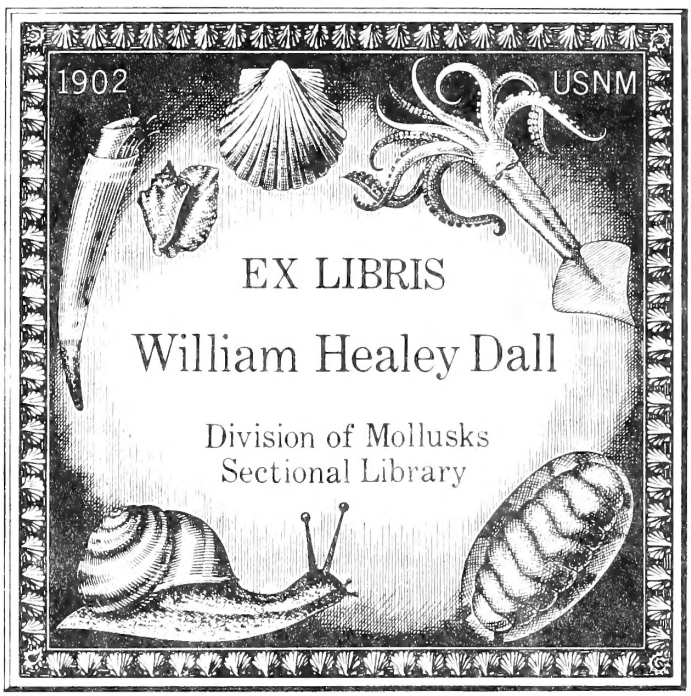
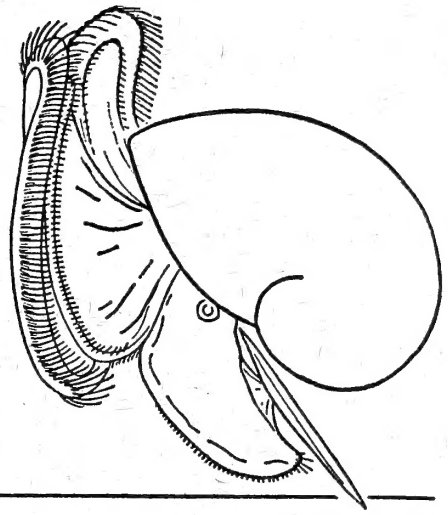

1902
USNM
EX LIBRIS
William Healey Dall
Division of Mollusks
Sectional Library

THE

VELIGER

A Quarterly published by
CALIFORNIA MALACOZOOLOGICAL SOCIETY, INC.
Berkeley, California



VOLUME 14 JULY 15, 1971 SUPPLEMENT

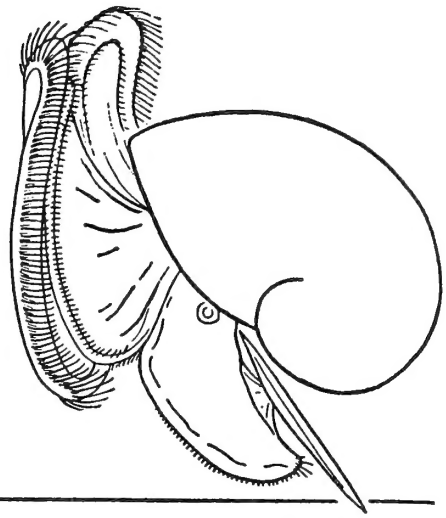
The Northwest American Tellinidae

BY

EUGENE V. COAN

THE
VELIGER

A Quarterly published by
CALIFORNIA MALACOZOOLOGICAL SOCIETY, INC.
Berkeley, California



VOLUME 14 JULY 15, 1971 SUPPLEMENT

The Northwest American Tellinidae

BY

EUGENE V. COAN

Note: The various taxa above species are indicated by the use of different type styles as shown by the following examples, and by increasing indentation.

ORDER, Suborder, **DIVISION, Subdivision,** SECTION,
SUPERFAMILY, FAMILY, Subfamily, *Genus, (Subgenus)*
New Taxa

The Northwest American Tellinidae

BY

EUGENE V. COAN

Research Associate
California Academy of Sciences, Golden Gate Park, San Francisco, California 94118

(12 Plates; 30 Text figures)

INTRODUCTION

A MUCH NEEDED TAXONOMIC REVIEW of the Tellinacea occurring from the Arctic coast of Alaska to the central portion of the outer coast of Baja California has been conducted. Preliminary nomenclatural conclusions with regard to the entire Tellinacea were presented to the June 1967 meeting of the American Malacological Union, Pacific division (COAN, 1968a). Only the data on the Tellinidae are published here.

The Tellinidae, one of the largest families of Bivalvia, and of considerable ecologic and potential economic importance, have not been critically revised on the northwest Pacific coast in recent years. A review can bring the nomenclature and certain aspects of the taxonomy of organisms to such a level as to be of immediate benefit to workers in a variety of disciplines (such as ecology, physiology, and paleontology), provide a firm basis for further and more advanced kinds of taxonomic research, and lead to the discovery and initial outlining of problems of current interest in biogeography, paleontology, and comparative morphology.

The historical perspectives of this project within the context of West American marine malacology will first be discussed, especially emphasizing progress toward nomenclatural stability; then some of the basic issues of systematic and population biology that are taken into consideration will be outlined.

Historical Considerations. – The history of malacology on this coast can be divided into a series of overlapping periods. Aside from those species named in the North Atlantic that also occur in the North Pacific, West American nomenclature is relatively free from problems posed by the pre-Linnean entanglements of 1758 - 1830 – the "Linnean Era," as we may term it. The few species-level names applicable to our fauna from this period have been investigated in the present study as carefully as was practical. The definitive search for type specimens and the selection of lectotypes for these species is more properly the task of European workers with access to European collections; it is unfortunate that this has generally not yet been properly done (for instance, see *Macoma balthica*).

The early history of malacology on the West American coast is mainly one of sporadic naming of new taxa collected by expeditions between 1830 and about 1845. One might call this the "Era of Exploration." As far as the Tellinacea are concerned, the most important of these expeditions were (1) the voyage of the *Blossom* to the Bering Sea and the Arctic Ocean, with species described by Broderip, Sowerby, and Gray in 1829 and 1839, (2) the travels of Thomas Nuttall in California and Oregon, with material described by Conrad in 1837, (3) the voyage of the *Sulphur* to Mexico and California, with mollusks described by Hinds from 1842 to 1845, and (4) the travels of Hugh Cuming in Central and South America in the 1820's and 1830's, his collected material described by Broderip, Sowerby, Carpenter, and many others from 1832 on.

The type specimens from the *Blossom*, originally in the Zoological Society of London, are mostly lost to science. A careful search was made in an attempt to locate the tellinaceans from this expedition in the British Museum (Natural History) (see *Macoma brota*), but none could be found (KEEN, verbal communication).

The types of species described by Conrad are mainly in the British Museum (Natural History) and have been discussed by KEEN (1966a). She did not select lectotypes, however, properly leaving this task to specialists in various groups.

Many of the specimens collected and described by Hinds are housed in the British Museum (Natural History) (KEEN, 1966b). Finally, the Cuming collection also

went to the British Museum, and Cuming's travels and the history of his material have been discussed by DANCE (1966). Dr. Keen was able to locate many of these type specimens and photograph them.

The species collected on these early expeditions were, in general, well described and illustrated, and few problems have been encountered in allocating the species-level names, although many of the original specimens have been lost. The losses occurred because there were no large national collections at the time nor was the importance of the preservation of original materials recognized.

The period from about 1845 to 1880 may, in part, be considered the "Era of Monographs." Works from this period dealt with species of large taxonomic units from the entire world. Chief among these of importance in the study of the Tellinidae are KÜSTER & RÖMER (1841-1873), HANLEY (1844-1845, 1846), DESHAYES (1855), SOWERBY (1866b-1869), TRYON (1869), and BERTIN (1878). One might think that these workers, aided by the large collections at their disposal and a world-wide point of view, would have been able to make significant contributions. This was generally not the case, and many difficult problems arise as a result of their publications. Several were shell dealers and were possibly interested in proliferating the number of named species in order to increase the value of their merchandise. They often described new taxa with incorrect or unknown localities, without comparisons, with brief, cryptic, virtually useless Latin descriptions, and without illustrations. Sometimes type material was sold and never ended up in present-day collections, at least in recognizable form. Dr. Keen's extensive studies at the British Museum (Natural History) bettered West American malacology in that she located the type specimens of many Deshayes and Sowerby species.

In two cases (*Tellina nuculoides* and *Leporimetes obesa*), older names were encountered for relatively well known species. These names were both from monographs, one described from an incorrect locality, the other originally allocated to an incorrect genus and subsequently ignored. It seems to be the consensus of West Coast malacologists that such names, even if they are technically *nomina oblita,* should be recognized and used. The ecological and physiological literature on West American species is not now large, and the nomenclatural work possible at present will probably prevent forgotten names from cropping up frequently in the future.

The period from about 1850 to 1921 in the eastern Pacific might be termed the "Era of Faunal Accounts." Such accounts were books and papers on the mollusks, treating either the entire fauna or that of one limited area. This category includes the account of C. B. ADAMS (1852a, 1852b) on Panama, the books and papers by CARPENTER, especially his catalogue of Mazatlán shells (1857c) and his more general books on West America (1857b, 1864a, 1872), and the many important works of DALL (especially 1891, 1900a, 1909, 1916a, 1921a). The quality of work done by these authors was superior to that of the monographers or, for that matter, to contemporary work in most areas of the world.

Although Adams, Carpenter, and Dall were not West Coast residents, they did much to summarize previous literature and describe new species in a useful and careful manner. The type specimens of nearly all of these species are extant and well labeled. Those of Adams are mainly in the Museum of Comparative Zoology at Harvard University and have been reviewed by TURNER (1956). Those of Carpenter are partly in the British Museum (Natural History) and partly in museums in North America, mainly in the United States National Museum and the Redpath Museum (PALMER, 1945, 1951, 1958, 1963; BRANN, 1966; KEEN, 1968; COAN, 1969c).

One might term the period from 1900 to 1965 the "Era of the Paleontologist and the Amateur." The thorough and comprehensive work of Carpenter and Dall in reviewing previous literature and describing new species, aided by large collections, placed West American molluscan systematics farther ahead and on firmer nomenclatural ground than that of most other areas of the world. The kind of systematic work needed, studies of geographic distribution, correlated with paleontology, had to wait until principles of biology and geology caught up with molluscan systematics. The chief professional contributions to malacology were those made by paleontologists working on Recent and fossil material, such as ARNOLD (1903), GRANT & GALE (1931), KEEN (1937, 1958b), WEAVER (1943), KEEN & BENTSON (1944), HERTLEIN & STRONG (1949-1950, 1955), and OLSSON (1961).

In this period, among the most active workers on Recent molluscan systematics was a group of amateurs in southern California, whose contributions were rather good in terms of their concepts of what constituted a species and of population and geographic variation (BURCH & BURCH, 1943; BURCH, 1945a-1945c).

Some features of the development of marine molluscan systematics are illustrated by means of the following Table of the dates of proposal of new names definitely applicable to the entire northwest American Tellinacea (new names and Pleistocene synonyms are included but not misspellings, *nomina nuda*, species described "in synonymy," nor synonyms possibly or definitely from other areas of the world, or from the Pliocene or earlier:

Dates (in 25-year periods)	Valid Taxa	Invalid Taxa
1758 - 1782	1	–
1783 - 1807	1	–
1808 - 1832	3	2
1833 - 1857	18	13
1858 - 1882	8	6
1883 - 1907	7	10
1908 - 1932	6	6
1933 - 1957	–	1
1958 - 1969 (12 years)	1	–
Totals:	45	38

It can be seen that the number of synonyms is nearly equal to the number of valid taxa (is equal to it, if one counts probable synonyms from the Pliocene or earlier). A new tellinacean species has not been discovered since 1921, the species recently described (DUNNILL & COAN, 1968) being a reinterpretation of previously known material.

Thus, what is required of West American marine molluscan systematics now is chiefly the task of analyzing previously described species and arranging them in a meaningful classification. In doing this, nomenclature must be stabilized by a thorough search for applicable names and for the type specimens upon which they were based. Taxonomists now attempt to ground their analysis of species as well as they can on a biological species concept and on a study of many specimens from a wide array of places and times. This task is best accomplished by a review of entire genera, families, or superfamilies at one time in order to understand better their members' distributions and the relationships of one species to others in the same area and in other areas and ages.

The need for a more stable nomenclature and classification of the Tellinidae is now great. For example, one researcher in southern California is working on the phylogeny of the superfamily; a worker in central California has recently completed a project on substrate relationships and feeding in *Tellina nuculoides* and *T. modesta*; another in central California has completed work on the ecology of *Macoma balthica*; someone in northern California is working on reproductive cycles of *Macoma nasuta* and *M. secta*; and a student in British Columbia has completed a project on the benthic ecology of eight species of *Macoma*. In the present study, the need for changing the names of several species on which these workers have already published is pointed out.

Principles and Assumptions. – I have attempted to rely on a biological species concept, one with multiple defining factors, as best outlined by MAYR (1963, 1969). This concept uses as its chief basis the cohesion of co-adapted gene complexes, established by continuous interbreeding within the area occupied by populations of animal species. This, together with the disruptive effect of selection, enhancing differences between closely related species in their areas of overlap, results in a degree of continuity within species and a degree of discontinuity between them that would not be present were there not such forces.

From the morphological standpoint, the problem of recognizing such biological species in the coastal marine environment seems to be a simpler one than on land. This may be true because one is dealing with distribution along a line, however convoluted, rather than within a complex area, and because there may be a relatively higher degree of panmixis, randomness of interbreeding over a large area, than is generally present on land (MAYR, 1963: 316). Such panmixis may be especially characteristic of a majority of clams, most of which have pelagic larvae (THORSON, 1950, 1961). The importance of pelagic gametes in this regard is unknown.

With these concepts in mind, I looked for continuously occurring, morphologically similar populations throughout the range of presumed species but also expected some degree of variation in morphology along the range and some degree of variation among members of populations of one area. I also expected morphologically similar species inhabiting the same range but differing ecologically.

Because of the presumed degree of panmixis present in the coastal environment, I anticipated making little use of the concept of subspecies (MAYR, 1963: 348), which has been misused in marine mollusks for the expression of intra-population variation, as explained by MCLEAN (1966). I find myself somewhat in disagreement with MAYR (1963) on the matter of fossil subspecies and believe one should go to some lengths to avoid using them. The problem does not often arise, however, because of the gaps in our knowledge of the fossil record.

The nature of the process of analysis and classification of relatively large taxonomic groups requires a review of many specimens in widespread collections. As a result, such a study cannot be a detailed one in comparative morphology. Decisions had to be made quickly on the identity of museum specimens, although some review and reëxamination were utilized where difficulty was encountered. In attempting to achieve systematic order in this manner, I tried to be careful not to "force" order where there was unsatisfyingly little. I have outlined cases in which, with methods appropriate to analysis and classification, I cannot be certain where to draw the lines between species. Such problems require the still more careful studies of comparative morphology and ecology, dealing with small species-groups only.

It is not always possible to do a thorough job of systematic revision of supra-specific taxa in connection with a review of the present sort, because one is dealing with the

limited number of species of a single area. For example, the arrangement used here above the species-level within the Tellinidae is provisional only. The magnitude of review required for a more complete generic revision of this family would be a large task in itself.

What one can and should do, on the other hand, is to arrange species within the fauna studied into species-groups and attempt to relate these groups to Cenozoic forms of the area covered and to the Recent and Quaternary faunas of adjacent areas. One cannot expect to be able to carry this out in the same detail that is appropriate to the analysis of species of the Recent fauna.

However, one can make a number of comparative statements and from these form hypotheses about the biogeography and evolution of the species. For instance, it has been possible in the Tellinidae to suggest which species-groups have had a long history on our coast and which have arrived from elsewhere. It has often been possible to suggest areas of the world from which such species have come, or, in some cases, areas that have been recipients of West American species. Sometimes these geographic statements bring insights into isolating factors that may have resulted in speciation.

ACKNOWLEDGMENTS

It would be impossible to conduct a project of the present sort, one which synthesizes a great deal of information from many sources and bridges biology and geology, without the help of many persons, such as the curators of museums throughout the world, amateurs who have provided data from their collections, and colleagues who have given me advice on difficult questions.

Many of these almost two hundred individuals and institutions that have been of assistance in this research will be apparent from the taxonomic portion of the text. Several persons, however, deserve special recognition. Dr. Myra Keen of Stanford University photographed many type specimens for me on her visits to the British Museum (Natural History) and provided guidance and encouragement. Mr. Barry Roth of the California Academy of Sciences made the line drawings. Thanks are also extended to Drs. Donald P. Abbott and George S. Myers of Stanford University, Dr. Warren O. Addicott of the United States Geological Survey, Dr. Kenneth J. Boss of Harvard University, Mr. Robert M. Dunnill, formerly of the University of Victoria, Drs. Leo G. Hertlein and Victor A. Zullo of the California Academy of Sciences, Dr. Joseph Rosewater of the United States National Museum, Dr. Norman Tebble of Oxford University, and Mr. D. L. F. Sealy of the British Museum (Natural History). This research was supported by U. S. National Institutes of Health Predoctoral Fellowship 4-F-1-GM-22925 from the National Institute of General Medical Sciences, and publication costs were partially financed by a grant from the Theodore Roosevelt Memorial Fund of the American Museum of Natural History.

METHODS AND FORMAT

Methods. – The present review covers those species of the Tellinidae inhabiting the northwest coast of America, from the Arctic coast of Alaska to the middle of the outer coast of Baja California – the beginning of the Panamic province – at about the latitude of the border between Baja California Norte and Baja California Sur, Isla Cedros, and Punta Eugenia. Species occurring in this area and in the Panamic province but not further northward were omitted, as these have been discussed by KEEN (1958b) and OLSSON (1961).

The first step in this project was a search for potentially applicable species-level names and their synonyms by canvassing literature on the Recent fauna and the Tertiary as far back as the Pliocene.

The original description of each taxon was located and the exact date of publication established as carefully as possible. A relatively thorough but non-critical list of references was accumulated, which included all of the significant accounts. Xerox copies or photocopies of the most important of these accounts were interleaved or pasted into notebooks.

An attempt was then made to locate the type specimens which formed the basis for each name. In this endeavor, I was greatly aided by visits made by Dr. Myra Keen to the British Museum (Natural History) and by the cooperation of many curators and museums. During my two visits to the Museum of Comparative Zoology at Harvard University and the United States National Museum, I spent a large portion of my time locating, verifying, and photographing type material. The same was true of some other museums I visited. When necessary, I selected one specimen from among the type material to serve as lectotype. Of the many type specimens searched for, I was able to study photographs of all except those of Middendorff and Schrenck in Leningrad, U. S. S. R.

Photographs of type or otherwise interesting material made possible continuing reëxamination and reconsideration. In my own photographic work I used an Asahi Pentax "Spotmatic" single lens reflex camera, extension tubes, Kodak "Panatomic-X" film, and whatever combina-

tion of sunlight, roomlight, spotlights, and desk lamps was available in each institution. Most of the film was commercially developed and printed. Prints were filed in the notebooks in plastic folders. Both internal and external views of valves were photographed when possible.

At the same time I was gathering information about type specimens, I began to go through the tellinaceans in each of the major collections, maintaining complete records of every lot studied as to tentative identification, catalogue number, approximate number of specimens, locality, and whatever data were available on habitat. Notes were also made about unusual specimens, maximum sizes, and variation among the specimens. In the Tellinidae about 3 500 lots were examined. A special effort was made to locate the sources of published records of rare species, isolated occurrences, and range limits.

The decision-making process with regard to species and synonyms involved examination of photographs of and notes about type specimens, review of lists of specimens studied, and consideration of conclusions reached by previous workers, in light of the principles and limitations discussed above.

As time went on, my ideas about synonymies and distribution inevitably changed. With complete records of all material seen, it was possible to borrow specimens about which doubt had arisen. My second visits to the United States National Museum and the Museum of Comparative Zoology were necessitated chiefly by the large number of specimens that I needed to reëxamine.

Most important of the collections studied was that of the United States National Museum. The West American tellinacean material in this institution was arranged in drawers as Dall had left it in about 1916.

The following is a list of important institutions in the present study, nearly all of which I visited myself. Abbreviations are as used in the text:

Academy of Natural Sciences, Philadelphia, Pennsylvania – ANSP
American Museum of Natural History, New York, New York
British Museum (Natural History), London, England – BM(NH)
California Academy of Sciences, San Francisco, California – CAS [GTC – Geology Type Collection]
Hopkins Marine Station (Stanford University), Pacific Grove, California
Los Angeles County Museum of Natural History, Los Angeles, California – LACM
Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts – MCZ
National Museum of Canada, Ottawa, Ontario, Canada – NMC
Pacific Marine Station (University of the Pacific), Dillon Beach, California
San Diego Natural History Museum, San Diego, California – SDNHM
Santa Barbara Museum of Natural History, Santa Barbara, California – SBMNH
Stanford University, Stanford, California – SU [PTC – Paleontology Type Collection]
United States Geological Survey, Menlo Park, California – USGS
United States National Museum, Smithsonian Institution, Washington, District of Columbia – USNM
University of California at Berkeley, California – UCB
University of California at Davis, California (the author's collection, recently acquired by UC at Davis)
University of California at Los Angeles, California – UCLA

It is unfortunate that material in the Hancock Foundation, University of Southern California, was not yet in sufficient order to be useful in this study, for specimens in it will change distributional records somewhat. After a discussion with Dr. Garth of that institution, I decided that it would be best not to attempt to include even the obvious records from that collection, for to do so would be to "skim the cream" off the collection, which should be studied as a whole. It will be possible to do this in a year or two.

Material from the major private collections of the following persons was also studied: Dr. S. Stillman Berry, Redlands, California; Dr. I. McT. Cowan, Vancouver, British Columbia, Canada; Mrs. Faye B. Howard, Santa Barbara, California; Mr. Barry Roth, San Francisco, California; and Mr. Robert R. Talmadge, Eureka, California.

When decisions about species and synonyms had been made, brief diagnoses were written. These followed a descriptive formula emphasizing diagnostic characters. In the case of the genus *Macoma,* a key was written to aid in identification.

Internal details of shells have not been emphasized, but, as a first step in this regard, sketches of inside views were made of each of the species from typical, but not necessarily type, material, showing hinge structures and the positions of adductor, retractor, pallial, and cruciform muscle scars. They were not camera lucida-controlled. Representative drawings for each species are reproduced in the present report.

Most descriptive terms used are relative and require further clarification. In the future, these should be more precisely defined mathematically. Size terms used herein (large, medium, and small) are additionally defined in millimeters. Most shape terms (overall lateral shape, relative length of ends, degree of roundness and truncation) are clarified by the drawings and photographs of each species. As an example of the meaning of "flattened" or "compressed," one may take *Tellina idae,* which measures 5.2 times as long as its diameter and 3.2 times as wide as its diameter. *Macoma obliqua,* described as "inflated,"

measures 2.6 times as long as its diameter and 1.9 times as wide as its diameter. "Thin" may be defined as "easily broken by careless handling." A thick shell is one broken only with considerable effort.

