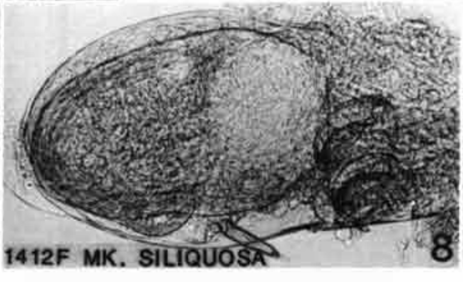

1441M M. MIRANDA 3


1438F M. METUENDA 4

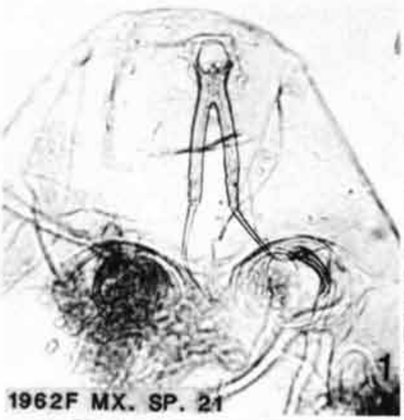

721F MK. GLACIERAE 5

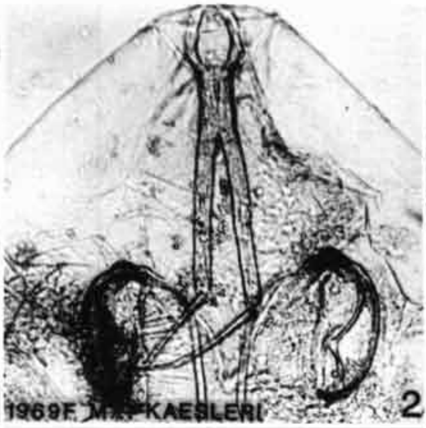

351M MX. KALBI 6

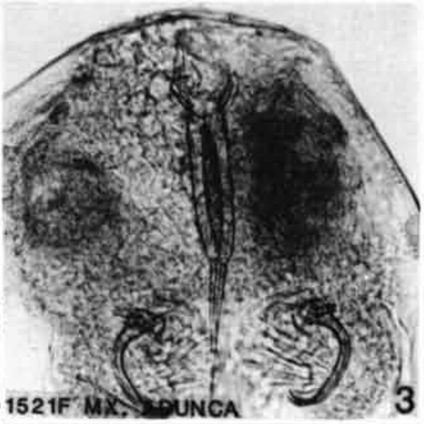

719F MK. GLACIERAE 7

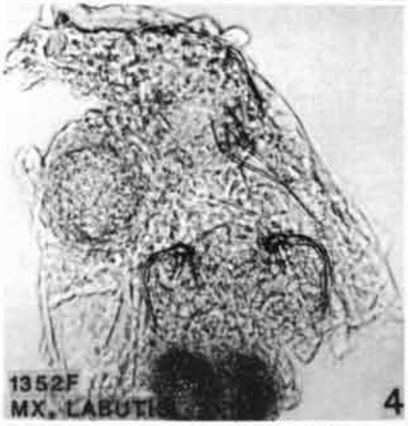

1412F MK. SILIQUOSA 8

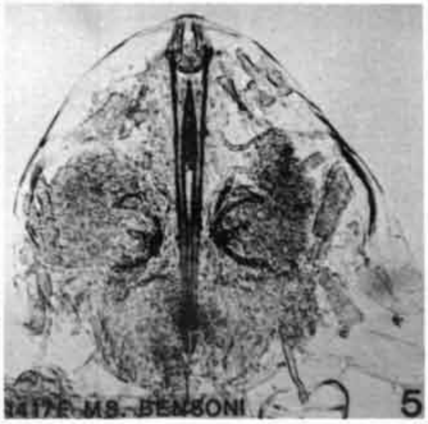

1412F MK. SILIQUOSA 9

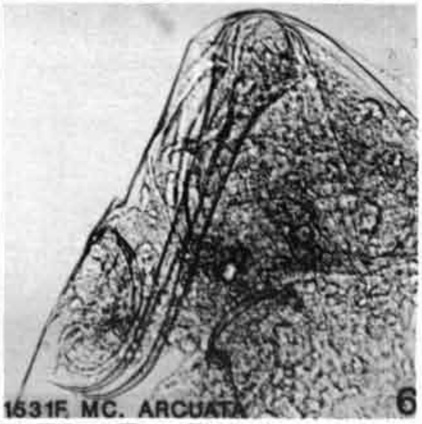

1962F MX. SP. 21 1