Localities were plotted on outline maps so that isolated occurrences and range records could be double-checked. West American Coast Pilots of Arctic Alaska through Panama (Hydrographic Office publications 10, 11, and 26; United States Coast Pilots 7, 8, and 9), United States Geological Survey state maps of Alaska, Washington, Oregon, and California, Canadian Geological Survey map MCR 3 of British Columbia, and the American Automobile Association map of Baja California, proved especially useful in plotting localities. It was necessary to obtain the original data lists from the *Albatross* collections (especially Townsend, 1901), because sometimes localities listed on USNM labels for particular stations proved to be in error. For range data, I relied almost entirely on material I examined myself, although I have included a few recently published distributional data on specimens I have not seen when I felt there was little question about their accuracy and when they significantly supplemented other records.

When northwest American species have been reported from other coasts, I have not given distributional data in detail, and have relied chiefly on recently published accounts and figures, such as those of Kira (1962) and Habe (1964) on Japan, Golikov & Scarlato (1967) on Siberia, Habe & Ito (1965) on northern Japan, Siberia, and the Bering Sea, Soot-Ryen (1958) and Ockelmann (1959) on Greenland and the North Atlantic. For northwest American species that have been reported from the Panamic province, I have taken distributional information mainly from Keen (1958b) and Olsson (1961).

Ecological data on the Tellinidae have been gleaned from the labels of specimens studied, from the as yet only partially published thesis of Dunnill (Master of Science, Department of Biology, University of Victoria, 1968) (Dunnill & Ellis, 1969), and from the published accounts of Burch (1945a-1945c), Soot-Ryen (1958) and Ockelmann (1959). There are a few other published data in the form of benthic studies and the like, but it is time-consuming to search for these and determine the authenticity of the identifications. This is more properly the task of a benthic ecologist working on a few selected species. Depths are reported in meters, and a conversion table from fathoms to meters was constructed with the use of a computer.

The problem of citing the paleontologic range of species covered in this report proved to be a greater one than anticipated. The literature on the Cenozoic formations of West America is very large, and there remain many unsolved stratigraphic problems. Little would be accomplished by merely listing records from earlier than the early Pleistocene. Many of these records may be in error, and as many taxonomic problems must be solved for fossil species as for Recent ones. It became apparent from the volume of literature and from the number of described species that a major review of fossil Tellinacea is now needed and, indeed, that a review would probably yield much useful information on stratigraphy and the evolution of this superfamily. Such a review must start from a study of type specimens and a review of material from which published records were made. Material must be interpreted in light of the latest insights into stratigraphy and systematics, and workers will have to take into account the paleontology of the entire northern Pacific basin and migratory routes into it and out of it during the Cenozoic.

In many cases, I have suggested species from the Pliocene or earlier that may either be regarded as synonymous with or ancestral to Recent species, and for some I have hypothesized evolutionary pathways. The outline is not thorough but goes beyond anything yet in print. The evaluation of these earlier species-level names was aided considerably by the major reviews of Weaver (1943) and Keen & Bentson (1944).

The literature on the late Pleistocene has been thoroughly and critically reviewed in light of the synonymies proposed for Recent species. In some cases I have reexamined specimens, although most records were taken at face value. More reëxamination should be made. I also covered papers on formations considered to be early Pleistocene, especially those of the San Pedro area, California. I have discussed the literature on the Saugus part of the "Fernando group" and the Santa Barbara formation but have omitted specific mention of other formations thought to border on the Plio-Pleistocene boundary, such as the Pico portion of the "Fernando group," the San Diego formation, and the Merced formation. Major recent accounts on the Pleistocene are Wagner (1960) on southwestern British Columbia, Addicott (1966) on central California, Valentine (1961) and Valentine & Meade (1961) on southern California and northern Baja California.

Format. – The present format departs somewhat from that used by other recent workers. The innovations employed may be especially well suited to the presentation of a study of this sort.

(1) The applicable synonymous species-level names are listed in chronological order, with the name in use listed first and "first revisions" indicated. Under each name are listed accounts published under those names and also accounts of type material pertinent to each (even if the

latter were published under other synonymous names). These accounts are listed in chronological order with major changes in generic or subgeneric allocation indicated in brackets following the account in which they were first employed. It is to be assumed that nearly all following accounts used the same name combinations. Other pertinent comments are also included in brackets.

The works listed do not represent a complete catalogue of literature, but are the major ones concerning living and fossil northwest American material, especially those containing previously unpublished information and taxonomic innovations. Some recent foreign papers are cited. Not included are books written largely for amateurs nor general works on marine biology.

Aside from the standard taxonomic conventions and abbreviations (the latter are listed at the end of this section), a few special conventions are used in the synonymies. For instance, "not of's" are listed first in cases of misidentification, but last in cases of homonymy. Numbers following dates (as 1851: 27) are page numbers.

(2) The type material pertinent to the valid name and its northeastern Pacific synonyms is discussed; type material of other nominal species is mentioned when it is important to the present study.

Measurements given are of the greatest lengths of type specimens. When type material is no longer extant the dimensions from original accounts or of original illustrations are given. (In most early accounts the figures were printed at natural size without special indication.) Photographs of type specimens or original illustrations are included.

(3) Type localities of the various nominal species are given. There seems little reason to restrict previously broad type localities (such as "California") or to designate type localities for species originally described without them (such as *Leporimetis obesa*) unless it is necessary to do so for nomenclatural reasons. This is usually done in connection with the definition of subspecies (Mayr, 1969). The designation of lectotypes for Carpenter's species restricts the type locality to one of his several original localities. The original collector is also cited and sometimes major collections are mentioned when this clarifies the history of the specimens.

(4) A nomenclatural commentary may be given to explain nomenclatural complications not made clear in the synonymy or in the discussion of type material.

(5) Description. A short diagnosis of each species is given, which emphasizes distinguishing characters. Internal details are not discussed in detail but are illustrated with drawings. Photographs of specimens other than type material may be included.

(6) Geographic Distribution and Ecology. The major end-points of the range are given, together with references to the specimens that form their bases. The intermediate range data are summarized.

The sources of ecologic information on each species other than from museum labels or personal experience are indicated. I mention also the approximate number of lots examined.

(7) Geologic Distribution and Biogeography. The final section is a summary of paleontologic records from the published accounts. I have not listed all Pleistocene records, but generally have given only the end-points and indicated the published accounts that form their bases. This is followed by an account of the seemingly related fossil species from earlier than the Pleistocene and related living species in other provinces.

References are included under "Literature Cited" for all genera, species, and papers mentioned.

Conventions, symbols, and abbreviations used, other than those for museums listed above, are as follows:

cf. (*conferre*)	– to be compared to, "probably identical to"
ex (Gray) MS	– from the manuscript name of (Gray)
ICZN	– International Commission on Zoological Nomenclature, or International Code of Zoological Nomenclature (Stoll, *et al.*, 1964)
"in synonymy"	– a name proposed in the synonymy of another and therefore not available
m	– meter(s)
mm	– millimeter(s)
nomen dubium	– a name representing an unidentifiable taxon
nomen nudum	– an unavailable name lacking any description, definition, or other indication
not, not of	– as in the case of homonyms or misidentifications
pair	– the two valves of one specimen
USFC	– United States Fish Commission (*Albatross*) station number

SYSTEMATIC ACCOUNT

Family Tellinidae Blainville, 1814

Within the Tellinacea this family is that most highly evolved for feeding on bottom deposits, although not all species rely solely on this food source; some also filter feed. Yonge (1949) reviewed the functional morphology of the Tellinidae, considering also the evolutionary relationships of the superfamily. Boss (1966) in a recent, significant account on the Tellinidae reviews much of the previous anatomical and functional literature.

The Tellinidae may be defined as those Tellinacea that are relatively elongate, inequivalve, with a posterior flex-

ure, especially in the right valve, but no conspicuous gape. The ligament is external, but not seated on a conspicuous nymph. There are two cardinal teeth in each valve, and lateral teeth may or may not be evident. The separate siphons are relatively elongate and motile compared to those in other families and can be contracted into a sheath. They contain an extra middle layer of circular muscles but do not have the rows of sensory cells characteristic of the Psammobiidae.

The outer demibranch does not overhang the inner, and there are either one or two food tracts, as contrasted to as many as three in the other families. The ctenidia are mostly flat and homorhabdic, and the ventral tips of the inner (anterior) demibranch are not inserted into a distal oral groove. The ventral mantle edge just dorso-anterior to the cruciform muscles has special folds for the collection of pseudofeces. The stomach is of "type 5" (PURCHON, 1960), in that the typhlosole enters the right caecum as well as the left. The rectum does not have the circular muscles of some other families. The heart is elongate, with an aortic bulb.

The posterior cruciform muscle is often divided, with a smaller anterior element. The sense organ associated with the cruciform muscle communicates to the outside directly, not by means of a duct.

The entire family is much in need of a thorough, worldwide revision. Until this is carried out, division of the family into subfamilies and genera should be conservative. I use only the genera *Tellina, Leporimetis,* and *Macoma,* with subgenera tentatively suggested for the species-groups recognized. The following quotation from KEEN (1969) with regard to the genus *Tellina* is as applicable to the entire family.

> "Most modern attempts to divide *Tellina, s. l.,* into a number of genera, each with several subgenera, abound in inconsistencies. Evolutionary history of the family in different ocean basins seems to have resulted in many parallel forms or homeomorphs, so that subdivision on one set of characters (*e. g.,* shell outline) runs counter to that on another (*e. g.,* hinge details or musculature). A proper review being beyond the scope of the present summary, the expedient of a conservative classification is adopted herein, treating most generic taxa as subgenera of *Tellina.*"

Even division of the family into two subfamilies seems premature, being based largely on the presence or absence of lateral hinge teeth. I suspect that the loss of these is polyphyletic, although most Macominae probably will be found to have bases other than the lack of lateral teeth and sculpture. They seem to be especially well adapted to and characteristic of quiet areas with fine substrates.

Tellina Linnaeus, 1758

[Type species: *Tellina radiata* Linnaeus, 1758, by subsequent designation of CHILDREN, 1823]

Into the genus *Tellina* are placed, pending a revision of the family, those forms with lateral hinge teeth in one or both valves, especially the right (missing in adult specimens of a few species although present in juveniles). A majority of the species are elongate, relatively compressed, conspicuously sculptured, brightly colored, and are tropical to subtropical.

(Peronidia) Dall, 1900a

[Type species: *Tellina albicans,* Gmelin, 1791, by original designation]

Medium to large in size (30 to 110 mm); heavy; compressed; equivalve or with left valve larger; elongate; equilateral or longer anteriorly; rounded anteriorly; pointed, truncate, twisted to right posteriorly; shell surface smooth, with fine concentric grooves or ridges, often stronger at ends of shell and in right valve; no escutcheon or lunule present; lateral teeth approximately equidistant from cardinals, weak, even absent in adults of some species, strongest in left valve and anteriorly, pallial sinuses approximately equal or slightly longer in right valve, only slightly detached from pallial line.

Tellina (Peronidia) lutea alternidentata
Broderip & Sowerby, 1829

(Plate 1, Figures *1* to *3*; Text figure 1)

Tellina alternidentata Broderip & Sowerby
BRODERIP & SOWERBY, 1829: 363
SOWERBY, in GRAY, 1839: 153; plate 44, figure 5
Tellinea lutea Wood, of authors, not of Wood
[not WOOD, 1828: 3; plate 1 (*Tellina* 3)]
MIDDENDORFF, 1849: 578
GREWINGK, 1850: 286 [see also DALL, 1904]
MIDDENDORFF, 1851: 258-259; plate 21, figures 2, 3
CARPENTER, 1857b: 219, 221, 223, 301
CARPENTER, 1864a: 523 [1872: 9]
SCHRENCK, 1867: 563-564
SOWERBY, 1867: plate 19, figures 97a, 97b
DALL, 1900a: 304, 322, 326; plate 4, figures 15, 16 [*Tellina (Peronidia)*]
DALL, 1904: 116
I. OLDROYD, 1925: 169; plate 1, figure 9
GRANT & GALE, 1931: 363
BURCH & BURCH, 1943: 14
BURCH, 1945a: 9; 1945b: 16; 1945c: 30
MACGINITIE, 1959: 180

Tellina lutea venulosa Schrenck, of authors, not *Tellina venulosa* Schrenck
[not Schrenck, 1861: column 412]
[not Schrenck, 1867: 556-559, 972; plate 22, figures 2-5]
Dall, 1916a: 36
Dall, 1921a: 46
I. Oldroyd, 1925: 169; plate 1, figure 11
Grant & Gale, 1931: 363
Burch, 1945a: 9; 1945b: 16

Type Material:

Tellina alternidentata – Lost (Keen, verbal communication). The description and 60 mm-long figure (Sowerby, in Gray, 1839) are sufficient to identify the species. Plate 1, Figure *1*.

Tellina lutea Wood (not a synonym) – Lost (Keen, verbal communication). The original specimen was about 76 mm long. See Nomenclatural Commentary. Plate 1, Figure *2*.

Tellina venulosa Schrenck (not a synonym) – Presumably in the Zoologiche Institut, Leningrad. I have not been able to obtain information about the type material.

Type Localities:

Tellina alternidentata – Icy Cape, Arctic Alaska; voyage of the *Blossom*.

Tellina lutea – None given in original account, but probably from Japan.

Tellina venulosa – Sakhalin Island, between "Wjachtu and Choji."

Nomenclatural Commentary:

Considering the name "*lutea*" [Latin: yellow] and the early date of Wood (1828), I feel confident that the original material of *Tellina lutea* came from Japan. *Tellina guildfordiae* Griffith & Pidgeon, 1833, *ex* Gray MS, seems to be the same thing. I have seen only a few Japanese specimens that fit this concept (USNM 343959, 228959, "C1588"; SU 13821), none from north of southern Hokkaido. Specimens from north and east of this point are pink or purple within. Japanese authors consider the yellow and pink morphological forms as distinct species (Omori, 1966). I am here provisionally recognizing the pink, North Pacific specimens as a subspecies, *T. lutea alternidentata*. The Japanese species-name used for such northern specimens, *T. zyonoensis* Hatai & Nishiyama, 1938, is regarded as a synonym. It is possible that the present status may be retained if further study of material from northern Japan proves that populations are continuous, south to north, yellow to pink. If the two species are, indeed, separable, then West American workers can simply drop the "*lutea*" from the name.

There is a distinct species in the western Pacific, *Tellina venulosa* Schrenck, 1861. It is more curved ventrally, more produced posteriorly, and has a higher pallial sinus. It overlaps the distribution of the above complex from Sakhalin Island south. Schrenck (1867) described three varieties, "*forma semisulcata*," "*var. (ubique) sulcata*," and "*var. laevigata*," which are presumably synonyms. Since none of Schrenck's type specimens have recently been illustrated, one cannot be certain that the species is on firm nomenclatural ground. Use of the name *T. venulosa* for smooth eastern Pacific specimens of *T. lutea alternidentata* is in error.

Description:

Large (to 110 mm); elongate; moderately inflated; heavy; left valve more convex; equilateral to slightly longer posteriorly; rounded anteriorly; pointed and truncate posteriorly; smooth or with fine concentric ridges; often worn, leaving a few concentric rings of outer shell material; periostracum heavy, greenish; pink within, sometimes with an orange hue (Plate 1, Figure *3*). Other internal details as in Text figure 1.

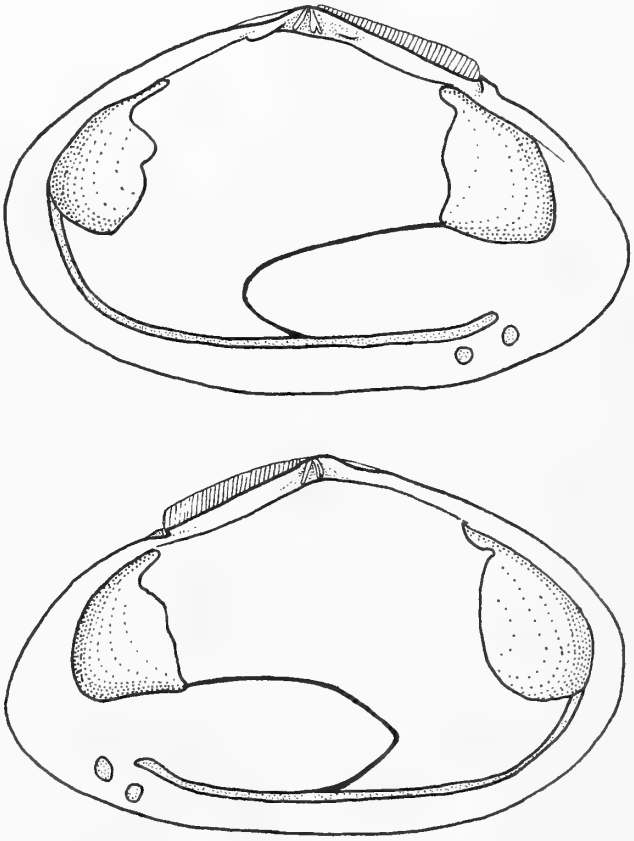


Figure 1
Tellina lutea alternidentata, internal view of valves
MCZ 78910, Swikshak, Alaska; 102 mm

Geographic Distribution and Ecology:

Cape Kruzenstern, Arctic coast of Mackenzie, Canada (BM[NH] 1860.1.23.5), Arctic coast of Alaska, along the coasts of the Bering Sea, through the Aleutian Islands as far east as Kanatak, Cook Inlet, Alaska (CAS 28932, 28933), and as far south as Hokkaido (USNM 344700). (*Tellina lutea lutea* is probably restricted to Japan, from southern Hokkaido south.) It has been taken from the intertidal area to 84 m, probably on exposed coasts, in sand.

Material seen: 193 West American lots.

Geologic Distribution and Biogeography:

This species is known in the Pleistocene of Kodiak Island (Maddren, 1919; Twenhofel, 1952) and the Pliocene of Nome, Alaska (MacNeil, Mertie & Pilsbry, 1943). There are also records in the Miocene of Alaska. Woodring, Stewart & Richards (1941) suggest that *Tellina oldroydi* Wiedey, 1928, described from the Miocene of southern California, may be related.

Type Material:

Tellina bodegensis – BM(NH) 1874.12.11.372, holotype, pair, about 33.5 mm. Plate 1, Figure *4*

Tellina santarosae – USNM 60212, lectotype herein, left valve, figured by Dall, 51.8 mm; USNM 663881, paralectotypes, one pair and one valve. Plate 1, Figure *5*.

Type Localities:

Tellina bodegensis – "Russian Bodegas" [area north of Bodega Bay], California; R. B. Hinds, 13 m, in sand.

Tellina santarosae – Santa Rosa Island, California; S. Bowers.

Nomenclatural Commentary:

Southern specimens of this species differ, on an average, from northern material, but I do not think the generally flatter shape, thinner shell, and minor sculptural differences warrant the subspecific recognition suggested by Burch (1945a).

Description:

Medium-sized (to 60 mm); elongate; flattened; adults thick; longer, rounded anteriorly; pointed, slightly trun-

Tellina (Peronidia) bodegensis Hinds, 1845

(Plate 1, Figures *4*, *5*; Text figure 2)

Tellina bodegensis Hinds
- Hinds, 1845: 67; plate 21, figure 2
- Middendorff, 1849: 578-579
- Carpenter, 1857b: 207, 211, 219, 224, 234, 302, 349
- Carpenter, 1864a: 583, 600, 639, 683 [1872: 69, 86, 125, 169]
- Dall, 1900a: 304-305 [*Tellina (Peronidia)*]
- Arnold, 1903: 158, 392; plate 15, figure 7
- Packard, 1918: 275, 382; plate 25, figure 5
- Oldroyd, 1924: 52, 214; plate 41, figure 5
- I. Oldroyd, 1925: 168; plate 44, figure 5
- Grant & Gale, 1931: 362, 922; plate 20, figure 13
- Burch & Burch, 1943: 14, 15, 24 (text figure)
- Burch, 1945a: 4 (text figure), 8; 1945b: 16; 1945c: 30
- Keen, 1966b: 267

Tellina (Peronidia) santarosae Dall
- Dall, 1900a: 305, 321, 325; plate 3, figure 6; plate 4, figures 1, 2
- I. Oldroyd, 1925: 168
- Burch & Burch, 1943: 15
- Burch, 1945a: 8, 9; 1945b: 16; 1945c: 30

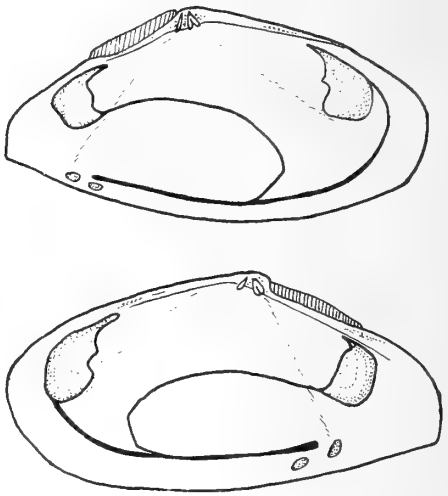


Figure 2

Tellina bodegensis, internal view of valves
Roth collection 1286, Monterey, California; 53.8 mm

Explanation of Plate 1

Figure *1*: *Tellina lutea alternidentata*. Original illustration of *Tellina alternidentata*; 60 mm

Figure *2*: *Tellina lutea lutea*. Original illustration of *Tellina lutea*; specimen was 76 mm

Figure *3*: *Tellina lutea alternidentata*. Specimen illustrated by Sowerby (1867: plt. 19, fig. 97a), BM(NH) 1874.12.11.364; 76 mm

Figure *4*: *Tellina bodegensis*, holotype, BM(NH) 1874.12.11.372; 33.5 mm

Figure *5*: *Tellina bodegensis*. Lectotype (herein) of *Tellina santarosae*, USNM 60212; 51.8 mm

Figure 1

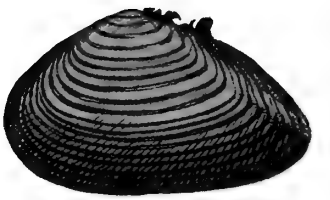


Figure 2

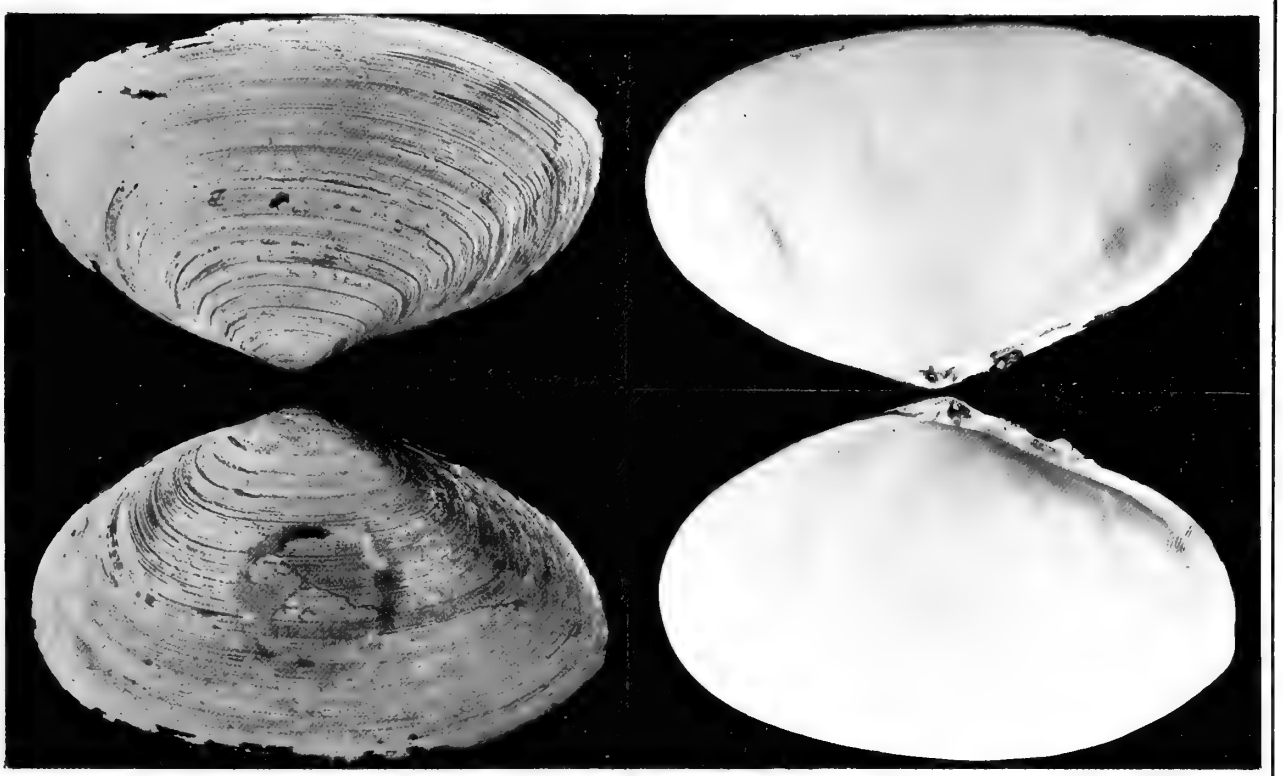


Figure 3

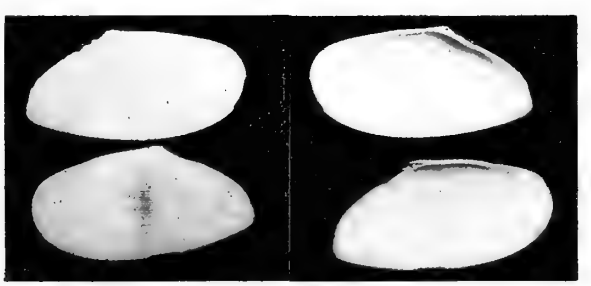


Figure 4

Figure 5

cate posteriorly; sculpture of heavy, closely spaced concentric ribs; white, sometimes with a slight yellow or pink hue internally. Other internal details as in Text figure 2.

Geographic Distribution and Ecology:

La Paz Bay, Graham Island, Queen Charlotte Islands, British Columbia (COWAN, 1964), to Rosario, Baja California Norte (Berry Collection 13491), with numerous intermediate records; possibly as far south as Bahía Magdalena, Baja California Sur (SU 284/8). Specimens at Stanford (SU 284/7) from La Paz, Baja California Sur, probably represent a labeling error. It is found in the intertidal area to 96 m, mainly on open coast, but occasionally in bays, in sand (BURCH, 1945a; SMITH & GORDON, 1948). MACGINITIE (1935) reports that this species comes to the surface if exposed by the tide for too long a time. Its abundance on exposed beaches indicates that it may be a dominant in a *Tellina* community, similar to the *Tellina* communities described by THORSON (1957).

Material seen: 164 lots.

Geologic Distribution and Biogeography:

This is one of the several species of tellinaceans that has a long and well documented geologic history. It is known in the late Pleistocene from Cayucos, California (VALENTINE, 1958), to Bahía Magdalena, Baja California Sur (JORDAN, 1924, 1936), with many intermediate records. There are records in the early Pleistocene of the San Pedro area, California (ARNOLD, 1903; T. OLDROYD, 1925; BURCH, 1947; VALENTINE & MEADE, 1961), in Californian formations transitional between the Pliocene and the Pleistocene, in the Pliocene of California, the Miocene of Oregon and California, and the Oligocene of Washington. *Tellina oregonensis* Conrad, 1848, described from the Miocene of Oregon, may be ancestral and seems closely related to the following: *T. emacerata* Conrad, 1849, from the Miocene of Oregon; *T. aragonia* Dall, 1909, from the Miocene of Oregon; *T. clallamensis* Reagan, 1908, from the Miocene of Washington; and *T. eugenia* Dall, 1909, from the Oligocene of Washington.

I know of no Asian or Caribbean homologue.

(Tellinella) MÖRCH, 1853, *ex* Gray MS

[Type species: *Tellina virgata* Linnaeus, 1758, by subsequent designation of STOLICZKA, 1870]

Medium to large in size (30 to 80 mm); medium in thickness and degree of inflation; equivalve or with left valve slightly larger; elongate; approximately equilateral; rounded anteriorly; pointed, truncate, and twisted to right posteriorly; shell surface with medium to fine concentric ribs or lamellae; oblique lamellae present on anterior end in some species; sculpture strongest in right valve; posterior end with one or two strong radial ribs; escutcheon and lunule present in some species; some ligamental material present anterior to beaks; lateral teeth strong, strongest in right valve; anterior lateral closest to cardinal complex; pallial sinuses long, reaching almost to anterior adductor muscle scar, approximately equal in size, slightly to moderately detached from pallial line.

Tellina (Tellinella) idae Dall, 1891

(Plate 2, Figure *6*; Text figure 3)

Tellina idae Dall
- DALL, 1891: 183-185, 191; plate 6, figure 3, plate 7, figures 1, 4
- DALL, 1900a: 301, 326; plate 4, figures 10, 11
- ARNOLD, 1903: 158-159, 392; plate 15, figure 6 [*Tellina (Angulus)*]
- I. OLDROYD, 1925: 164-165; plate 14, figure 4
- GRANT & GALE, 1931: 358, 922; plate 20, figures 12, 14a, 14b
- BURCH & BURCH, 1943: 10-11
- BURCH, 1945a: 5-6; 1945b: 16 [*Tellina (Tellinella)*]

Type Material:

USNM 120098, holotype, pair, 46.9 mm; Plate 2, Figure *6*

Type Locality:

Long Beach-San Pedro area, California; Mrs. G. L. Trobridge; I. S. Oldroyd Collection

Nomenclatural Commentary:

None necessary.

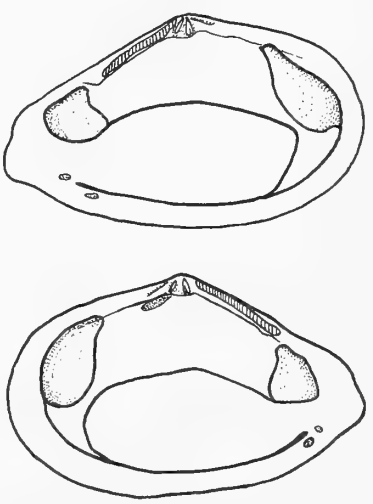


Figure 3

Tellina idae, internal view of valves
SU 274, San Pedro, California; 59 mm

Description:

Medium-sized (to 60 mm); elongate; flattened; thin; approximately equilateral; rounded anteriorly; pointed posteriorly, with a strong fold and escutcheon; sculpture of well-spaced concentric lamellae; white inside and outside. Other internal details as in Text figure 3.

Geographic Distribution and Ecology:

Santa Barbara, California (UCB 2390), to San Diego, California (SDNHM 13052; SU 274/1) with several intermediate records. It is found from the intertidal area in bays (only before pollution?) to 91 m offshore, in sand.

Material seen: 100 lots.

Geologic Distribution and Biogeography:

Tellina idae is more common as a fossil than it is in the living fauna. In the late Pleistocene it has been recorded from Santa Monica, California (Hoots, 1931; Grant & Gale, 1931; Valentine, 1956), to Bahía San Quintín, Baja California Norte (Orcutt, 1921a; Jordan, 1926; Manger, 1934) with several intermediate records. In the early Pleistocene, there is a record in the northwestern portion of the Los Angeles basin, California (Rodda, 1957, as "*cf.*"), and one in the San Pedro area, California (Grant & Gale, 1931). In southern California it has frequently been reported from formations transitional between the Pliocene and Pleistocene and from the Pliocene.

There are several records of the species in the Miocene, and it may be related to, if not identical to, *Tellina insurana* Hanna, 1924 (new name for *T. tenuistriata* Davis, 1913, a homonym, also unnecessarily renamed *T. davisi* Salisbury, 1934), from the Miocene of central California, and *T. tenuilineata* Clark, 1918, from the Oligocene of central California. *Tellina englishi* Clark, 1915, from the Miocene of central California is also related but more elongate.

I know of no similar Asian or Caribbean species.

(Cadella) Dall, Bartsch & Rehder, 1938

[Type species: *Tellina lechriogramma,* Melvill, 1893, by original designation]

Small in size (under 20 mm); thick; rather inflated; approximately equivalve; ovate to ovate-elongate; longer, narrowly rounded anteriorly; rounded, only slightly truncate, not conspicuously twisted posteriorly; shell surface smooth or with conspicuous concentric sculpture; no lunule or escutcheon present; right valve with two cardinals; left valve with posterior cardinal lamellar or obscure; right valve with two conspicuous laterals, approximately equidistant from cardinals; left valve without laterals; pallial sinuses deep, approximately equal in size, only partially confluent with pallial line; usually tinted pink.

This subgenus is close to *Acorylus* Olsson & Harbison, 1953 (type species: *Tellina suberis* Dall, 1900b). Boss (1966) places the Caribbean species *T. gouldii* Hanley, 1846, in *Acorylus.*

Tellina (Cadella) nuculoides (Reeve, 1854)

(Plate 2, Figures *7, 8*; Text figure 4)

Donax nuculoides Reeve
- Reeve, 1854: plate 8, figure 59
- Sowerby, 1866a: 312; plate 4, figure 105
- Tryon, 1869: 114
- Bertin, 1881: 117 [as *"nuchloides"*]

Maera salmonea Carpenter
- Carpenter, 1864a: 627, 639 [1872: 113, 125]
- Carpenter, 1864b: 423 [1872: 235]
- Sowerby, 1867: plate 29, figure 155 [*Tellina*]
- Dall, 1900a: 302-303 [*Tellina (Moerella)*]
- Arnold, 1903: 157, 388; plate 13, figure 7
- Packard, 1918: 276; plate 25, figures 3a, 3b, plate 46
- Oldroyd, 1924: 51; plate 41, figures 3a, 3b
- I. Oldroyd, 1925: 165-166; plate 44, figures 3a, 3b
- Grant & Gale, 1931: 359
- Burch & Burch, 1943: 11
- Burch, 1945a: 5-6; 1945b: 16, 21; 1945c: 30
- Palmer, 1958: 15, 22, 26, 32, 34, 38, 48, 105-106, 338; plate 13, figures 17-19

Explanation of Plate 2

Figure *6*: *Tellina idae,* holotype, USNM 120098; 46.9 mm
Figure *7*: *Tellina nuculoides.* Original illustration of *Donax nuculoides;* 17 mm
Figure *8*: *Tellina nuculoides.* Lectotype (herein) of *Maera salmonea,* USNM 73449; 13.1 mm
Figure *9*: *Tellina meropsis,* lectotype (herein), USNM 123410; 14.6 mm
Figure *10*: *Tellina meropsis.* Lectotype (herein) of *Angulus gouldii,* USNM 13652; 13 mm
Figure *11*: *Tellina meropsis.* Lectotype (herein) of *Tellina paziana,* USNM 108580; 9 mm
Figure *12*: *Tellina carpenteri.* Lectotype (herein) of *Angulus variegatus,* USNM 15467b; 12.7 mm
Figure *13*: *Tellina carpenteri.* Holotype of *Tellina arenica,* CAS GTC 9233; 24.6 mm

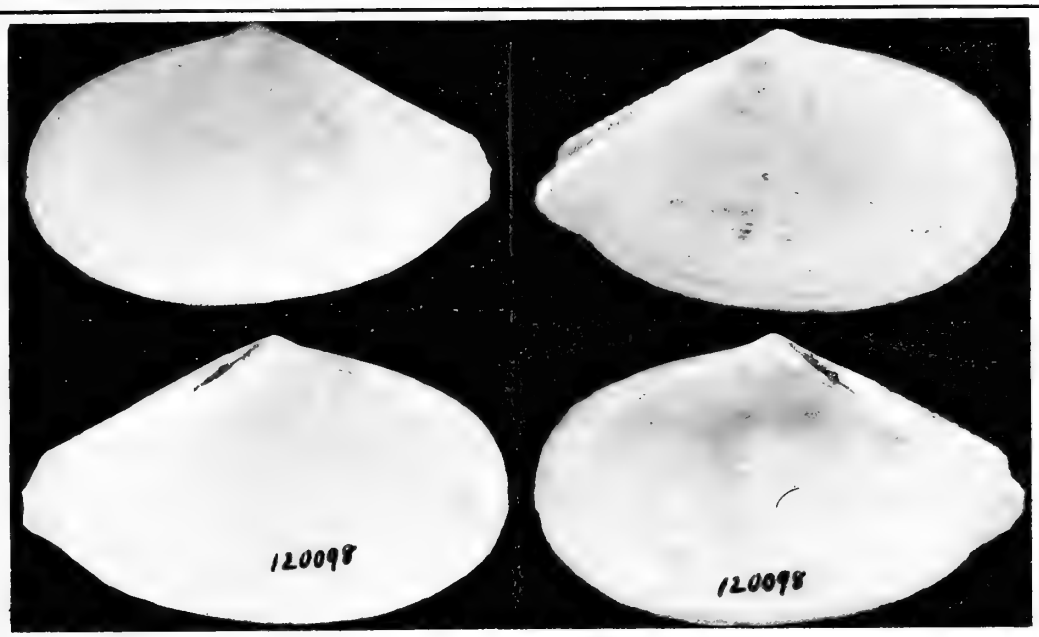


Figure 6

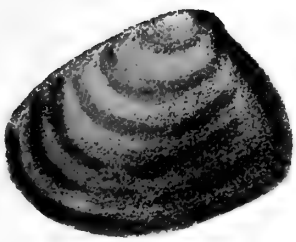


Figure 7

Figure 8

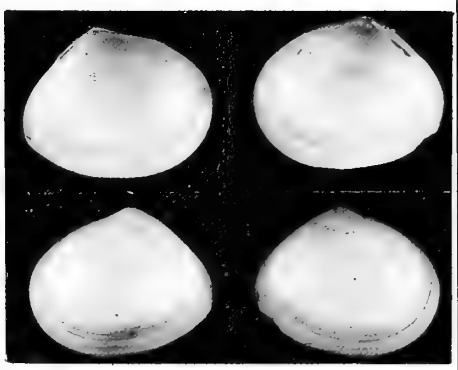


Figure 9

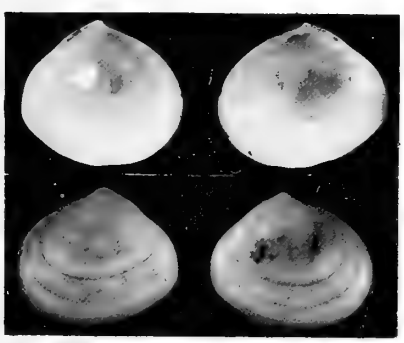


Figure 10

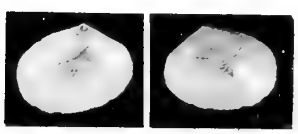


Figure 11

Figure 12

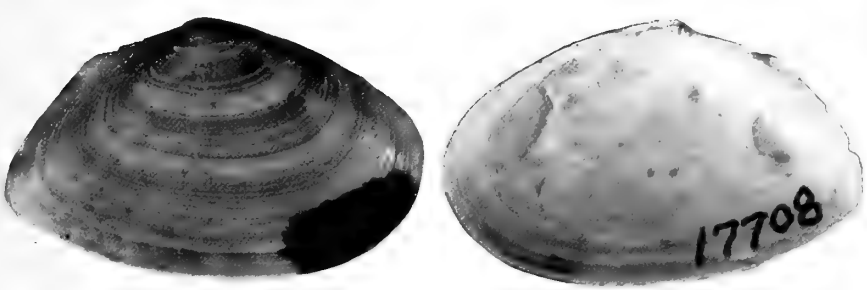


Figure 13

Type Material:

Donax nuculoides – Lost. Reeve's description and 17 mm-long figure are sufficient to identify the species. Plate 2, Figure 7.

Maera salmonea – USNM 73449, lectotype herein, pair, 13.1 mm; USNM 663882, paralectotypes, 4 valves.

PALMER (1958) suggested that the specimen should be regarded as a neotype. However, it is certainly original material and bears Carpenter's initials. The fact that the word "type" was not written on the label does not mean that it was not from among the originally examined specimens. Plate 2, Figure 8.

Type Localities:

Donax nuculoides – "Russian Bodegas" [area north of Bodega Bay], California; R. B. Hinds.

Maera salmonea – Either Vancouver Island, British Columbia, or Neah Bay, Washington. The specimen is probably from the latter locality and would have been collected by J. G. Swan.

Nomenclatural Commentary:

It is unfortunate that workers have missed Reeve's name for so long, but in spite of the fact that the type specimen is lost, there is little doubt as to its identity.

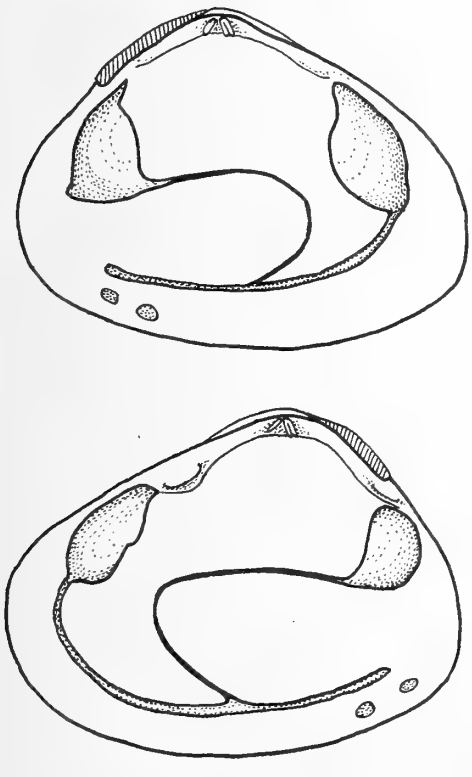


Figure 4

Tellina nuculoides, internal view of valves
MCZ 88265, Vancouver Island, British Columbia; 12.6 mm

Description:

Small (to 19 mm); ovate; moderately inflated; thick for size; longer, rounded anteriorly; rounded, slightly truncate posteriorly; posterior dorsal margin rather straight; smooth; often covered with a shiny greenish periostracum; externally reddish, with reddish concentric lines; internally reddish. Other internal details as in Text figure 4.

Geographic Distribution and Ecology:

Attu Island, Aleutian Islands (USNM 108633), and Saint George Island, Pribiloff Islands (USNM 217129), through the Aleutian Islands, southern Alaska, British Columbia, Washington, Oregon, California, and south to Islas Los Coronados, Baja California Norte (UCLA 20458), with many intermediate records. It occurs from the intertidal area to 73 m, in protected areas, in a variety of bottom types (rock, gravel, sand, and mud), but is most common on coarse sand. It is a suspension feeder (MAURER, 1967a-1967c, 1969). Talmadge (in correspondence) observed it crawling in tight curves in sand at low tide.

Material seen: 118 lots.

Geologic Distribution and Biogeography:

Tellina nuculoides is known in the late Pleistocene from Cayucos, California (VALENTINE, 1958), to Huntington Beach, California (VALENTINE, 1959), with three intermediate records. In the early Pleistocene, there are records from the San Pedro area, California (ARNOLD, 1903; T. OLDROYD, 1925; BURCH, 1947). I would question the Californian Miocene records.

There is a closely related species in Japan, *Tellina lubrica* Gould, 1861, which differs in being longer anteriorly and attaining a larger size. The type of the latter was rediscovered in the course of the present study (USNM 1688).

(Angulus) Megerle von Mühlfeld, 1811

[Type species: *Tellina lanceolata* Gmelin, 1791, by subsequent designation of GRAY, 1847]

Small to medium in size (under 40 mm); thin; inflated to compressed; equivalve or with left valve more convex; oval to elongate; almost equilateral to longer anteriorly; broadly to sharply rounded anteriorly; pointed to rounded and broadly truncate posteriorly; moderately twisted to right posteriorly; shell surface smooth or with fine concentric sculpture, strongest in right valve; no escutcheon or lunule present; lateral teeth conspicuous in right valve only, anterior one close to cardinals, posterior weaker and

more distant; often with internal anterior radial strengthening ribs, strongest in left valve; pallial sinuses long, slightly longer in right valve, confluent with pallial line along most of their length.

Workers have placed West American species in the subgenus *Moerella* Fischer, 1887. For the same reasons outlined by Boss (1968) with regard to Atlantic species, I use the subgenus *Angulus* for similar West American species. *Tellina (Angulus) meropsis* fits least well into this subgenus.

Tellina (Angulus) meropsis Dall, 1900

(Plate 2, Figures *9 - 11*; Text figure 5)

Tellina (Moerella) meropsis Dall
- Dall, 1900a: 303, 317, 325; plate 3, figure 1
- I. Oldroyd, 1925: 166
- Grant & Gale, 1931: 359, 908, 922; plate 14, figures 9a, 9b, plate 20, figures 9a, 9b
- Burch & Burch, 1943: 11-12
- Burch, 1945a: 6; 1945b: 16; 1945c: 30
- Keen, 1958b: 170; figure 389
- Olsson, 1961: 401-402, 542; plate 69, figures 9, 9a

Angulus gouldii Carpenter, *ex* Hanley MS, not *Tellina gouldii* Hanley
- Carpenter, 1864a: 639, 665 [1872: 125, 151]
- Carpenter, 1865b: 132-133 [1872: 300-301]
- Palmer, 1958: 105 [under *Tellina (Moerella) meropsis*] [not Hanley, 1846: 272; plate 56, figure 26]

Tellina (Moerella) paziana Dall [First reviser: Olsson, 1961]
- Dall, 1900a: 303, 318, 325; plate 3, figure 8
- Keen, 1958b: 172-173; figure 401

Type Material:

Tellina meropsis – USNM 123410, lectotype herein, pair, 14.6 mm; USNM 663883, paralectotypes, 3 pairs. The specimen figured by Dall (1900a) was from another lot. Plate 2, Figure *9*.