1969F MX. KAESLERI 2

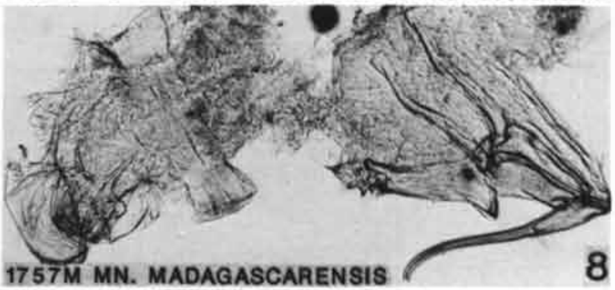

1521F MX. ADUNCA 3

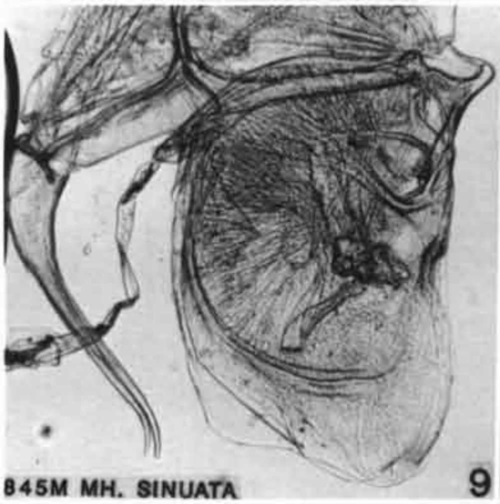

1352F
MX. LABUTIS 4


1417F MS. BENSONI 5


1531F MC. ARCUATA 6


852F MH. SINUATA 7


1757M MN. MADAGASCARENSIS 8


845M MH. SINUATA 9


1939F MH.
INAEQUALIS 10


UM48780 MX.
SAPELOENSIS 11

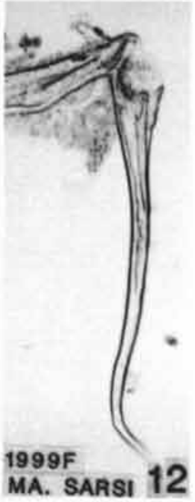
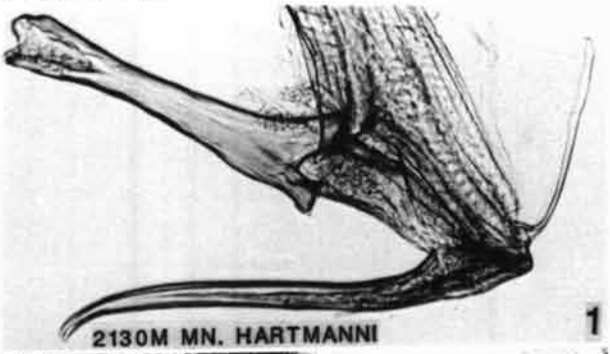
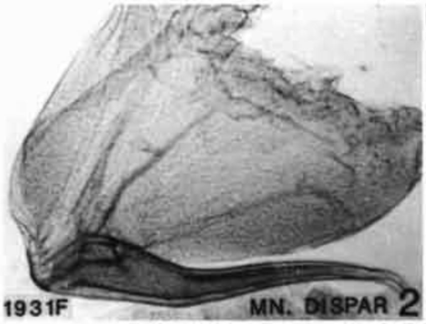
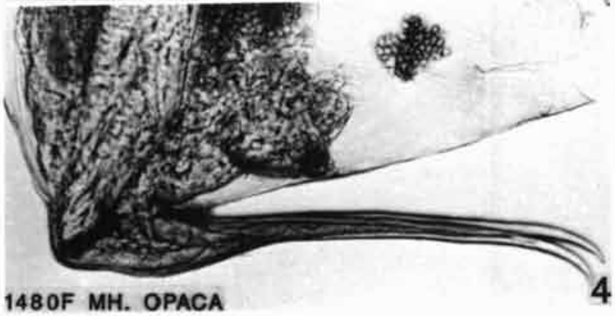