Angulus gouldii – USNM 13652, lectotype herein, pair, 13 mm. The lots from San Diego are not in the USNM collection. Palmer (1958) did not look for the type of this species on the grounds that this was merely a misuse of Hanley's name. However, Carpenter was unaware of Hanley's description and fully described the species as a new one, so it must be regarded as being *of* Carpenter (with a type specimen) and as a homonym. Plate 2, Figure *10*.

Tellina paziana – USNM 108580, lectotype herein, figured right valve, 9 mm; USNM 663877, paralectotype, left valve. Plate 2, Figure *11*.

Type Localities:

Tellina meropsis – San Diego, California; I. S. Oldroyd.

Angulus gouldii – Isla Cedros, Baja California Norte; W. O. Ayres

Tellina paziana – Southwest of Punta San Lorenzo, north of La Paz, Baja California Sur; USFC 2823, in 48 m, among broken shells.

Nomenclatural Commentary:

Tellina paziana was based on juvenile specimens of *T. meropsis*, as concluded by Olsson (1961). Misidentified specimens of *T. meropsis* with slight concentric ribbing account for Californian records of the Panamic *Tellina (Merisca) reclusa* Dall, 1900a.

Description:

Small (to 20 mm); ovate; inflated; longer, rounded anteriorly; truncate posteriorly, with a low fold; smooth or with traces of fine concentric lamellae; white inside and outside. Other internal details as in Text figure 5.

Geographic Distribution and Ecology:

Pacific Grove, California (Berry Collection 3305), probably as a result of larval settlement in an especially warm year, as the species has not been taken in the Monterey area since. Carpinteria, California (SU 43378), throughout southern California, the outer coast of Baja California, the Gulf of California, and south to Santa Elena, Ecuador (Olsson, 1961). It is found from the intertidal area in bays to 48 m offshore on protected outer coast, in sand.

Material seen: 82 northwest American lots.

Geologic Distribution and Biogeography:

Tellina meropsis is known in the late Pleistocene from the northwestern portion of the Los Angeles basin, California (Hoots, 1931; Rodda, 1957), to Laguna San Ignacio, Baja California Sur (Hertlein, 1934), with several intermediate records. It has also been reported from the

Explanation of Plate 3

Figure *14*: *Tellina modesta*. Lectotype (herein) of *Angulus modestus*, USNM 4245; about 8 mm

Figure *15*: *Tellina modesta*. Lectotype (herein) of *Angulus modestus obtusus*, USNM 19429; 17 mm

Figure *16*: *Tellina modesta*, CASGTC 13619, southwest shore of Monterey Harbor, California; 16 mm

Figure *17*: *Leporimetis obesa*. Lectotype (herein) of *Tellina obesa*, BM(NH) without registry number; 83 mm

Figure *18*: *Leporimetis obesa*. Holotype of *Tellina turgida*, BM (NH) 1967577; about 75 mm

Figure *19*: *Leporimetis obesa*. Holotype of *Tellina alta* and *Scrobicularia biangulata*, BM(NH) 1861.5.20.117; 45 mm

Figure *20*: *Macoma calcarea*. Original illustration of *Tellina calcarea*; 28.3 mm

Figure *14*

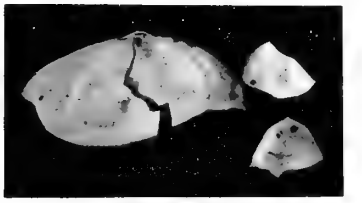


Figure *15*

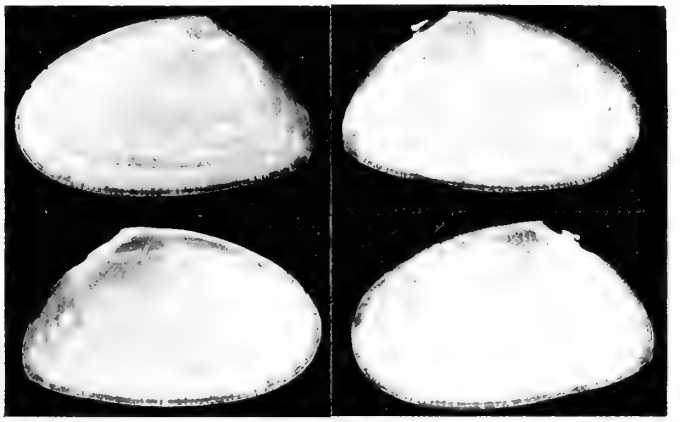


Figure *16*

Figure *17*

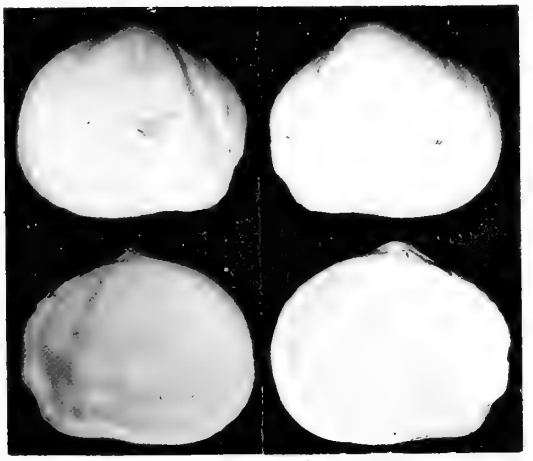


Figure *18*

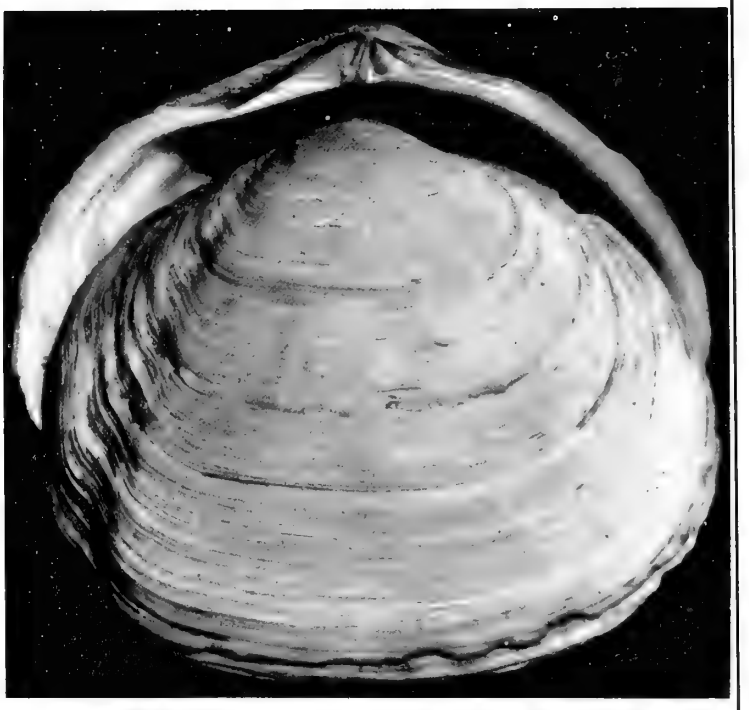


Figure *19*

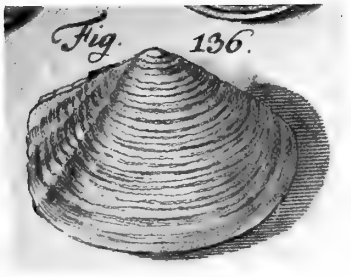


Figure *20*

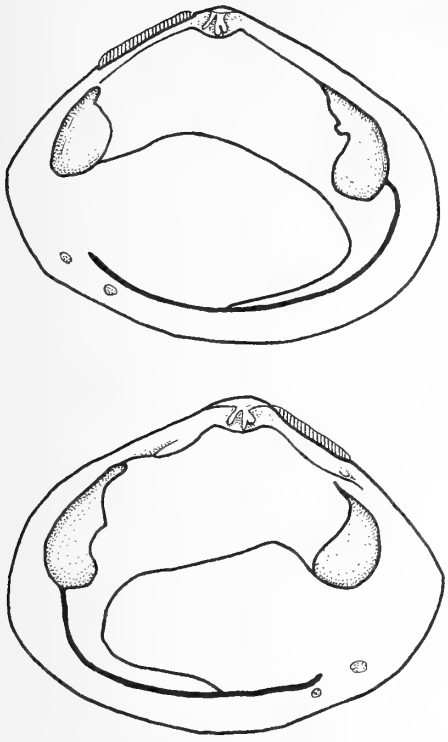


Figure 5

Tellina meropsis, internal view of valves
MCZ 70108, San Diego, California; 16.5 mm

Pleistocene (or Pliocene?) of Isla Carmen, Baja California Sur (HERTLEIN, 1957; EMERSON & HERTLEIN, 1964), and of Santa Elena, Ecuador (HOFFSTETTER, 1952). There is one record in a southern Californian formation transitional between Pliocene and Pleistocene.

It is most similar to *Tellina mera* Say, 1834, from the Caribbean; *T. meropsis* differs from this species in being more rounded, shorter posteriorly, and usually heavier.

Tellina (Angulus) carpenteri Dall, 1900

(Plate 2, Figures *12*, *13*; Text figure 6)

Tellina (Angulus) carpenteri Dall, new name for *T. variegata* (Carpenter), not of Gmelin
DALL, 1900a: 303, 320
PACKARD, 1918: 276; plate 15, figure 10
OLDROYD, 1924: 51, 209, 214; plate 10, figure 4, plate 41, figures 10a, 10b
I. OLDROYD, 1925: 166; plate 29, figure 2, plate 44, figures 10a, 10b
GRANT & GALE, 1931: 361
BURCH & BURCH, 1943: 12, 25 (text figure)
BURCH, 1945a: 3 (text figure), 7; 1945b: 16; 1945c: 30
Angulus variegatus Carpenter, not *Tellina variegata* Gmelin
CARPENTER, 1864a: 611, 627, 639 [1872: 97, 113, 125]
CARPENTER, 1864b: 423-424 [1872: 235-236]
PALMER, 1958: 15, 22, 26, 38, 48, 104-105, 388; plate 13, figures 12-16
[not *Tellina variegata* GMELIN, 1791: 3237]
Tellina (Moerella) arenica Hertlein & Strong
HERTLEIN & STRONG, 1949: 68-69, 97; plate 1, figures 5, 11
KEEN, 1958b: 170-171; figure 393

Type Material:

Angulus variegatus – USNM 15467b, lectotype herein, left valve, 12.7 mm; USNM 663890, paralectotype, small pair. Plate 2, Figure *12*.

Tellina arenica – CASGTC 9233, holotype, right valve, 24.6 mm; CAS, one paratype. Plate 2, Figure *13*.

Type Localities:

Angulus variegatus – Either Catalina Island, California, or Neah Bay, Washington. The former would have been collected by J. G. Cooper, the latter by J. G. Swan. The lectotype is more likely from Neah Bay, because large, heavy valves are more common in shallow water there than in southern California.

Tellina arenica – CAS Loc. 17708, Arena Bank, southern end of Gulf of California, in 79 m.

Nomenclatural Commentary:

This species may have two forms in southern California, a large, flat, light-colored, offshore one and a smaller, more inflated, more brightly colored one in bays. The

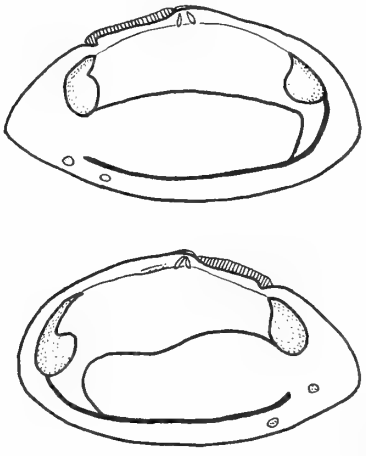


Figure 6

Tellina carpenteri, internal view of valves
MCZ 139930, west coast of Vancouver Island, British Columbia
15 mm

relationship between these two is uncertain. The fact of importance here, however, is that the type specimens of the two nominal species are morphologically of the former category, so I regard the two as synonyms.

Description:

Small (to 20 mm); elongate, more so than in *Tellina modesta*; moderately inflated, somewhat more so than in *T. modesta*; almost equilateral to longer anteriorly; rounded anteriorly; more pointed posteriorly than in *T. modesta*, but broadly truncate; smooth or with low concentric undulations; without a conspicuous internal radial strengthening rib; pink to rosy; color sometimes throughout, sometimes in patches. Other internal details as in Text figure 6.

Geographic Distribution and Ecology:

Ketchikan, Alaska (UCLA 20466), through British Columbia, Washington, Oregon, California, Baja California and the Gulf of California, to Panama (KEEN, 1958b). It has been taken in the intertidal area in bays and offshore to 441 m, in a variety of bottom types (BURCH, 1945a). On exposed coasts, it seems to average somewhat farther offshore and in finer substrates than the next species, and BANDY (1958) reports that it constitutes 20 - 22% of the molluscan fauna between about 300 and 500 m in southern California. Specimens (reported as *Tellina arenica*) were as abundant as 95.5 per m^2 between 2 and 30 m in sandy-silt to sand in Bahía de los Angeles, Gulf of California (COAN, 1968b). BURCH (1945a) records the species as spawning in summer in Anaheim Bay, California.

Material seen: 143 northern West American lots.

Geologic Distribution and Biogeography:

In the late Pleistocene *Tellina carpenteri* has been recorded from Goleta, California (OLDROYD & GRANT, 1931), from Bahía San Quíntin, Baja California Norte (ORCUTT, 1921b; JORDAN, 1926), and from Bahía Magdalena, Baja California Sur (JORDAN, 1924, 1936). There are a few records in the early Pleistocene of the San Pedro area, California (T. OLDROYD, 1925; SCHENCK, 1945; BURCH, 1947).

I know of no related fossil or Asian species. It may be similar to *Tellina probrina* Boss, 1964, from the western Atlantic.

Tellina (Angulus) modesta Carpenter, 1864

(Plate 3, Figures *14 - 16*; Text figure 7)

Angulus modestus Carpenter
CARPENTER, 1864a: 602, 639, 681 [1872: 88, 125, 167]
CARPENTER, 1865c: 56
DALL, 1900a: 304 [*Tellina (Angulus)*]
OLDROYD, 1924: 51
I. OLDROYD, 1925: 167
GRANT & GALE, 1931: 361
BURCH & BURCH, 1943: 12-13 [*Tellina (Oudardia)*]
BURCH, 1945a: 7-8; 1945b: 16
PALMER, 1958: 17, 22, 26, 38, 103, 338; plate 13, figures 4-9

Angulus modestus obtusus Carpenter, not *Tellina obtusa* Sowerby
CARPENTER, 1864a: 639 [1872: 125]
CARPENTER, 1865c: 56
PALMER, 1958: 22, 26, 34, 38, 48, 103-104, 338; plate 13, figures 10, 11 [under *Tellina buttoni*]
[not *Tellina obtusa* SOWERBY, 1817: 175; plate 179]

Tellina (Oudardia) buttoni Dall, new name for *Tellina modesta obtusa* (Carpenter), not *T. obtusa* Sowerby
DALL, 1900a: 304, 320-321, 326; plate 4, figures 12, 13
DALL, 1900b: 1036, 1203; plate 47, figure 18
ARNOLD, 1903: 157-158, 394; plate 15, figures 2, 9
PACKARD, 1918: 275-276; plate 25, figures 7a, 7b
OLDROYD, 1924: 51-52, 214; plate 41, figures 7a, 7b
I. OLDROYD, 1925: 167-168; plate 44, figures 7a, 7b
GRANT & GALE, 1931: 361-362
BURCH & BURCH, 1943: 13, 25 (text figure)
BURCH, 1945a: 3 (text figure), 8; 1945b: 16; 1945c: 30

Type Material:

Angulus modestus – USNM 4245, lectotype herein, badly broken pair, about 8 mm. Carpenter's second specimen is lost. Plate 3, Figure *14*.

Angulus modestus obtusus – USNM 19429, lectotype herein, badly broken pair (left valve missing), originally stated to be about 17 mm; USNM 663876, paralectotype, smaller pair. There are also USNM specimens labeled as having been collected at Neah Bay, Washington, by J. G. Swan, but there is uncertainty about their origin; the catalogue numbers with the specimens do not agree with the record books. Plate 3, Figure *15*.

Type Localities:

Angulus modestus – Puget Sound, Washington; C. B. R. Kennerly.

Angulus modestus obtusus – San Pedro, California; J. G. Cooper.

Nomenclatural Commentary:

As first surmised by BURCH & BURCH (1943), there seems no good basis for separating Carpenter's two subspecies, and I regard them as synonyms. The type specimens of both have a distinct internal radial strengthening rib.

Misidentified specimens of this species account for records of *Tellina hiberna* Hanley, 1844c, from California (reported as *T. panamensis* Dall, 1900a). The latter is Panamic (KEEN, 1958b; OLSSON, 1961), and differs in being smaller, longer posteriorly, iridescent externally, more inflated, and lacking an internal radial rib.

Description:

Small (to 20 mm); elongate, but generally higher than the preceding species; moderately inflated; longer, rounded anteriorly; pointed, fairly truncate posteriorly, but more smoothly rounded than in the last species; unworn shells smooth, shiny; with an internal radial strengthening rib; white externally and internally (Plate 3, Figure *16*). Other internal details as in Text figure 7.

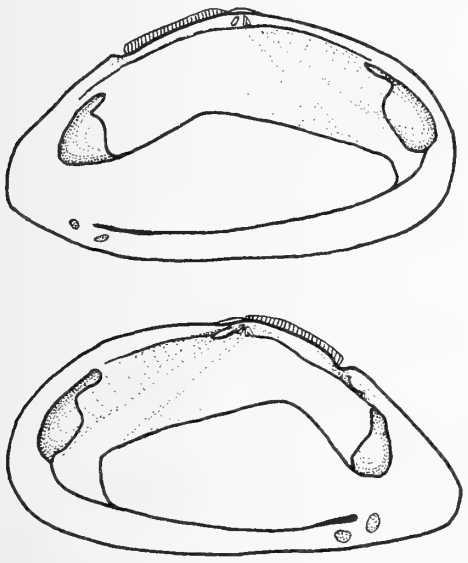


Figure 7

Tellina modesta, internal view of valves
MCZ 48170, Olga, Orcas Island, Washington; 21 mm

Geographic Distribution and Ecology:

Montagu Island, Alaska (LACM unnumbered) and Hinchinbrook Island, Alaska (MCZ 101898; ANSP 177931), to Bahía San Bartolomé, Baja California Sur (USNM 554319 and several other lots). It occurs in the intertidal area to 10 m in bays and on more exposed coasts below wave level to 91 m, in silty-sand to fine sand (Maurer, 1969). Offshore this species occurs in shallower water and in coarser sediments than the preceding one. Bandy (1958) found that it constituted 28% of the mollusks in depths of about 12 m in southern California, and Barnard (1963) named a *Tellina - Nothria* community from a 10 - 30 m zone in southern California based on it. Jones (1964) found it most common between 0 and 46 m, and Maurer (1967a-1967c, 1969) reports that it is mainly a deposit feeder.

Material seen: 151 lots.

Geologic Distribution and Biogeography:

Tellina modesta has a rather well documented history. It is known in the late Pleistocene from Point Año Nuevo, California (Addicott, 1966) to Laguna San Ignacio, Baja California Sur (Jordan, 1924; Hertlein, 1934). There are records in the early Pleistocene from the northwestern portion of the Los Angeles basin (Rodda, 1957) and the San Pedro area, California (Arnold, 1903; T. Oldroyd, 1925; Clark, 1931; Burch, 1947; Valentine, 1961), and in southern Californian formations transitional between the Pliocene and Pleistocene. There seem to be similarities between this species and *T. hannibali* Clark, 1915, from the Miocene of central California, and *T. wilsoni* Anderson & Martin, 1914, from the Miocene of southern California.

I know of no related Asian or Atlantic species.

Leporimetis Iredale, 1930

[Type species: *Tellina spectabilis* Hanley, 1844b, by original designation]

Medium to large in size (50 to 100 mm); medium in thickness to thick; inflated, often most so anteriorly; equivalve; rounded to rounded-quadrate; slightly longer posteriorly, equilateral, or longer anteriorly; rounded anteriorly; rounded to broadly truncate posteriorly, with a radial sulcus and ridge setting off postero-dorsal slope; very slightly twisted to right posteriorly; shell surface with concentric ribs and often radial striae; escutcheon and lunule present in some species; two cardinal teeth present in each valve; lateral teeth absent in both valves; ligament sunken below dorsal margin; pallial sinuses moderate in length, approximately equal in the two valves to longer in left valve, slightly to moderately detached from pallial line.

This generic name seems to be a senior synonym of *Florimetis* Olsson & Harbison, 1953, although the latter may be used as a subgenus. A world-wide review of this complex of species would be useful.

Leporimetis obesa (Deshayes, 1855)

(Plate 3, Figures *17 - 19*; Text figure 8)

Tellina obesa Deshayes
Deshayes, 1855: 354
Keen, 1966a: 170-171 (text figure 1)
Tellina turgida Deshayes ["First Revision" herein]
Deshayes, 1855: 354
Keen, 1966a: 170
Tellina alta Conrad, 1837, not of Conrad, 1833 [*alba,* of authors, a misspelling]

Conrad, 1837: 258
Hanley, 1846: 332; plate 62, figure 200
Carpenter, 1857a: 213
Carpenter, 1857b: 195, 302, 349
Carpenter, 1864a: 526, 536, 540, 639-640 [*Lutricola*] [1872: 12, 22, 26, 125]
Dall, 1900a: 306 [*Metis*]
Dall, 1900b: 1044
Arnold, 1903: 160
I. Oldroyd, 1925: 169; plate 57, figure 3
Keen, 1966a: 170-171
[not of Conrad, 1833: 41]

Scrobicularia biangulata Carpenter [*biangularis*, misspelling, of authors]
Carpenter, 1856: 230 [1872: 12]
Carpenter, 1857a: 213
Carpenter, 1857b: 195, 303
Grant & Gale, 1931: 363-364, 922; plate 20, figure 16 [*Apolymetis*]
Burch & Burch, 1943: 16, 24 (text figure)
Burch, 1945a: 4 (text figure), 9-10, 24 (text figure); 1945b: 16; 1945c: 30
Durham, 1950: 89-90, 169, 170; plate 24, figure 1, plate 25, figure 12
Keen, 1958b: 178
Palmer, 1958: 26, 45, 48, 107, 399; plate 14, figure 5

Type Material:

Tellina obesa – BM(NH) without registry number, lectotype herein, the pair with more flexuous posterior-ventral margin (as seen from inside), 83 mm; paralectotype, slightly smaller pair. Plate 3, Figure *17*.

Tellina turgida – BM(NH) 1967577, holotype, pair, about 75 mm. Plate 3, Figure *18*.

Tellina alta and *Scrobicularia biangulata* – BM(NH) 1861. 5.20.117, holotype of both species, pair, 45 mm. Carpenter was not aware that this specimen was Conrad's type. Plate 3, Figure *19*.

Type Localities:

Tellina obesa – "China Seas," presumably in error; Cuming Collection. Probably from southern California.

Tellina turgida – "Catbalonga; Philippines," presumably in error; Cuming Collection. Probably from southern California.

Tellina alta and *Scrobicularia biangulata* – Santa Barbara, California; T. Nuttall.

Nomenclatural Commentary:

Keen (1966a) discussed the history of the two Deshayes species. As in other such cases in the present study, workers on this coast would prefer to adopt so-called *nomina oblita*, rather than petition for the conservation of more widely used names. The second-occurring Deshayes name has been chosen because of the uses (evidently in error) of *Tellina turgida* in the Philippines and in the Indian Ocean. There seem to be species that resemble *Leporimetis obesa*, one in the Indo-Pacific and one in South Africa, both rare and poorly understood.

Description:

Large (to 100 mm); ovate; inflated; heavy; somewhat longer posteriorly; beaks prominent; rounded anteriorly; rounded, slightly truncate, folded posteriorly; sculpture of low ribs and undulations; traces of dark periostracum present; mostly yellow within, rarely white. Internal details as in Text figure 8.

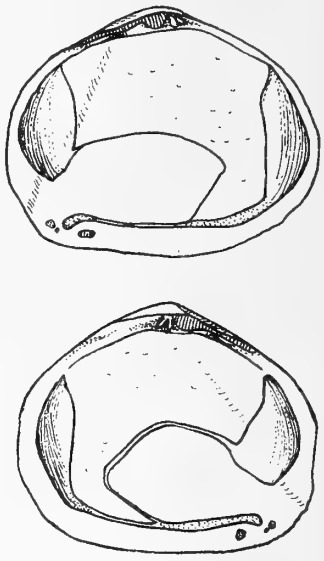


Figure 8
Leporimetis obesa, internal view of valves
MCZ 199410, Newport Bay, California; 51 mm

Geographic Distribution and Ecology:

Point Conception, California (SU 4500), to Bahía Magdalena, Baja California Sur (Berry Collection 24737; SDNHM 22626), with several intermediate records. Spe-

Explanation of Plate 4

Figure *21*: *Macoma calcarea*. Original illustration of *Tellina lata*; 47 mm

Figure *22*: *Macoma calcarea*. Original illustration of *Tellina proxima*; 24 mm

Figure *23*: *Macoma calcarea*. Holotype of *Macoma sitkana*, US NM 108656; 41.6 mm

Figure *24*: *Macoma calcarea*. Holotype of *Macoma calcarea obliqua*, Zoologisk Museum, University of Oslo; 46.5 mm

Figure 21

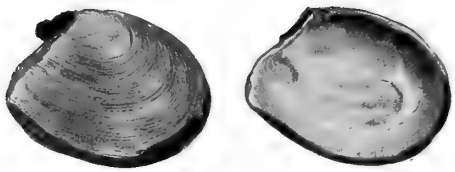


Figure 22

Figure 23

Figure 24

cimens in collections from San Francisco (MCZ 257633), Pacific Grove (SBMNH K9), and Guaymas (UCLA 24185) probably represent labeling errors. This species is found in bays, or below wave line on open, protected coast, in the intertidal area to 46 m, in sand (Burch, 1945a).

Material seen: 92 lots.

Geologic Distribution and Biogeography:

This species has a long and well documented history in the eastern Pacific. It is known in the late Pleistocene from Tomales Bay, California (Dickerson, 1922; Addicott, 1966), to Bahía Magdalena, Baja California Sur (Dall, 1918; Smith, 1919; Jordan, 1924, 1936). There is a record in the Pleistocene (undifferentiated) of Las Islas Tres Marías, Nayarit (Hertlein, 1934).

There are records from the early Pleistocene of the San Pedro area, California (Arnold, 1903; T. Oldroyd, 1925; Burch, 1947; Clark, *in* Natland, 1957), and many records in southern Californian formations transitional between the Pleistocene and the Pliocene, as well as several Pliocene records. It is also known from the Miocene and seems to be the same as *Arcopagia medialis* Conrad, 1857a, from the Miocene of Monterey County, California, and *A. unda* Conrad, 1857d, from the Miocene of Santa Barbara County, California. Other species described in the genus from the Tertiary of the eastern Pacific may not be related.

I know of no similar Asian forms. The affinities of this species seem closest to two currently living in the Panamic province and to the one in the Caribbean. It is closest to *Leporimetis cognata* (Pilsbry & Vanatta, 1902), which occurs from Bahía Magdalena, throughout the Gulf of California, to northern Peru (Olsson, 1961). *Leporimetis obesa* differs from *L. cognata* in being larger, heavier, yellow within, having a heavier hinge, and in lacking radial threads.

Macoma Leach, 1819

[Type species: *Macoma tenera* Leach, 1819, by monotypy; = *Tellina calcarea* Gmelin, 1791]

Into the genus *Macoma* are placed, pending a revision of the family, those forms lacking lateral hinge teeth. A majority of the species are relatively more rounded than *Tellina,* more inflated, smooth, white, often chalky, and are chiefly arctic and sub-arctic.

It is difficult to pick key characters for species of *Macoma,* as nearly every feature chosen is gradational, and exceptions can be found. In the following key, qualitative and sometimes relative rather than quantitative choices are emphasized, and interpretations of terms may create some difficulty. Certain figures are cited for the preliminary choices to aid in decision making. In this dichotomous key, which works best with live-collected, adult specimens, a balance of several characters is used to distinguish, for the most part, between what I believe to be natural groups. Of necessity, some species are keyed out twice. *Macoma frigida* is not included because of its uncertain West American occurrence.

1a. Anterior ventral edge of pallial sinus detached and more or less paralleling pallial line for at least ¼ of way to posterior adductor muscle scar (true of both valves) (Figure 9) 2
1b. Anterior ventral end of pallial sinus not detached from pallial line for a substantial distance, although it may overlap slightly near point of juncture (usually in one valve only) (Figure 28) 18
2a. Very thin, fragile *and* inflated; periostracum thin, never thick; rounded to ovate (Plate 9, Figure *50*) 3
2b. Thick to thin, but not markedly thin; may be somewhat inflated; periostracum thick to thin (Plate 5, Figure *26*) 4
3a. Produced to quadrate posteriorly; left valve flexed; conspicuously more inflated anteriorly ..... *Macoma carlottensis*
3b. Rounded to only slightly quadrate posteriorly; left valve not flexed; anterior end only slightly more inflated ..... *Macoma leptonoidea*
4a. Pallial sinuses approximately equal in size and short, reaching about ⅔ of way to anterior adductor muscle scar *and* periostracum shiny, thin (Figure 25) 5
4b. Pallial sinuses unequal in size, that in left valve longer, often reaching almost to anterior adductor muscle scar; periostracum dark, silky or shiny (if sinuses subequal, periostracum not shiny) (Figure 9) 8
5a. Large (over 30 mm); tendency to form a posterior dorsal flange 6
5b. Small (under 30 mm); not flexed posteriorly; no such flange present 7
6a. With a conspicuous posterior flexure; often produced posteriorly; elongate ..... *Macoma indentata* (place 1)
6b. Quadrate posteriorly, not strongly flexed or produced; ovate ..... *Macoma secta* (place 1)
7a. Rostrate posteriorly; longer anteriorly *Macoma yoldiformis*
7b. Produced posteriorly, not rostrate; longer anteriorly to equilateral ..... *Macoma acolasta*
8a. Small (usually under 30 mm); thin; periostracum dark or shiny; elongate to rounded (shell, if thick, decidedly small or periostracum decidedly shiny) (Plate 7, Figure *36*) 9
8b. Medium-sized to large (over 30 mm); thick; periostracum dark to silky, never shiny (shell, if thin, decidedly elongate, not rounded) (Plate 4, Figure *23*) 13
9a. Rather inflated; rounded to oval; periostracum dull 10
9b. Not inflated; oval to elongate; periostracum shiny 11
10a. Oval, not quadrate posteriorly; more inflated *Macoma loveni*
10b. Quadrate posteriorly; less inflated ..... *Macoma crassula*
11a. Heavier; larger (mostly over 25 mm); pointed posteriorly ..... *Macoma lama* (place 1)
11b. Thinner; smaller (under 25 mm); posterior end more rounded 12

12a. Flattened; rounded postero-dorsally; Arctic to Shelikof Strait ..... *Macoma moesta moesta*
12b. More inflated, especially anteriorly; no postero-dorsal rounding; Shelikof Strait to Puget Sound *Macoma moesta alaskana*
13a. Rotund to triangular; pallial line often striose (Figure 14) 14
13b. Oval to elongate; pallial line only slightly striose, if at all (Figure 10) 15
14a. Rotund; moderately inflated; almost equilateral, with posterior end slightly shorter ..... *Macoma obliqua*
14b. Triangular; flattened; posterior end conspicuously shorter ..... *Macoma middendorffi*
15a. With a conspicuously beveled escutcheon *Macoma elimata*
15b. Without an escutcheon 16
16a. Produced posteriorly and slightly pointed, with ventral posterior margin upturned; relatively thinner and smaller (mostly less than 50 mm) than next two species ..... *Macoma calcarea*
16b. Posterior end quadrate to rounded, not produced; ventral posterior margin not upturned; relatively heavier and larger (over 50 mm) than the above 17
17a. Posterior end rounded; thick ..... *Macoma lipara*
17b. Posterior end quadrate; thinner ..... *Macoma brota*
18a. Pallial sinuses reaching to or almost to anterior adductor muscle scars (Figure 28) 19
18b. Pallial sinuses terminate only $\frac{1}{2}$ to $\frac{3}{4}$ of way to anterior adductor muscle scars (Figure 27) 20
19a. Pallial sinus in left valve nearly always reaching center of anterior adductor muscle scar and fusing with it; twisted to right posteriorly ..... *Macoma nasuta*
19b. Pallial sinuses do not reach or reach only to bases of anterior adductor muscle scars; equivalve, not twisted posteriorly ..... *Macoma inquinata*
20a. Pallial sinuses unequal; thick, shiny periostracum present; posterior end usually shorter, its dorsal and ventral slopes even; thick ..... *Macoma lama* (place 2)
20b. Pallial sinuses about equal; periostracum thin, less shiny; equilateral or posterior end longer (rarely shorter), its dorsal slope often broken by a flange or its ventral one by an indentation; thick to thin 21
21a. Small (usually under 30 mm); with no tendency to form postero-dorsal flange; often thick and rounded; often reddish ..... *Macoma balthica*
21b. Large (over 30 mm); with tendency to form postero-dorsal flange 22
22a. Very thin, inflated; rounded posteriorly; flange only slightly developed ..... *Macoma expansa*
22b. Heavy; produced or quadrate posteriorly; flange conspicuous 23
23a. With a conspicuous posterior flexure; often produced posteriorly; elongate ..... *Macoma indentata* (place 2)
23b. Quadrate posteriorly, not strongly flexed or produced; ovate ..... *Macoma secta* (place 2)

(Macoma) Leach, 1819

Small to large in size (20 to 100 mm); medium in thickness to heavy; moderately inflated; equivalve or with left valve somewhat larger; rounded to elongate; equilateral to longer anteriorly; rounded anteriorly; rounded to broadly truncate, twisted to right posteriorly; periostracum dark, silky, or shiny; beveled escutcheon present in some species; pallial sinuses long, longer in left valve, detached from pallial line along much of their length.

Species group of *Macoma (Macoma) calcarea* (Gmelin)

Medium-sized to large in size (30 to 60 mm); chalky to smooth; periostracum dark to silky, rarely shiny.

Macoma (Macoma) calcarea (Gmelin, 1791)

(Plate 3, Figure *20*; Plate 4, Figures *21 - 24*; Plate 5, Figure *25*; Text figure 9)

Tellina calcarea Gmelin
[Chemnitz, 1782: 140; plate 13, figure 136 – non-binomial]
Gmelin, 1791: 3236
Carpenter, 1857b: 221, 232
Carpenter, 1864a: 584, 639 [*Macoma*, synonym of *M. lata*] [1872: 70, 125]
Dall, 1900a: 299, 307
Dall, 1900b: 1046
Oldroyd, 1924: 53, 209; plate 10, figure 2 [figure is of *M. brota*]
I. Oldroyd, 1925: 173-174; plate 42, figure 5 [figure is of *M. brota*]
Grant & Gale, 1931: 369-370 [in part only]
Burch & Burch, 1943: 19-20
Burch, 1945a: 11; 1945b: 17
Soot-Ryen, 1958: 24
MacGinitie, 1959: 181-182; plate 24, figures 5-7, plate 26, figures 6-9
Ockelmann, 1959: 125-128; plate 2, figure 10
Dunnill & Coan, 1968: 8-17; figures 5-10
Dunnill & Ellis, 1969: 10-13, 33; figures 4(1), 9(e)
Tellina lata Gmelin [First Reviser: probably Dall, 1900a]
[Lister, 1687: plate 407, figure 253 – pre-Linnaean]
Gmelin, 1791: 3237
Middendorff, 1849: 578, 601; plate 8, figures 8-10
Middendorff, 1851: 257-258; plate 23, figures 1-5
Carpenter, 1857b: 219, 221, 223, 301

Explanation of Plate 5

Figure *25*: *Macoma calcarea*. Holotype of *Macoma calcarea longisinuata*, Zoologisk Museum, University of Oslo; 33.4 mm
Figure *26*: *Macoma elimata*, holotype, NMC 46070; 27.2 mm
Figure *27*: *Macoma brota*. Original illustration (lectotype herein) of *Tellina edentula*; 53.2 mm
Figure *28*: *Macoma brota*, CASGTC 13620; CAS locality 20463. Unalaska Island, Aleutian Islands, Alaska; 75 mm

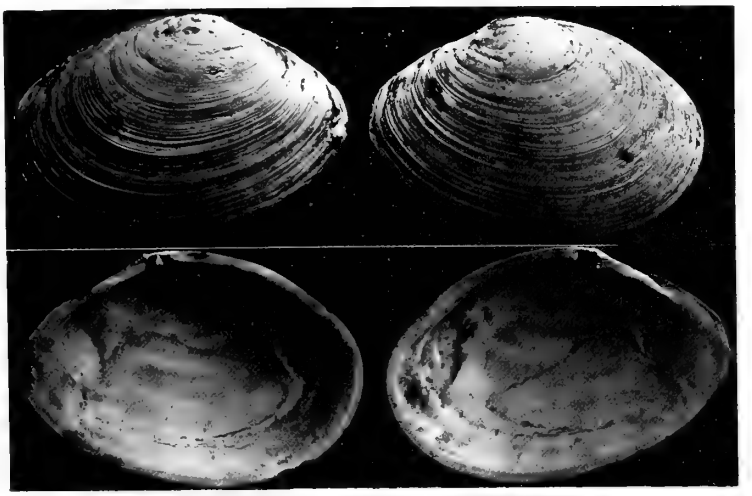


Figure 25

Figure 26

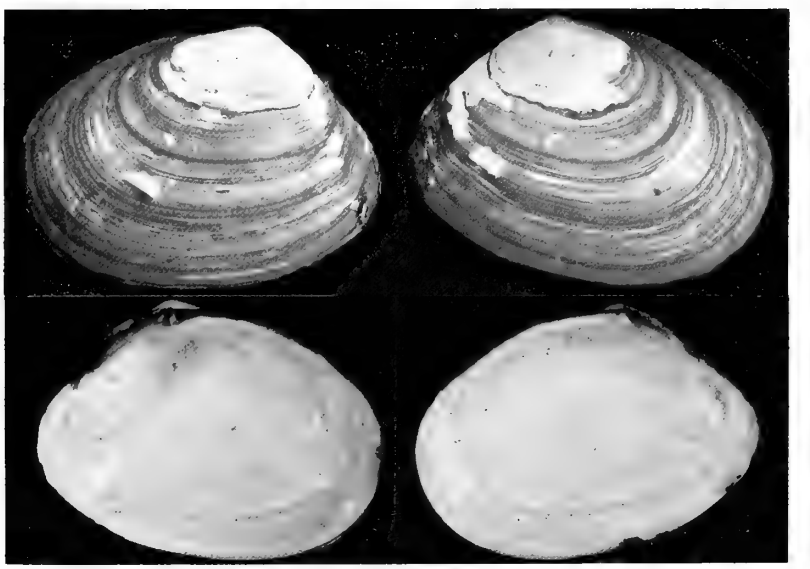


Figure 27

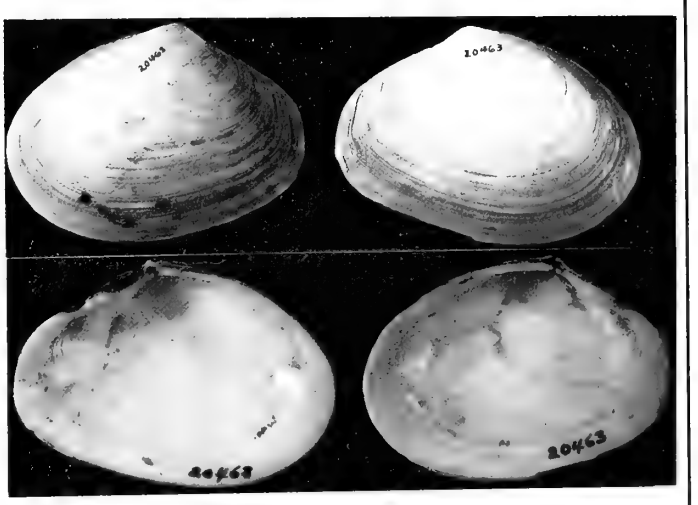


Figure 28

Carpenter, 1864a: 584, 602, 639 [*Macoma*] [1872: 70, 88, 125]
Krause, 1885: 37-38
Dall, 1900a: 299

Tellina proxima Sowerby, in Gray, *ex* Brown MS
Sowerby, in Gray, 1839: 154; plate 44, figure 4
Carpenter, 1857b: 178, 221
Carpenter, 1864a: 584, 602 [*Macoma*] [1872: 70, 88]

Tellina lata nasuta Middendorff, 1849, not *Tellina nasuta* Conrad
Middendorff, 1849: 578
[not Conrad, 1837: 258-259]

Macoma sitkana Dall
Dall, 1900a: 307, 323, 326; plate 4, figures 6, 7
I. Oldroyd, 1925: 171
Burch, 1945a: 11; 1945b: 17

Macoma calcarea obliqua Soot-Ryen, not *M. obliqua* (Sowerby)
Soot-Ryen, 1932: 15-17, 36; plate 2, figures 4-6
[not Sowerby, 1817: 137-138; plate 161, figure 1]

Macoma calcarea sootryeni Petrov, *ex* Scarlato, 1953 MS (unpublished thesis), new name for *M. calcarea obliqua* Soot-Ryen, not of (Sowerby)
Petrov, 1966: 230

Macoma calcarea longisinuata Soot-Ryen
Soot-Ryen, 1932: 17, 36; plate 2, figures 1-3

Type Material:

Tellina calcarea – Based on Chemnitz' figures, but the type specimen cannot be found in the Zoologiske Museum, University of Copenhagen (Knudsen, in correspondence). The figure measures 28.3 mm long and unfortunately is not a good representation of the species. Plate 3, Figure *20*.

Tellina lata – The figure in Lister (1687) is 47 mm long and of sufficient quality to identify the taxon. This specimen seems not to be extant in the Zoological Collections, University Museum, Oxford University (Hull, in correspondence). Plate 4, Figure *21*.

Tellina proxima – Lost (Keen, verbal communication). The figure is 24 mm long and is adequate to allocate the name. Plate 4, Figure *22*.

Tellina lata nasuta – Probably in Zoological Institute, Leningrad; inquiries there remain unanswered.

Macoma sitkana – USNM 108656, holotype, pair, 41.6 mm. Plate 4, Figure *23*.

Macoma calcarea obliqua – Zoologisk Museum, University of Oslo, holotype, pair, 46.5 mm. Plate 4, Figure *24*.

Macoma calcarea longisinuata – Zoologisk Museum, University of Oslo, holotype, pair, 33.4 mm. Plate 5, Figure *25*.

Type Localities:

Tellina calcarea – Iceland and Faeroe Islands.

Tellina lata – "Norwegian Sea."

Tellina proxima – "Arctic Ocean," presumably the Alaskan coast; voyage of the *Blossom*.

Tellina lata nasuta – Several localities given by Middendorff; one from northwestern Russia is listed first.

Macoma sitkana – Sitka Harbor, Alaska; W. H. Dall, 27 m.

Macoma calcarea obliqua – Station 9, northwest of Ostrov Vrangelya, East Siberian Sea (73°15′ N, 175°30′ E), 44 m.

Macoma calcarea longisinuata – Station 30, north of Ostrov Kotel'nyy, Novosibirskiye Ostrova (76°34′ N, 139°00′ E), 20 m.

Nomenclatural Commentary:

For an author to have been considered the "first reviser" of the two Gmelin species, he would have had to cite both as being *of* Gmelin, or mentioned both of Gmelin's usages in his synonymies, considered them to represent the same species, selected one of the names to stand as the name of the species, and relegated the other to synonymy. Since it was not until comparatively recent times that Chemnitz' species were considered to have been validated only by later authors, the first publication meeting all of these requirements seems to be Dall (1900a).

The species exhibits considerable variation, and it is possible that the situation is more complex than that represented by one circum-arctic name. For instance, there are some very large specimens in collections from the Bering Sea (CAS 20455, 60 mm), much larger than any Atlantic material I have seen. These may represent something else, or perhaps even hybrids with *Macoma brota* Dall. As is the case with many arctic species, this problem ought to be approached statistically from a world-wide viewpoint. Until this is done, I have chosen to be nomenclaturally conservative. There is little question that *M. sitkana* should be regarded as a synonym, more question about *M. calcarea sootryeni* and *M. calcarea longisinuata*.

This species has occasionally been cited as *Macoma sabulosa* (Spengler, 1798), a European synonym.

Description:

Medium-sized (to 55 mm, rarely to 60 mm); ovate-elongate; moderately inflated; fairly thin; rounded anteriorly; pointed, slightly truncate posteriorly; ventro-posterior margin upturned; chalky-white externally, with remnants of thin, dark periostracum ventrally in adult;

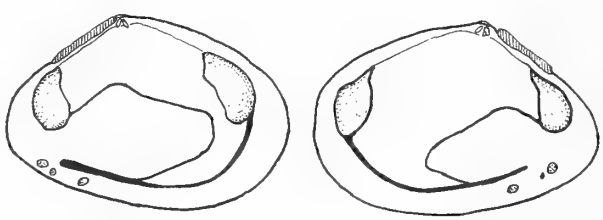


Figure 9
Macoma calcarea, internal view of valves
USNM 223783, north of Unimak Island, Alaska; 47 mm

periostracum shiny in juvenile; pallial sinuses detached from pallial line, that in left valve larger. Other internal details as in Text figure 9.

Geographic Distribution and Ecology:

Circum-arctic; throughout the Bering Sea, the Aleutian Islands, southern Alaska, British Columbia, and south to Victoria (ANSP 65841) and Sooke, Vancouver Island, British Columbia (SU 52025). I have seen no specimens from Washington. *Macoma calcarea* occurs in numbers of up to 226 per m² from 2 to 320 m, most common over 50 m, in silty-sand to sand (Soot-Ryen, 1958; Ockelmann, 1959; MacGinitie, 1959; Dunnill, 1968; Dunnill & Ellis, 1969).

Material seen: 169 West American lots.