1999F
MA. SARSI 12

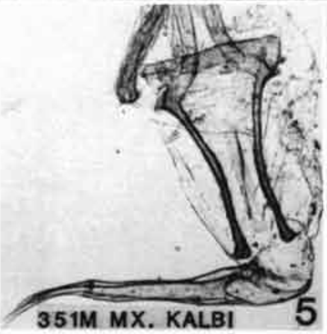
PLATE 112

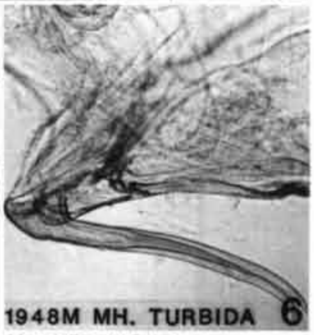

2130M MN. HARTMANNI 1


1931F MN. DISPAR 2

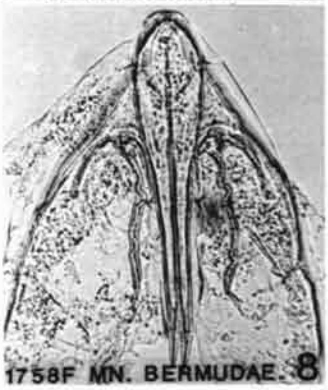

1937M MN. AFRICANA 3


1480F MH. OPACA 4

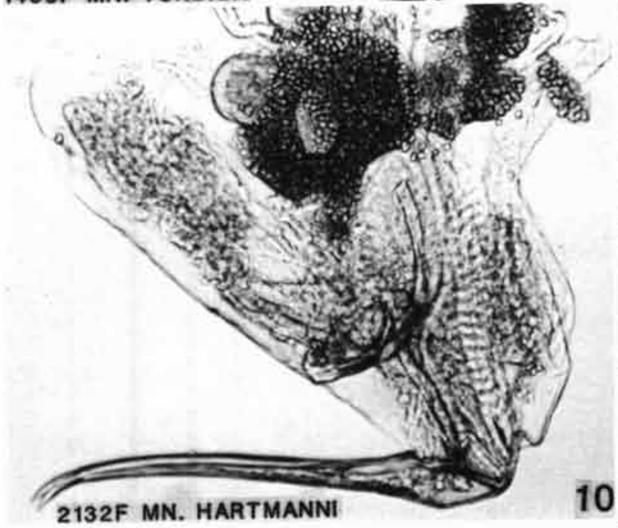

351M MX. KALBI 5


1948M MH. TURBIDA 6

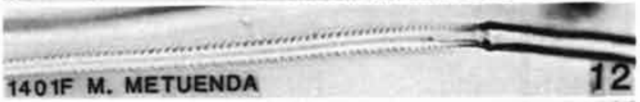

1488F MH. TURBIDA 7


1758F MN. BERMUDAE. 8

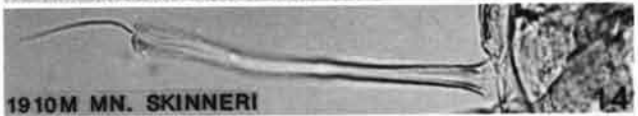

1762M MN. HORTULI 9


2132F MN. HARTMANNI 10


1433M M. MAIORIS 11


1401F M. METUENDA 12


1757M MN. MADAGASCARENSIS 13


1910M MN. SKINNERI 14


XE3367 MN. PROPINQUA 15

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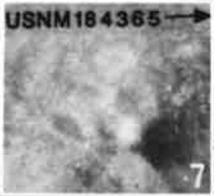