Geologic Distribution and Biogeography:

In the Pleistocene, this species is known from the Arctic coast of the Northwest Territories (Dall, 1919, 1924), Arctic Alaska (Meek, 1923), Saint Paul Island (Dall, 1899), the Kenai Peninsula (Twenhofel, 1952, as *"cf."*), Middleton Island (Miller, 1953, as *"cf."*), southeastern Alaska (Dall, 1904; Knopf, 1912; Chapin, 1918; Smith, 1919; Twenhofel, 1952); British Columbia (Newcombe, 1914; Smith, 1919; Crickmay, 1925, 1929b; Draycot, 1951; Armstrong & Brown, 1954; Wagner, 1960), and the Puget Sound area, Washington (Arnold & Hannibal, 1913; Hertlein & Crickmay, 1925; Henderson, 1927), although the last records should be reëxamined and some may prove to be of the next species.

There are records from the Pliocene of Alaska and California, the Miocene of Alaska and Oregon, and the Oligocene of Washington. An ancestral form may be *Macoma arctata* (Conrad, 1849), from the Miocene of Astoria, Oregon, which is very similar to *Tellina arctata juana* Reagan, 1908, from the Miocene of Washington; *M. arctata wynoocheensis* Weaver, 1912, from the Miocene of Oregon; and *M. twinensis* Clark, 1925, from the Oligocene of Washington.

This species evidently had its origin in the northern Pacific basin and reached the northern Atlantic only during the last period of submergence of the Bering Strait area, as it is unknown earlier than Pleistocene in the northern Atlantic (Richards, 1962; British Museum [Natural History], 1963).

Macoma orientalis Scarlato, *in* Golikov & Scarlato, 1967, from Siberia to northern Japan, is a western Pacific relative of this species. It differs in being thinner, more inflated, more expanded antero-dorsally, more rounded posteriorly, and in having a more shiny, adherent periostracum. The pallial sinus is directed more dorsally.

Macoma (Macoma) elimata Dunnill & Coan, 1968

(Plate 5, Figure *26*; Text figure 10)

Macoma elimata Dunnill & Coan
Dunnill & Coan, 1968: 1-11; figures 2-6
Dunnill & Ellis, 1969: 11, 15-16, 33; figures 4 (2), 9 (f)
Macoma calcarea (Gmelin), of authors, not of Gmelin
[not Gmelin, 1791: 3236]
Arnold, 1903: 161, 394; plate 16, figure 2 [but not the figure?]
Woodring, Bramlette & Kew, 1946: 84, plate 33, figure 6

Type Material:

NMC 46070, holotype, pair, 27.2 mm; paratypes widely distributed. Plate 5, Figure *26*.

Type Locality:

North end of Moresby Island, Satellite Channel, Vancouver Island, British Columbia; R. M. Dunnill, 54 m, silty-sand.

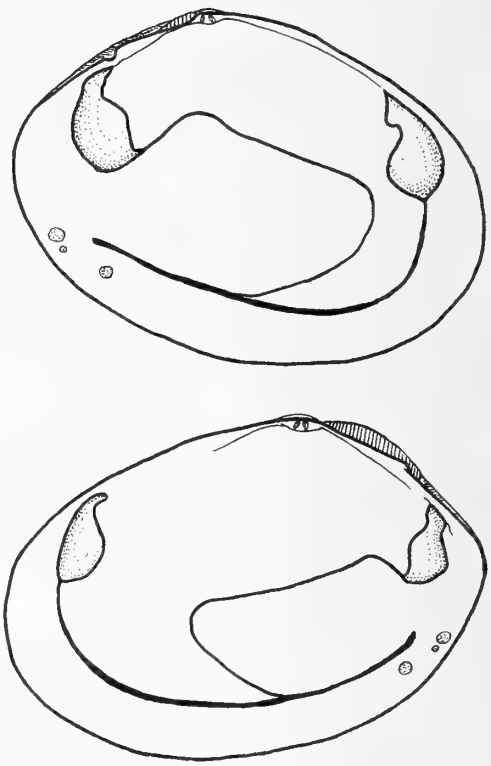


Figure 10

Macoma elimata, internal view of valves
USNM 108672, north end of Vancouver Island, British Columbia
35.3 mm

Nomenclatural Commentary:

This species has been reported from the Pleistocene of southern California in error, as *Macoma planiuscula* Grant & Gale, 1931.

Description:

Medium-sized (to 33 mm); elongate; moderately inflated; thin; longer, rounded anteriorly; truncate posteriorly; postero-dorsal margin straight, with a conspicuously beveled escutcheon; periostracum thin, greenish-gray, little eroded; pallial sinuses detached from pallial line, that in left valve larger. Other internal details as in Text figure 10.

Geographic Distribution and Ecology:

Craig (UCLA 20512) and Ketchikan (UCLA 20514), Alaska, to Redondo Beach, California (LACM A4052; SU unnumbered). It has been found in numbers up to 217 per m² in 9 to 435 m, most common over 50 m; in silty-sand to sand (Dunnill, 1968; Dunnill & Coan, 1968; Dunnill & Ellis, 1969).

Material seen: 65 lots.

Geologic Distribution and Biogeography:

There are no certain records in the late Pleistocene. Those of Crickmay (1929a) at Deadman Island, San Pedro, California, were derived from reworked early Pleistocene material. There are many records in the early Pleistocene, from Santa Barbara, California (Keen & Bentson, 1944), to the San Pedro area, California (Willett, 1937; T. Burch, 1947), in which it has been reported as *Macoma calcarea, M. planiuscula,* or *M. nasuta.* There is also material in those southern Californian formations transitional between Pliocene and Pleistocene. I have studied material from each of these areas.

The species may be related to *Macoma albaria* (Conrad, 1849), from the Miocene of Oregon. *Tellina obruta* Conrad, 1848, from the same formation, may be an earlier synonym. If I am correct about these relationships, specimens of this species-complex do not have a beveled escutcheon before the early Pliocene.

Macoma (Macoma) brota Dall, 1916

(Plate 5, Figures *27, 28*; Text figure 11)

Macoma brota Dall, new name for *Tellina edentula* Broderip & Sowerby, not of Spengler
Dall, 1916a: 36 [*nomen nudum*]
Dall, 1916b: 413
Oldroyd, 1924: 52-53
I. Oldroyd, 1925: 170-171; plate 9, figure 2
Grant & Gale, 1931: 368
Burch & Burch, 1943: 19
Burch, 1945a: 10-11; 1945b: 17; 1945c: 30
Dunnill & Ellis, 1969: 8-10, 33; figures 3 (2), 9 (a)

Tellina edentula Broderip & Sowerby, not of Spengler
Broderip & Sowerby, 1829: 363
Sowerby, in Gray, 1839: 154; plate 41, figure 5, plate 44, figure 7
Carpenter, 1857b: 175, 195, 219, 223, 301
Carpenter, 1864a: 526, 584, 600, 627, 639 [*Macoma*] [1872: 12, 70, 86, 113, 125]
Krause, 1885: 37
Dall, 1900a: 307
[not Spengler, 1798: 96-97]

Type Material:

Tellina edentula – Lost, according to Dr. Keen. Since the two figures given by Sowerby, in Gray (1839) are somewhat different from each other, I select plate 44, figure 7 as lectotype. This figure measures 53.2 mm in length, and it is the closer of the two to the "type" of Dall's *Macoma brota,* USNM 108668. Plate 5, Figure *27.*

Type Locality:

Bering Strait, Alaska; voyage of the *Blossom.*

Nomenclatural Commentary:

See next species.

Description:

Large (to 65 mm); ovate to ovate-elongate; moderately inflated; rather heavy; longer, rounded anteriorly; broadly truncate posteriorly; periostracum thin, dark to silky, present only as ventral fragments in adult; pallial sinuses detached from pallial line, that in left valve somewhat larger (Plate 5, Figure *28*). Other internal details as in Text figure 11.

Geographic Distribution and Ecology:

Bathurst Inlet, Mackenzie, Arctic Canada (MCZ 192915), along the entire eastern shore of Bering Sea, through the Aleutian Islands, as far east as Adak Island (USNM 108612), south coast of Alaska, British Columbia, to Puget Sound, Washington (USNM 184278 and several other lots). It is found in numbers of up to 75 per m² from 14 to 260 m, most common over 35 m in silt to sand (Dunnill, 1968; Dunnill & Ellis 1969).

Material seen: 102 lots.

Geologic Distribution and Biogeography:

Macoma brota has been reported in the Pleistocene of the Canadian Arctic (Dall, 1919, 1924) and southwestern British Columbia (Crickmay, 1925, 1929b). It seems

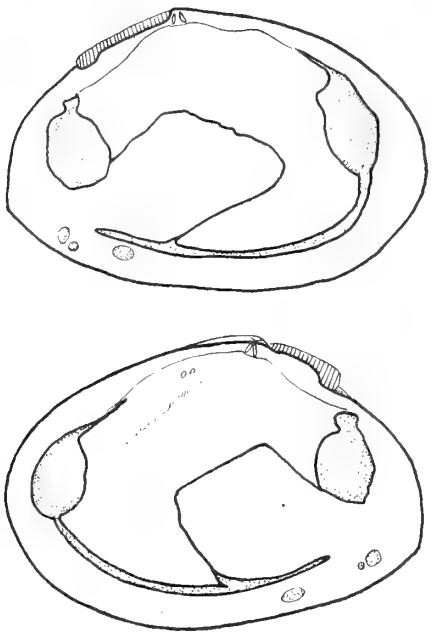


Figure 11

Macoma brota, internal view of valves
USNM 108664, southeast of Alaska Peninsula, Alaska; 69 mm

to be closely related to *M. astori* Dall, 1909, from the Pliocene of Coos Bay, Oregon. The latter has also been reported from the Miocene. This Miocene material ought to be compared with *M. grewingkii* Dall, 1904, from southern Alaska. Grewingk's figure (plate 7, figure 1) seems to be drawn backwards with regard to the position of the pallial sinus.

An Oligocene ancestor of this Miocene species may be *Macoma lorenzoensis* (Arnold, 1908) from central California, which may be synonymous with *M. lorenzoensis arnoldi* Tegland, 1933, from the Oligocene of Washington. There may be some relation of these last to *Tellina benedenii* Nyst & Westendorp, 1839, from the Pliocene and Pleistocene of Europe, even though the latter has lateral teeth.

It is possible that *Macoma brota* represents populations that were "trapped" north of Bering Strait when it closed in the early Pliocene. If this species is related to *Tellina benedenii,* then the loss of lateral teeth took place later in eastern Atlantic-Arctic populations than it did in populations remaining in the Pacific.

Macoma (Macoma) lipara Dall, 1916

(Plate 6, Figure *29*; Text figure 12)

Macoma brota lipara Dall
DALL, 1916a: 36 [*nomen nudum*]
DALL, 1916b: 414
OLDROYD, 1924: 53, 209; plate 10, figure 1
I. OLDROYD, 1925: 171; plate 42, figure 6
GRANT & GALE, 1931: 368-369
BURCH & BURCH, 1943: 19
BURCH, 1945a: 11; 1945b: 17
DUNNILL & ELLIS, 1969: 9, 24, 26-27, 33; figures 3 (1), 9 (b)

Type Material:
USNM 223032, holotype, pair, 72.7 mm. Plate 6, Figure *29.*

Type Locality:
Off Fort Rupert, Queen Charlotte Strait, Vancouver Island, British Columbia; USFC 4201, about 259 m, in mud.

Nomenclatural Commentary:
GRANT & GALE (1931) suggested that *Macoma astori* Dall, 1909, from the Pliocene of Coos Bay, Oregon, might be an older name for this species. I do not concur.

Description:
Large (to 75 mm); ovate; moderately inflated; heavy for size; somewhat longer, rounded anteriorly; rounded posteriorly, with only a slight degree of truncation; periostracum very thin, silky to shiny; pallial sinuses detached from pallial line, that in left valve larger. Other internal details as in Text figure 12.

Geographic Distribution and Ecology:
There seems to be an isolated population in the southeastern corner of the Bering Sea (USNM 210287, 212948).

Explanation of Plate 6

Figure *29*: *Macoma lipara,* holotype, USNM 223032; 72.2 mm
Figure *30*: *Macoma middendorffi,* lectotype (herein), USNM alcoholic type collection 40945; 58.9 mm
Figure *31*: *Macoma obliqua.* Lectotype (herein) of *Tellina obliqua,* BM(NH) Fossil Mollusca Section 43058; 45.6 mm
Figure *32*: *Macoma incongrua.* Lectotype (herein) of *Tellina incongrua,* Zoologisches Museum, Humboldt-Universität 7624; 24.4 mm

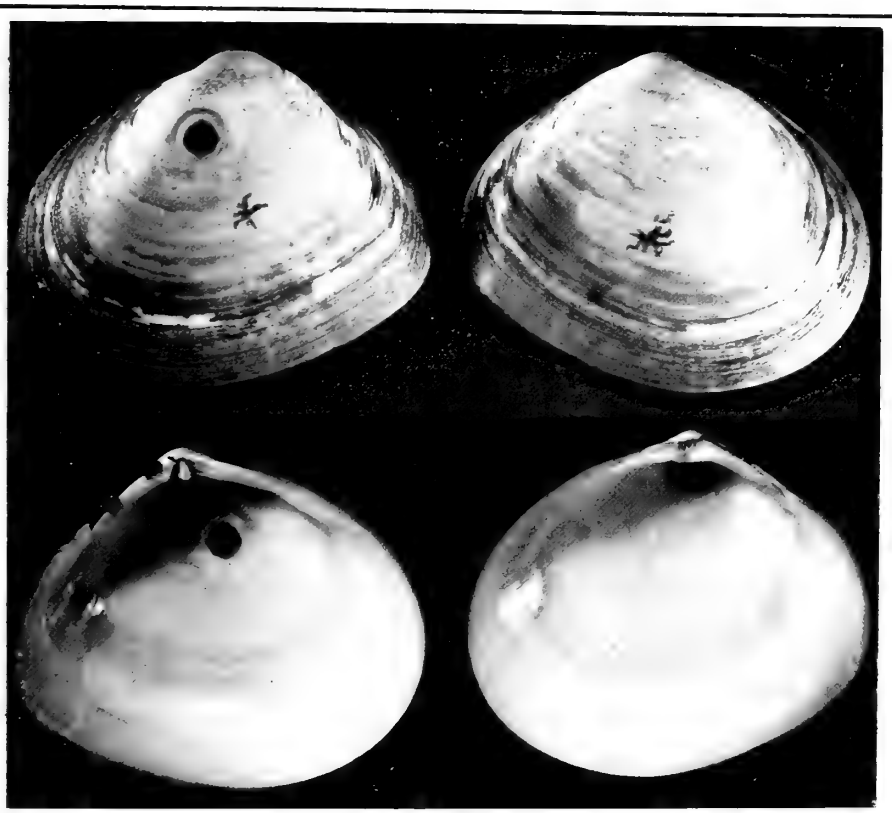


Figure 32

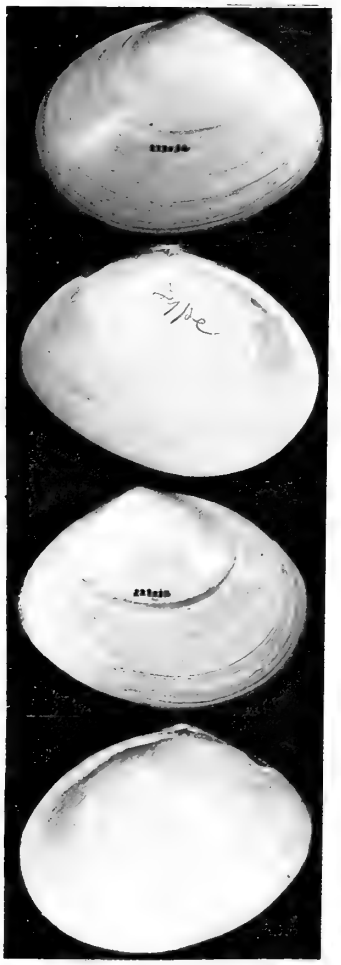


Figure 29

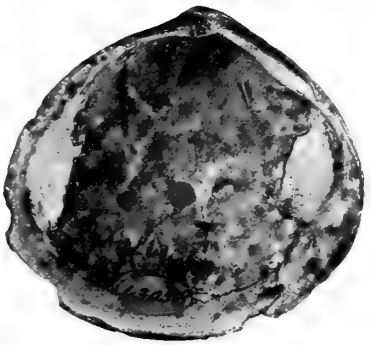


Figure 31

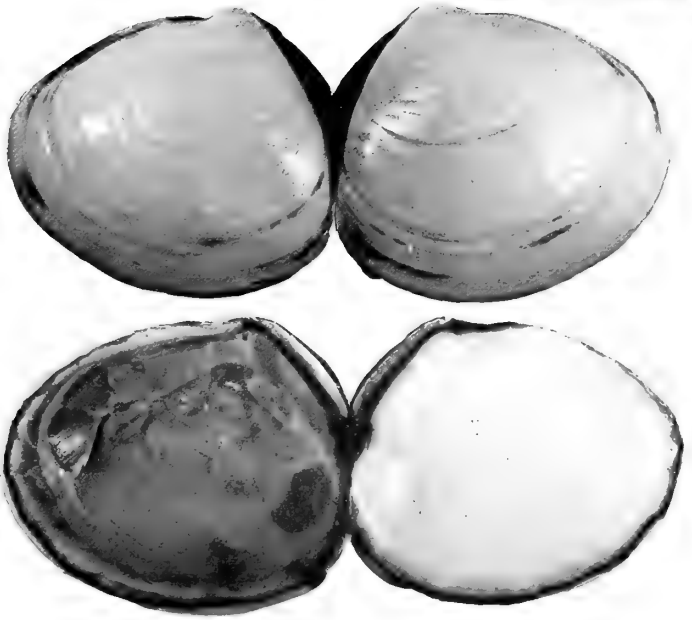


Figure 30

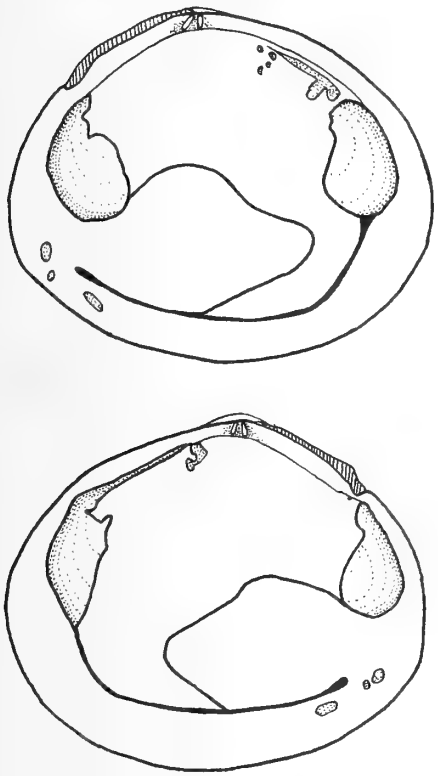


Figure 12

Macoma lipara, internal view of valves
MCZ 223485, Malcolm Island, British Columbia; 70 mm

The latter of these two lots seems to be intermediate between this species and *Macoma brota*. This situation requires additional investigation. The main distribution is from Port Etches (USNM 108697) and Galena Bay (LACM 5498), Alaska, to Eureka, California (Talmadge Collection). There is one lot from Cordell Bank, near San Francisco, California (CAS 33047), but this may be fossil. It has been found in numbers of up to 23 per m² from 26 to 259 m, especially over 40 m, in silt to fine sand (Dunnill, 1968; Dunnill & Ellis, 1969).

Material seen: 32 lots.

Geologic Distribution and Biogeography:

There are no records of this species in the Pleistocene, except that of Addicott (1966) in central California, the specimen having been derived from the Pliocene Purisima formation by reworking. Like the preceding species, this seems allied to, but not identical with *Macoma astori* Dall, 1909, from the Pliocene of Oregon.

Macoma (Macoma) middendorffi Dall, 1884

(Plate 6, Figure *30*; Text figure 13)

Macoma "(edentula?)" middendorffi Dall [*middendorffii* of authors, a misspelling]
Dall, 1884: 347, 348
Dall, 1886: 308-309; plate 4, figure 11
Dall, 1900a: 306
I. Oldroyd, 1925: 170; plate 53, figure 1
Grant & Gale, 1931: 372-373
Burch, 1945a: 10; 1945b: 17
Tellina edentula Broderip & Sowerby, of authors, not of Broderip & Sowerby
[not *Tellina edentula* Broderip & Sowerby, 1829: 363]
Middendorff, 1849: 578
Middendorff, 1851: 259-260; plate 21, figure 1

Type Material:

Macoma middendorffi – USNM alcoholic type collection 40945, lectotype herein, pair, 58.9 mm. Plate 6, Figure 30.

Type Locality:

Ostrov Beringa, Komandorskiye Ostrova, Union of Soviet Socialist Republics; L. Stejneger.

Nomenclatural Commentary:

None necessary.

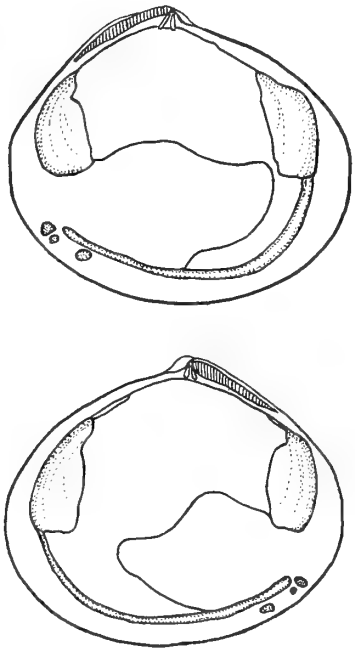


Figure 13

Macoma middendorffi, internal view of valves
USNM 108595, Ostrov Beringa, Komandorskiye Ostrova, U. S. S. R.
56 mm

Description:

Large (to 60 mm); trigonal; flattened; very heavy; somewhat longer, rounded anteriorly; rounded, somewhat truncate posteriorly; sculpture of rounded growth lines; periostracum inconspicuous; pallial sinuses partially detached from pallial line, that in left valve larger; pallial line striose. Other internal details as in Text figure 13.

Geographic Distribution and Ecology:

Point Barrow, Alaska (USNM 207073), the Bering Sea, along the west coast of Alaska, the Aleutian Islands, and in Siberia. Dall's record from Chirikoff Island, Alaska, is based on what appears to be a worn, broken specimen of *Macoma obliqua*. Depth records are from 27 to 32 m, in sand (DALL, 1886).

Material seen: 28 lots.

Geologic Distribution and Biogeography:

This species is known from the Pleistocene of Nome (MOFFIT, 1913; SMITH, 1919; MACNEIL, MERTIE & PILSBRY, 1943) and Kodiak Island (MADDREN, 1919; TWENHOFEL, 1952), Alaska. Records from Oregon (SMITH, 1919; HERTLEIN & CRICKMAY, 1925) probably represent misidentifications. It is also known in the Pliocene and Miocene of Alaska.

It seems closest to *Macoma obliqua* and perhaps represents populations of this species-group that remained in the Bering Sea, when, in the early Pliocene, *M. obliqua* became isolated in the Atlantic-Arctic.

Macoma (Macoma) obliqua (Sowerby, 1817)

(Plate 6, Figure *31*; Plate 7, Figure *33*; Text figure 14)

Tellina obliqua J. SOWERBY, 1817, not of WOOD, 1815 [conserved name, ICZN pending, COAN & SEALY, 1969]
SOWERBY, 1817: 137-138; plate 161, figure 1
WOOD, 1848: 228; plate 21, figures 7a-7d
WOOD, 1874: 152, 216
British Museum (Natural History), 1963: 106; plate 38, figures 7-9
COAN, 1969a: 277-279
[*non* WOOD, 1815: 152; plate 41, figures 4, 5]

Tellina incongrua von Martens, of authors, not of von Martens
[not VON MARTENS, 1865: 430-431]
DALL, 1900a: 306 [*Macoma*]
OLDROYD, 1924: 52, 209; plate 10, figure 5
I. OLDROYD, 1925: 170; plate 42, figure 10
GRANT & GALE, 1931: 373
BURCH & BURCH, 1943: 18-19, 25 (text figure)
BURCH, 1945a: 3 (text figure), 10; 1945b: 17; 1945c: 30
MACGINITIE, 1959: 180
DUNNILL & ELLIS, 1969: 18-21, 33; figures 6 (2), 9 (m)

Type Material:

Tellina obliqua – BM(NH) Fossil Mollusca Section 43058, lectotype herein, larger left valve, 45.6 mm; paralectotype, smaller right valve. Plate 6, Figure *31*.

Tellina incongrua (not a synonym) – Zoologisches Museum, Humboldt Universität, Berlin, 7624, lectotype herein, pair, figured by RÖMER, *in* KÜSTER & RÖMER (1871), 24.4 mm (von Martens' measurement of 33 mm is probably in error); paralectotypes, other specimens in same lot. Plate 6, Figure *32*.

Type Localities:

Tellina obliqua – Red Crag, Suffolk, England; Pleistocene; G. R. Leathes.

Tellina incongrua – Yokohama, Japan.

Nomenclatural Commentary:

Specimens from the eastern Pacific are so very different from specimens from Japan that I initially considered naming the West American form a new species or subspecies. However, in investigating the relationships between the Pacific boreal fauna and that of the Miocene, Pliocene, and Pleistocene of the Atlantic Ocean, I discovered that the eastern Pacific species is identical with *Macoma obliqua* (Sowerby), described from the Red Crag (Pleistocene) of England (COAN, 1969a).

DALL (1900a) suggested that *Tellina rotundata* Sowerby, 1867, might be a synonym of *Macoma incongrua*, but an examination of the holotype showed that it is *M. balthica* (Linnaeus, 1758). Dall also suggested that *M. californiensis* Bertin, 1878, was a synonym. Photographs of the two syntypes of the latter, kindly provided by l'École des Mines, Paris, prove these to be specimens of

Explanation of Plate 7

Figure *33*: *Macoma obliqua*, USNM 223682, Sitka Harbor, Alaska; 40.7 mm

Figure *34*: *Macoma frigida*, lectotype (herein), BM(NH) 1907. 10.28.37-38; about 24 mm

Figure *35*: *Macoma moesta moesta*. Holotype of *Tellina moesta*, BM(NH) without registry number; about 26 mm

Figure *36*: *Macoma moesta moesta*. Lectotype (herein) of *Macoma krausei*, USNM 108606; 22.7 mm

Figure *37*: *Macoma moesta moesta*. Lectotype (herein) of *Macoma oneilli*, NMC 4240; 21.4 mm

Figure *38*: *Macoma moesta alaskana*. Lectotype (herein) of *Macoma alaskana*, USNM 108652; 14.4 mm

Figure *39*: *Macoma crassula*. Holotype of *Tellina crassula*, BM (NH) without registry number; 16 mm

Figure *40*: *Macoma crassula*. Lectotype (herein) of *Macoma inflata*, Redpath Museum 6151; about 13 mm

Figure 33

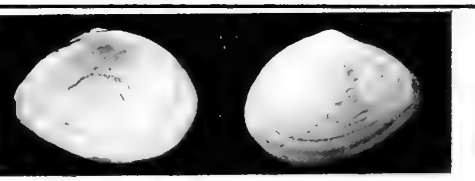


Figure 34

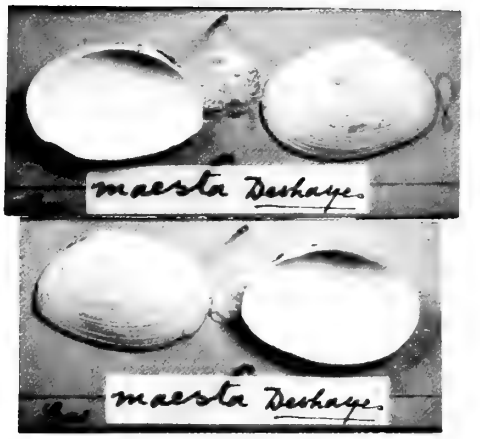


Figure 35

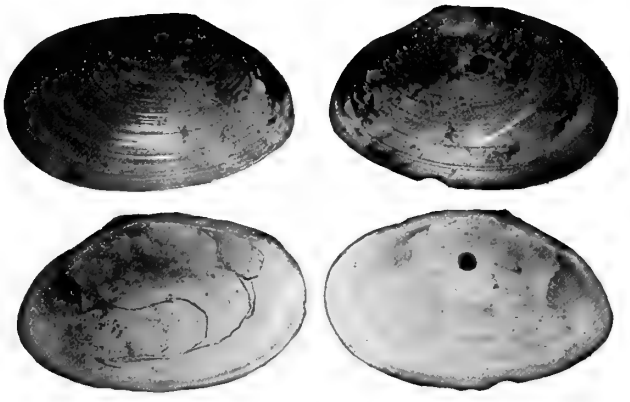


Figure 36

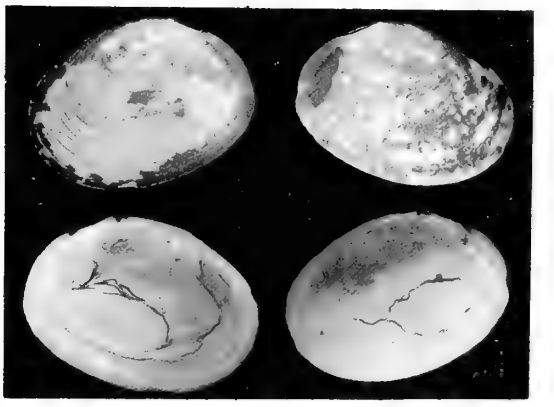


Figure 37

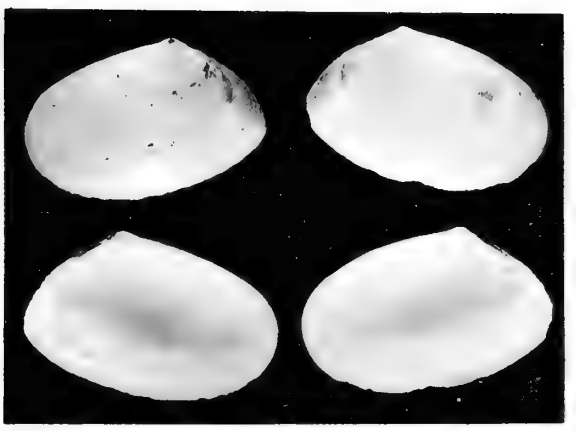


Figure 38

Figure 39

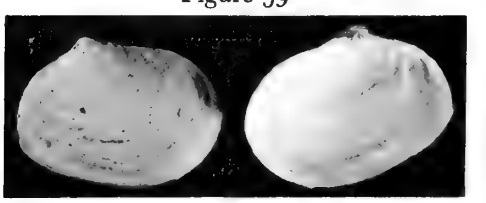


Figure 40

Macalia bruguieri (Hanley, 1844b), mislabeled as to locality, for this species is Asian.

Description:

Medium-sized (to 50 mm); ovate; inflated; heavy; almost equilateral to longer anteriorly; rounded anteriorly; slightly truncate posteriorly; sculpture of rounded growth lines; traces of dark periostracum present throughout;

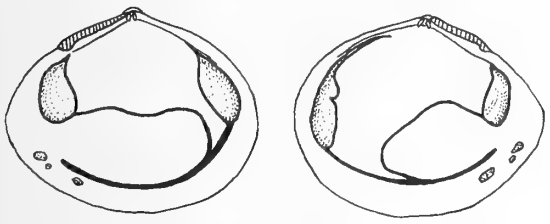


Figure 14
Macoma obliqua, internal view of valves
USNM 223682, Sitka, Alaska; 40.7 mm

pallial sinuses partially detached from pallial line, that in left valve larger; pallial line vertically striated (Plate 7, Figure *33*). Other internal details as in Text figure 14.

Geographic Distribution and Ecology:

Point Barrow, Alaska (USNM 207073), along the western coast of Alaska, throughout the Aleutian Islands as far east as Ostrov Beringa (USNM 108594), along the southern coast of Alaska, British Columbia, and as far south as off the northern portion of the outer coast of Washington (USNM 210313, 207220, 409608). Published records from near San Pedro, California (Mattox, 1955; Bandy, 1958), probably represent identification errors (Jones, in correspondence), possibly of *Macoma carlottensis.* There is, however, one specimen (USNM 209537), a single, worn valve, from off Point La Jolla, California, in about 282 m. Without additional evidence, I would consider this to be either a fossil or a mislabeled lot. It has been taken in numbers of up to 151 per m^2 from the intertidal area to 183 m, especially over 50 m, in gravel to sand (Dunnill, 1968; Dunnill & Ellis, 1969).

Material seen: 203 lots.

Geologic Distribution and Biogeography:

Macoma obliqua is known in the Pleistocene of Nome, Alaska (Moffit, 1913; MacNeil, Mertie & Pilsbry, 1943), southwestern British Columbia, Puget Sound, Oregon (Addicott, 1966), and southern California (Oldroyd & Grant, 1931; Rodda, 1951), with a number of intermediate records.

Members of this species-complex were apparently among the first group of boreal *Macoma* to reach the Atlantic as a result of the late Miocene submergence of Bering Strait. Representatives are apparently *M. lyelli* Dall, 1894, from the late Miocene of Martha's Vineyard, Massachusetts, and *M. cookei* Gardner, 1943, from the late Miocene of Virginia. *Macoma obliqua* is present in the late Pliocene of England and Europe and the Pleistocene of England, Belgium, and Iceland; it has apparently become extinct in the Atlantic since the Pleistocene.

In the Recent fauna it is closest to *Macoma incongrua,* which occurs from the Kurile Strait, Kamchatka, south through Japan to Korea. I believe that the two should be regarded as distinct species in spite of the proximity of their ranges.

Macoma obliqua differs from *M. incongrua* in being more rounded posteriorly, heavier, and less twisted to the right posteriorly. The pallial sinuses do not extend as far dorsally; that in the left valve does not reach as far toward the anterior adductor muscle scar nor merge with it as it does in *M. incongrua.* The pallial sinuses parallel the ventral pallial line for a greater distance.

Macoma incongrua may be closely related to the next species, *M. frigida.*

Macoma (Macoma) frigida (Hanley, 1844)

(Plate 7, Figure *34*; Text figure 15)

Tellina frigida Hanley
Hanley, 1844b: 143-144
Hanley, 1846: 327; plate 19, figure 119
Krause, 1885: 36

Type Material:

BM(NH) 1907.10.28.37-38, lectotype herein, separated pair, about 24 mm, marked "T" and "X"; paralectotype, unseparated pair. Plate 7, Figure *34.*

Type Locality:

Kamchatka; Petit collection to Hanley collection.

Nomenclatural Commentary:

I am not certain that this is a distinct species. The type specimens may even be unusual specimens of *Macoma calcarea.*

Description:

Small (to 30 mm); elongate; inflated; heavy; longer, rounded anteriorly; pointed posteriorly; periostracum dark, present as ventral fragments; shiny internally; pal-

lial sinuses detached from pallial line, that in left valve larger. Other internal details as in Text figure 15.

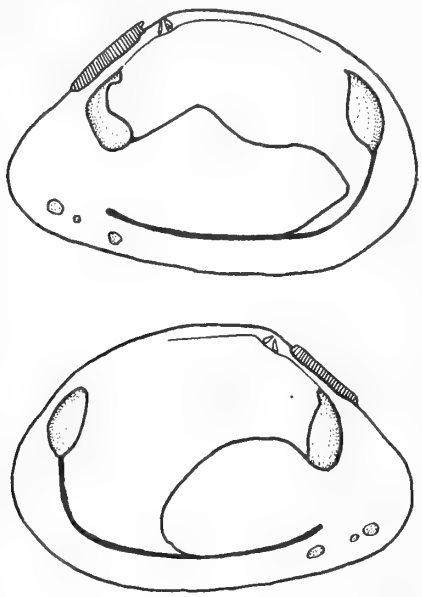


Figure 15
Macoma frigida, internal view of valves
USNM 34034, "north of Bering Strait";
left valve, 27 mm; right valve, 20 mm

Geographic Distribution and Ecology:
"North of the Bering Strait" (USNM 34034) and Kamchatka (type lot). The occurrence in Alaska is uncertain, and no ecologic data are available.

Geologic Distribution and Biogeography:
No fossil record. See previous species.

Species-group of *Macoma (Macoma) moesta* (Deshayes)

Small to medium in size (under 40 mm); chalky to smooth; periostracum dark to shiny.

Macoma (Macoma) moesta moesta (Deshayes, 1855)
(Plate 7, Figures *35-37*; Text figure 16)

Tellina moesta Deshayes
DESHAYES, 1855: 361
SOWERBY, 1868: plate 52, figure 307
DALL, 1916a: 36 [*Macoma*]
I. OLDROYD, 1925: 173
GRANT & GALE, 1931: 370, 922; plate 20, figure 3
BURCH, 1945a: 11; 1945b: 17
SOOT-RYEN, 1958: 23
MACGINITIE, 1959: 182-184; plate 21, figure 3, plate 23, figure 10, plate 24, figures 1-3
OCKELMANN, 1959: 129-131; plate 2, figure 13
Macoma krausei Dall
DALL, 1900a: 307, 322, 326; plate 4, figure 8
DALL, 1916a: 36 [as a synonym of *Macoma moesta*]
Macoma oneilli Dall
DALL, 1919: 20; plate 2, figure 1
I. OLDROYD, 1925: 173; plate 40, figure 7
BURCH, 1945a: 14

Type Material:
Tellina moesta – BM(NH), without registry number, holotype, pair, about 26 mm. Plate 7, Figure *35*.
Macoma krausei – USNM 108606, lectotype herein, pair, figured by DALL (1900a), 22.7 mm; USNM 663880, paralectotypes, 4 pairs and 1 valve. Plate 7, Figure *36*.
Macoma oneilli – NMC 4240, lectotype herein, about 21.4 mm; NMC 40576, paralectotype, right valve; USNM 216896, "virtual paralectotype," pair. Plate 7, Figure *37*.

Type Localities:
Tellina moesta – "Northern Ocean"; Cuming collection.
Macoma krausei – Off Icy Cape, Arctic Alaska; Captain E. E. Smith, 13 to 27 m, in sand.
Macoma oneilli – Dolphin and Union Strait, Mackenzie, Arctic Canada; Canadian Arctic Expedition station 43a, F. Johansen, 91 m, in mud.

Nomenclatural Commentary:
A defense of this synonymy is given by MACGINITIE (1959). There are additional synonyms in the Atlantic-Arctic. See also the next subspecies.

Description:
Small (to 30 mm); oval to oval-elongate; flattened; thin; longer, rounded anteriorly; broadly truncate to somewhat pointed posteriorly; periostracum thin, adherent, shiny; pallial sinuses partially detached from pallial line, that in left valve larger. Other internal details as in Text figure 16.

Geographic Distribution and Ecology:
Circum-arctic; Point Barrow (USNM 606408 and other lots), along the Arctic and west coasts of Alaska, throughout the Aleutian Islands, as far west as Kamchatka, and as far east as Chignik Bay on the Alaska Peninsula (USNM 663900). Low tide level to 260 m, in a variety of bottom types, mostly silt (SOOT-RYEN, 1958; OCKELMANN, 1959). Southern records of this species are in error or are of the next subspecies.

Material seen: 64 West American lots.

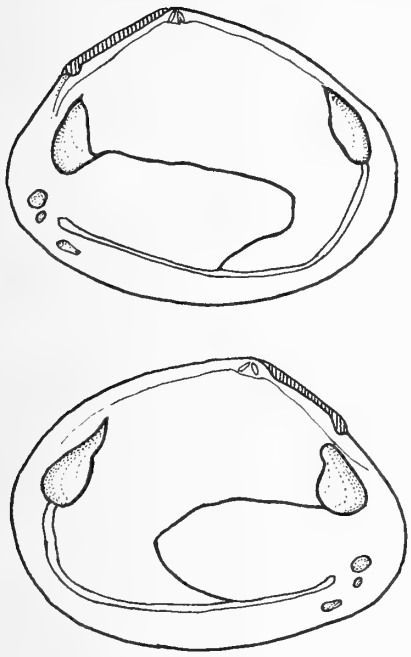


Figure 16

Macoma moesta moesta, internal view of valves
USNM 606413, Point Barrow, Alaska; 25 mm

Geologic Distribution and Biogeography:

I know of no West American fossil records, nor of similar Asian species from south of Kamchatka.

Macoma (Macoma) moesta alaskana Dall, 1900

(Plate 7, Figure *38*; Text figure 17)

Macoma alaskana Dall
DALL, 1900a: 309, 323-324, 325; plate 3, figure 5
OLDROYD, 1924: 55, 208; plate 4, figure 5
I. OLDROYD, 1925: 177-178; plate 13, figure 14
BURCH & BURCH, 1943: 22, 25 (text figure - mislabeled as *Macoma moesta*)
BURCH, 1945a: 3 (text figure), 15; 1945b: 17
T. BURCH, 1945: 30, 33; plate 2, figures 50, 51
DUNNILL & ELLIS, 1969: 6-8, 33; figures 2 (2), 9 (i)

Type Material:

USNM 108652, lectotype herein, pair, 14.4 mm; USNM 663878, paralectotypes, several juvenile specimens, some pairs. Plate 7, Figure *38*.

Type Locality:

Lituya Bay, Alaska; W. H. Dall, 15 m, in sand.

Nomenclatural Commentary:

Specimens of this subspecies account for records of *Macoma moesta moesta* from east and south of the western end of Shelikoff Strait. Dall's type specimens were juveniles, and this may be the reason that he did not realize the similarity between his species and *M. moesta.*

There are moderately elongate, inflated specimens of this species-complex from the north end of the Bering Sea, and there are oval, flattened specimens of *M. moesta alaskana* from southern Alaska. The occurrence of specimens seems to be continuous, and the degree of inflation and elongation seems to be more or less gradational along this distribution. Such gradation and the fact that the name "*Macoma alaskana*" is well-known in British Columbia, have influenced my decision to reach a nomenclatural compromise. However, I do not consider this problem solved, never having had the opportunity to study all available material at one time. Most collections have only a few lots. I would recommend that further study be carried out, using statistical measurements of several characters.

Description:

Small (to 25 mm); elongate; moderately inflated; thin; much longer, rounded anteriorly; pointed, truncate posteriorly; periostracum thin, adherent, shiny; pallial sinuses partially detached from pallial line, that in left valve larger. Other internal details as in Text figure 17.

Geographic Distribution and Ecology:

Kodiak Island area, Alaska (USNM 208625, 40216), to Tofino, outer coast of Vancouver Island, British Colum-

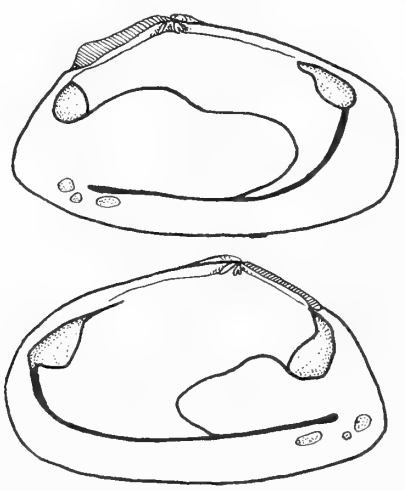


Figure 17

Macoma moesta alaskana, internal view of valves
USNM 108652, lectotype (herein); 14.4 mm

bia (Cowan Collection), and Seattle, Washington (University of Washington Collection). The source of MacGinitie's (1959) record from Monterey, California, is unclear and presumably in error. It has been taken from 1 to 260 m, especially below 50 m, in several bottom types (Dunnill, 1968; Dunnill & Ellis, 1969).

Material seen: 35 lots.

Geologic Distribution and Biogeography:

There is only one probable fossil record of this subspecies, Smith (1919) in the late Pleistocene of Victoria, British Columbia, as "*Macoma krausei.*" Its closest affinities are, of course, with the northern *M. moesta moesta.*

Macoma (Macoma) crassula (Deshayes, 1855)

(Plate 7, Figures *39, 40;* Plate 8, Figure *41*; Text figure 18)

Tellina crassula Deshayes
Deshayes, 1855: 354
Sowerby, 1868: plate 54, figures 319a, 319b
Macoma inflata Dawson, *ex* Stimpson MS, but not the *Macoma inflata* Dawson of authors
Dawson, 1872: 377-378; plate 5, figure 5
[*Not* preoccupied by *Tellina inflata* Gmelin, 1791, *ex* Chemnitz MS: 3230]
Tellina (Macoma) torelli Jensen, *ex* J. Steenstrup MS
Johnstrup, 1882, *ex* J. Steenstrup MS: 8 [*nomen nudum*] [as a "*forma*" of *Tellina crassula*]
Jensen, 1905a: 34-38, 52; plate 1, figures 3a-3i
Jensen, 1905b: 149-151
Jensen, 1905c: 343-345 (figures 3a-3h)
Ockelmann, 1959: 134-135; plate 2, figure 12 [*Macoma*]

Type Material:

Tellina crassula – BM(NH), without registry number, holotype, pair, 16 mm. Plate 7, Figure *39.*

Macoma inflata – Redpath Museum, McGill University, 6151, lectotype herein, figured by Dawson (1872), right valve, about 13 mm; paralectotypes, 5 valves in same lot, 6 valves in 6152, and 10 valves in an unnumbered lot. The last includes 3 valves of *Macoma loveni* (Jensen). Plate 7, Figure *40.*

Tellina torelli – Zoologiske Museum, University of Copenhagen, lectotype herein, pair, about 12.8 mm. This specimen is regarded as a lectotype because Jensen had material from many sources. Plate 8, Figure *41.*

Type Localities:

Tellina crassula – "Northern Ocean"; Cuming collection. This specimen probably came from either the Canadian or Alaskan Arctic.

Macoma inflata – Rivière du Loup, Quebec, Canada; Pleistocene; J. W. Dawson.

Tellina torelli – West Greenland; Captain C. Holböll.