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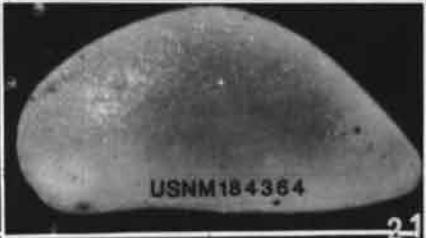

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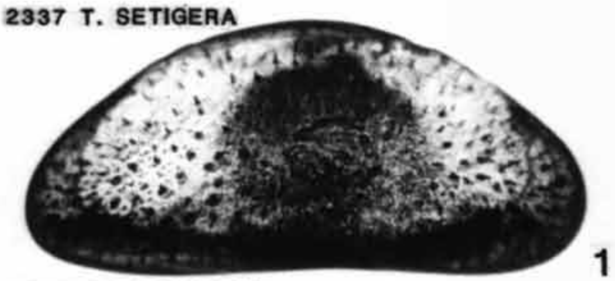

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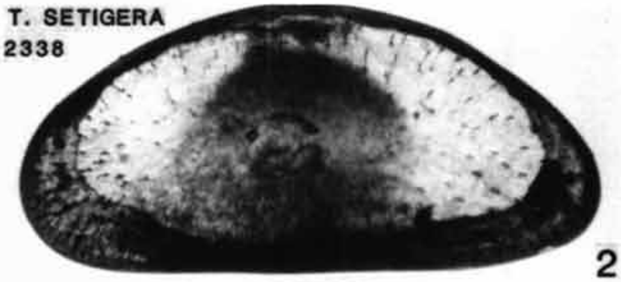

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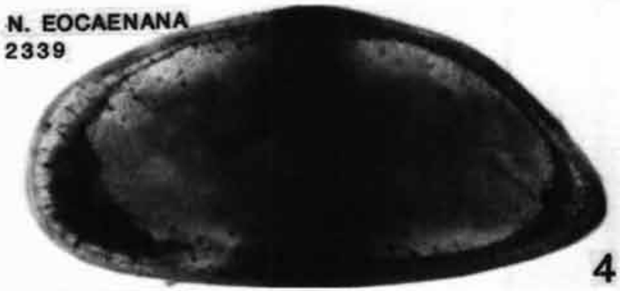

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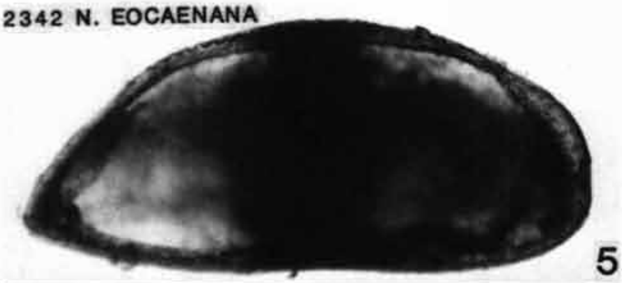

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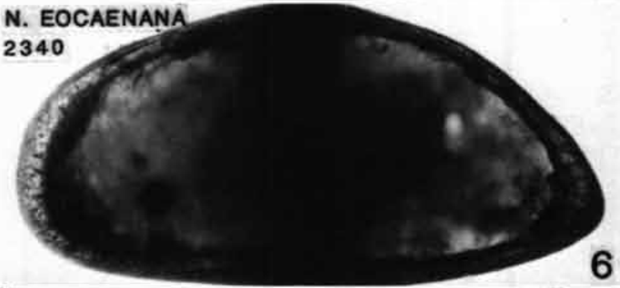

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