Nomenclatural Commentary:

This typically high-arctic species has usually been known as *Macoma torelli* (Jensen). *Tellina crassula,* described from an unknown locality in the "Northern Ocean," seems to be a senior synonym of this species. Jensen (1905a) considered this possibility, because the first appearance of *M. torelli* (as a *nomen nudum*) was as a "form" of *T. crassula* by Johnstrup (1882). After studying drawings of the holotype of *T. crassula* he concluded that Deshayes' specimen differed from his material in having shorter, nearly equal pallial sinuses. This conclusion is verified in my photographs of the type specimens of both species. These differences seem to be within the range of variation of the species. This requires further verification as there are few specimens available for study.

In any case, it may be wise to synonymize *Tellina torelli* with *T. crassula,* because this species would have to change names anyway. Many workers assumed that *Macoma inflata* Dawson was a *nomen nudum,* evidently missing Dawson's figure validating the name. Many also assumed that the name was preoccupied by Gmelin (1791), but the latter was proposed in *Tellina* and is a *Tellina* (*Tellina inflata* Sowerby, 1867, is a *Macoma,* but that combination cannot preoccupy Dawson's name, since Sowerby's name is preoccupied by Gmelin's). Having worked out this nomenclatural tangle, I suspected that Dawson's name would be the older one for the well-known Arctic *Macoma loveni* (Jensen), because authors had always listed *M. inflata* as a synonym of the former and Dawson's figure did appear to be of *M. loveni.* At last locating the type specimens of *M. inflata,* I was surprised to find that they were almost entirely *M. torelli,* rather than *M. loveni,* including the valve figured by Dawson.

Apparently the same species or a very similar one is found off northern Japan, where it has been reported as *Macoma nipponica* (Tokunaga, 1906) (Habe & Ito, 1965; Golikov & Scarlato, 1967). What is reported and illustrated by Habe & Ito (*op. cit.*) from the Bering Sea as *M. torelli* appears to be *M. balthica.*

Specimens I have studied (or seen illustrated) from the Pleistocene and Recent of the North Atlantic and from Point Barrow are more triangular, have more prominent beaks, and are thinner and more sharply truncate posteriorly than the one valve from Nunivak Island, Alaska, and the two lots from Japan in the USNM. It is possible that Atlantic-Arctic material may be separable from Bering Sea-Japanese material, either as a species or subspecies. As few specimens are available and members of the genus are variable, I do not feel justified in making a firm decision now.

Description:

Small (to 21 mm; Japanese specimens to 30 mm); ovate to ovate-elongate; inflated; proportionately heavy; longer, rounded anteriorly; abruptly truncate posteriorly; beaks often prominent; periostracum dark, thin; pallial sinuses partially detached from pallial line, that in left valve larger. Other internal details as in Text figure 18.

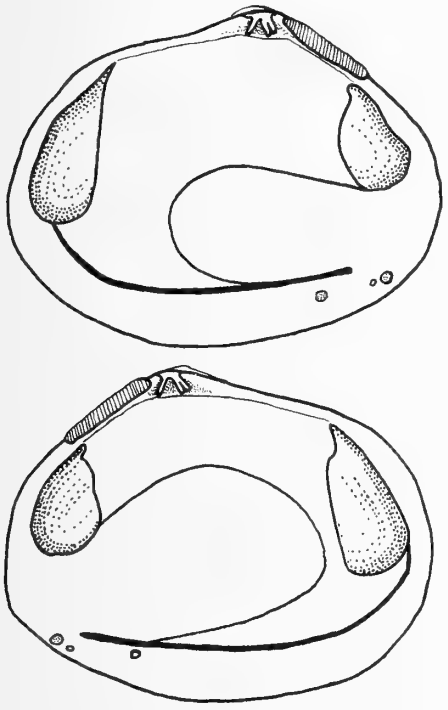


Figure 18

Macoma crassula, internal view of valves
outline and details of left valve from CAS 34342, Point Barrow, Alaska; 17 mm. Details of right valve from JENSEN, 1905a.

Geographic Distribution and Ecology:

Evidently circum-arctic; in Alaska it has been taken only at Point Barrow (CAS 34242) and at the north end of Nunivak Island (USNM 664920). It is found from 16 to 161 m, in gravel (OCKELMANN, 1959; GOLIKOV & SCARLATO, 1967).

Material seen: 2 West American lots.

Geologic Distribution and Biogeography:

As a fossil, the species is known only from the Pleistocene of the North Atlantic. As is the case with other species of *Macoma,* it may have had its origin in the northern Pacific and may be a recent arrival in the Arctic-Atlantic.

Macoma (Macoma) loveni (Jensen, 1905)

(Plate 8, Figures *42, 43*; Text figure 19)

Tellina (Macoma) loveni Jensen, *ex* J. Steenstrup MS
JOHNSTRUP, 1882, *ex* J. STEENSTRUP MS: 8 [*nomen nudum*] [as a "*forma*" of *Tellina moesta*]
JENSEN, 1905a: 45-52; plate 1, figures 5a-5h
JENSEN, 1905b: 151-152
JENSEN, 1905c: 348-350 (figures 5a-5e)
SOOT-RYEN, 1958: 24-25 [*Macoma*]
OCKELMANN, 1959: 132-134; plate 2, figure 11
HABE & ITO, 1965: 146; plate 50, figure 17
GOLIKOV & SCARLATO, 1967: 125-126 (figure 108)

Type Material:

Zoologiske Museum, University of Copenhagen, lectotype herein, smaller right valve, 12 mm. This valve seems to be one figured by JENSEN (1905a: plate 1, figure 5h) (the label with the lot also bears instructions in Jensen's writing for the preparation of a figure from the smaller of two specimens; his figure 5h is closest to the size of this valve); paralectotype, larger right valve. Plate 8, Figure *42*.

Type Locality:

Asåby, east coast of Vendsyssel, northern Denmark; Pleistocene ["*Yoldia*-layer"].

Nomenclatural Commentary:

Some workers have regarded *Macoma inflata* Dawson, 1872, as a synonym of this species. However, the type specimens prove to be of the preceding species.

Description:

Small (to 17 mm); oval; very inflated; thin; longer, rounded, expanded anteriorly; rounded, very slightly truncate posteriorly; periostracum thin, brown; pallial sinuses partially detached from pallial line, that in left valve larger (Plate 8, Figure *43*). Other internal details as in Text figure 19.

Geographic Distribution and Ecology:

Circum-arctic. In Alaska it has been taken only near Point Barrow (CAS 34341, 34342, 34343, 34344, 34597, 34598), but it has been reported in the Bering Sea (HABE & ITO, 1965) and at Possiet Bay, Siberia (GOLIKOV & SCARLATO, 1967), and there are USNM specimens from northern Japan. It may eventually be found along the eastern edge of the Bering Sea. It has been taken in from 4 to 816 m, in various bottom types, most common in coarse sediments (SOOT-RYEN, 1958; OCKELMANN, 1959; GOLIKOV & SCARLATO, 1967).

Material seen: 6 West American lots.

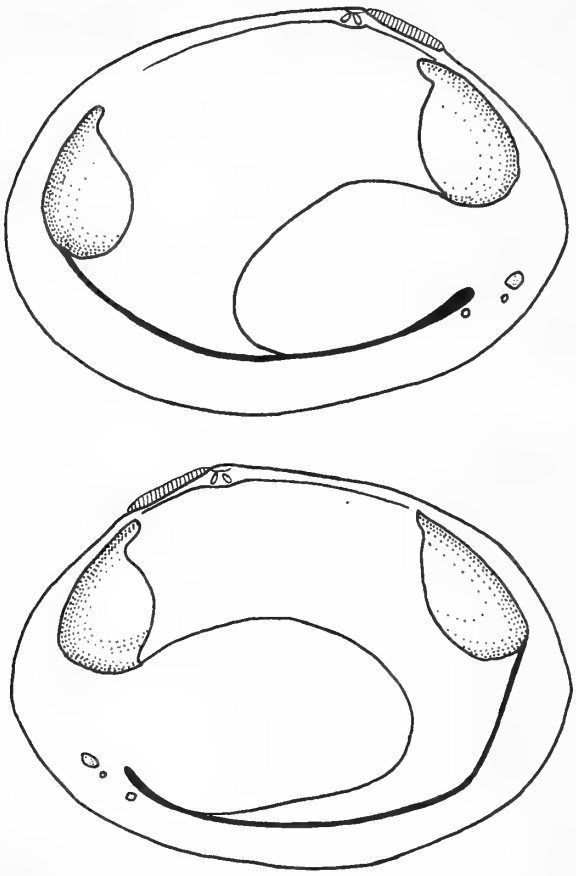


Figure 19
Macoma loveni, internal view of valves, CASGTC 13621 CAS locality 34342, Point Barrow, Alaska; 15.2 mm

Geologic Distribution and Biogeography:

There are no fossil records in the northern Pacific, but the species is present in the Pleistocene of Canada and northern Europe.

Macoma (Macoma) lama (Bartsch, 1929)
(Plate 8, Figures *44, 45*; Text figure 20)

Macoma lama Bartsch
BARTSCH, 1929: 133; plate 2, figures 8-14
GOLIKOV & SCARLATO, 1967: 127 (figure 110)
Macoma planiuscula Grant & Gale
GRANT & GALE, 1931: 372, 908, 922; plate 14, figure 11, plate 20, figure 8
BURCH & BURCH, 1943: 21, 25 (text figure)
BURCH, 1945a: 3 (text figure), 14; 1945b: 17
MACGINITIE, 1959: 180
Macoma carlottensis Whiteaves, of authors, not of Whiteaves
[not WHITEAVES, 1880: 196B-197B (text figure 1) – see same]
DALL, 1900a: 308

Type Material:

Macoma lama – USNM 369064, holotype, pair, 28.7 mm. Plate 8, Figure *44.*
Macoma planiuscula – SUPTC 977, holotype, pair, 23.3 mm; SUPTC 8066, paratype, pair. Plate 8, Figure *45.*

Type Localities:

Macoma lama – Uncertain; K. Derjugin. The description implies the west coast of Kamchatka, but the USNM labels and catalogue say "near Vladivostok, Manchuria," and are more likely correct.
Macoma planiuscula – Nunivak Island, Alaska; probably originally from USNM material.

Nomenclatural Commentary:

In addition to the complications indicated above, MACGINITIE (1959) first suggested that this Recent Pacific-Arctic species may be equivalent to *Macoma praetenuis* (Woodward, 1833), described from the Red Crag (Pleistocene) of England and known only from the Red Crag and equivalent deposits on the mainland of Europe. Some consistent morphological differences, however, can be found. *Macoma praetenuis* is larger, thinner, more rounded and less flexuous posteriorly, and it has a less prominent posterior diagonal ridge. To set aside Pleistocene material

Explanation of Plate 8

Figure *41*: *Macoma crassula.* Lectotype (herein) of *Tellina torelli.* Zoologisk Museum, University of Copenhagen; 12.8 mm
Figure *42*: *Macoma loveni.* Lectotype (herein) of *Tellina loveni,* Zoologisk Museum, University of Copenhagen; 12 mm
Figure *43*: *Macoma loveni,* CASGTC 13621, CAS locality 34342, Point Barrow, Alaska; 15.2 mm
Figure *44*: *Macoma lama,* holotype, USNM 369064; 28.7 mm
Figure *45*: *Macoma lama.* Holotype of *Macoma planiuscula,* SU PTC 977; 23.3 mm
Figure *46*: *Macoma yoldiformis,* lectotype (herein), USNM 4507; 11.7 mm

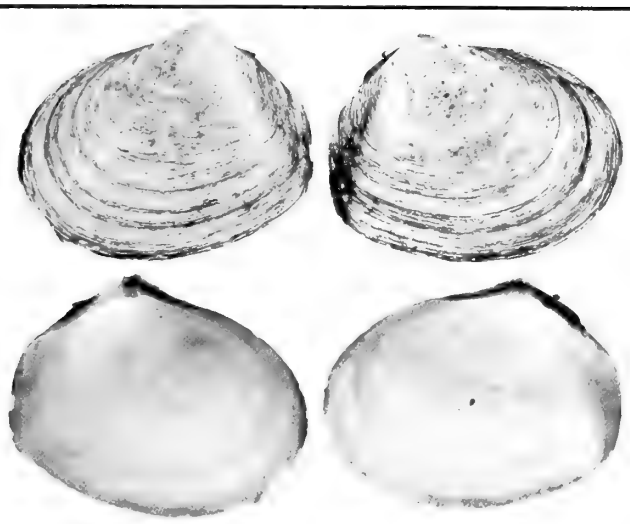


Figure *41*

Figure *42*

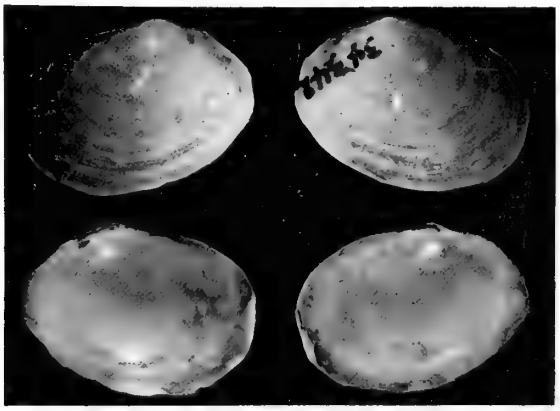


Figure *43*

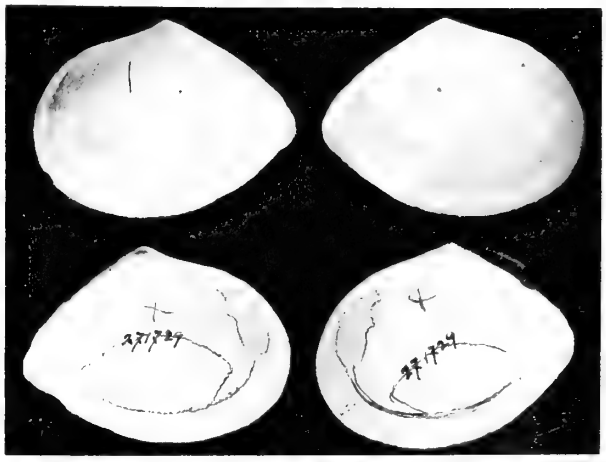


Figure *45*

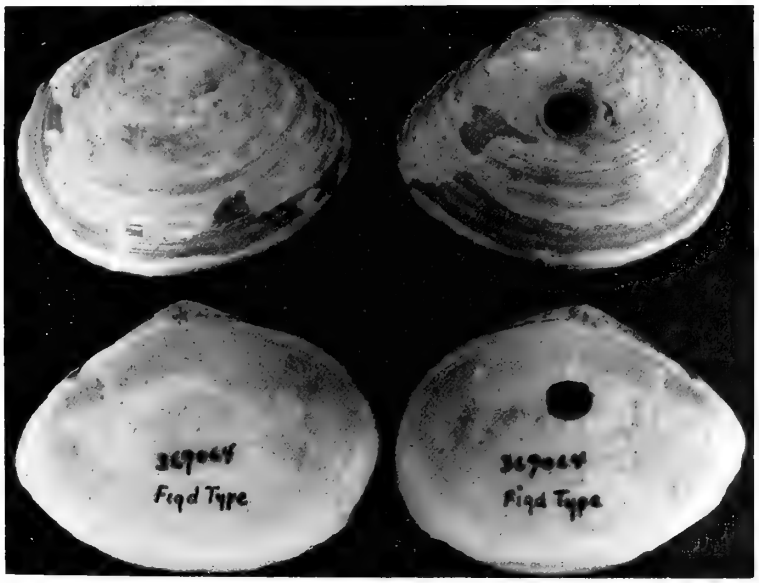


Figure *44*

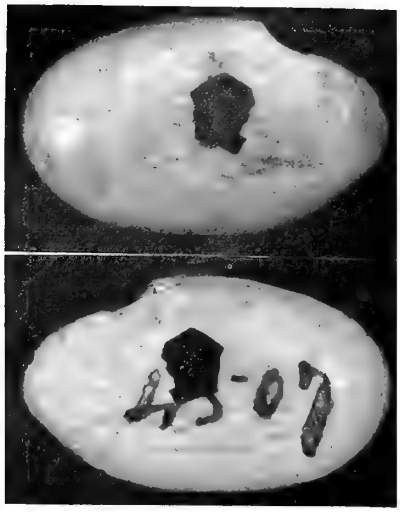


Figure *46*

as species distinct from Recent ones is not a common practice. However, because this species is no longer living in the Atlantic sector of the Arctic and because there are consistent morphological differences, I defer to the expressed preference of European workers (Sealy, in correspondence).

Description:

Medium-sized (to 41 mm); oval; flattened; heavy; almost equilateral to somewhat longer posteriorly; rounded anteriorly; pointed, often slightly twisted to right posteriorly; periostracum heavy, shiny; pallial sinuses partially detached from pallial line, that in the left valve larger. Other internal details as in Text figure 20.

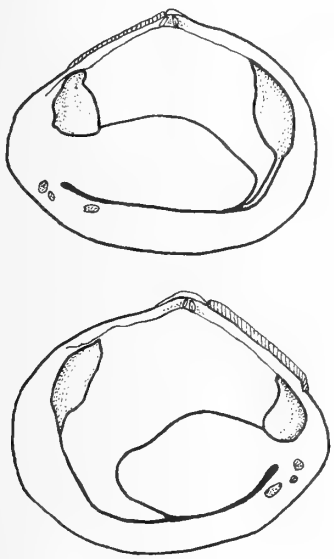


Figure 20
Macoma lama, internal view of valves
USNM 271729, Saint Paul Island, Pribilof Islands, Alaska
36 mm

Geographic Distribution and Ecology:

Dease Inlet, Arctic Alaska (USNM 363166), along the Bering Sea coast of Alaska, throughout the Aleutian Islands, Kamchatka, and south to the Vladivostok area (Golikov & Scarlato, 1967), along the south coast of Alaska, to the northern end of the Queen Charlotte Islands, British Columbia (SU 8754). It occurs from the intertidal area to 183 m, probably on fairly exposed coasts, in sand (Golikov & Scarlato, *op. cit.*).

Material seen: 104 lots.

Geologic Distribution and Biogeography:

I know of no West American fossil records except as misidentifications of *Macoma elimata* Dunnill & Coan, 1968. The presence of an ancestor in the Pleistocene of Europe and not in the northern Pacific suggests that differentiation of this species may have been associated with the second period of submergence of Bering Strait, that in the early Pleistocene. Among Recent species, it seems most closely related to *Macoma moesta moesta.*

(Psammacoma) Dall, 1900a

[Type species: *Psammotaea candida* Lamarck, 1818, by original designation]

Small to large in size (20 to 70 mm); thin; inflated, especially anteriorly; approximately equivalve; rounded to elongate; generally longer and sharply rounded anteriorly; conspicuously pointed or truncate and very slightly twisted to right posteriorly; periostracum thin, dark to shiny; no escutcheon or lunule present; ligament sometimes slightly sunken; pallial sinuses comparatively short, approximately equal in size to somewhat longer in left valve, detached from pallial line along at least half of their length.

The last two species are only tentatively assigned to this subgenus.

Macoma (Psammacoma) yoldiformis Carpenter, 1864
(Plate 8, Figure *46*; Text figure 21)

Macoma yoldiformis Carpenter
Carpenter, 1864a: 602, 611, 639 [1872: 88, 97, 125]
Carpenter, 1865c: 55
Dall, 1900a: 309
Arnold, 1903: 165, 394; plate 16, figure 6
Packard, 1918: 280; plate 25, figure 6
Oldroyd, 1924: 54-55, 214; plate 41, figure 6
I. Oldroyd, 1925: 177; plate 44, figure 6
Grant & Gale, 1931: 373
Burch & Burch, 1943: 22, 24 (text figure)
Burch, 1945a: 3 (text figure), 15; 1945b: 16; 1945c: 30
T. Burch, 1945: 30, 33; plate 2, figures 48, 49
Palmer, 1958: 17, 22, 27, 34, 38, 48, 108-109, 339; plate 14, figures 2-4
Dunnill & Ellis, 1969: 7, 30-33; figures 2 (2), 9 (j)

Type Material:

USNM 4507, lectotype herein, left valve, 11.7 mm. Palmer (1958) suggested that this valve be made a neotype on the grounds that Swan was not among the originally listed collectors. However, Swan was mentioned in the original account (Carpenter, 1864a), and the other lots have apparently been subsequently lost. Plate 8, Figure *46*.

Type Locality:
Neah Bay, Washington; J. G. Swan.

Nomenclatural Commentary:
None necessary.

Description:
Small (to 25 mm); elongate; inflated; thin; longer, rounded anteriorly; pointed, rostrate posteriorly; posterodorsal margin often somewhat produced into a flange; periostracum shiny, adherent; pallial sinuses partially detached from pallial line, approximately equal in size to slightly larger in left valve. Other internal details as in Text figure 21.

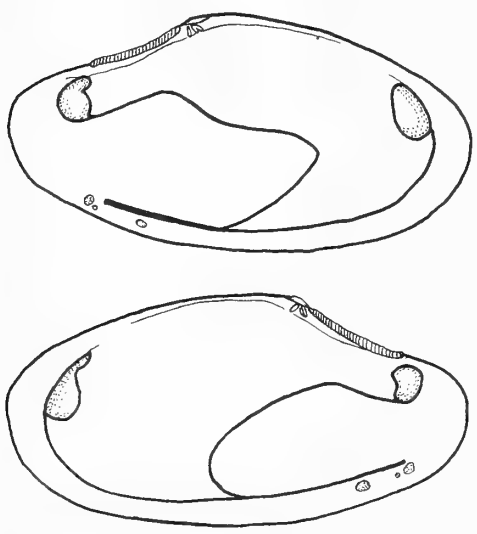


Figure 21
Macoma yoldiformis, internal view of valves
outline from USNM 4507, lectotype (herein); 11.7 mm
Internal details from USNM 73465, San Diego, California

Geographic Distribution and Ecology:
Dall Island, southern Alaska (UCLA 20511), with many records along the coasts of British Columbia, Washington, Oregon, and California, and to Bahía San Bartolomé, Baja California Sur (USNM 266150, 554483, 554531). Depth records are from the intertidal area to 93 m, in bays and offshore, in silt to sand (Burch, 1945a; Dunnill, 1968; Dunnill & Ellis, 1969).

Material seen: 100 lots.

Geologic Distribution and Biogeography:
In the late Pleistocene this species has been reported from Goleta, California (Oldroyd & Grant, 1931), to Laguna San Ignacio, Baja California Sur (Jordan, 1924; Hertlein, 1934), with several intermediate records. In the early Pleistocene, it is known only from the San Pedro area, California (Arnold, 1903; Clark, *in* Natland, 1957). It has also been reported from southern Californian formations transitional between the Pliocene and the Pleistocene, as well as in the Pliocene of central California. *Macoma wilcoxi* Hall & Ambrose, 1916, described from the Miocene of central California, may be related.

I know of no related Asian species. *Macoma yoldiformis* most closely resembles the next species, from which it differs in being thinner and more rostrate posteriorly. Of species in the Panamic province, it differs from *M. (Psammacoma) elytrum* Keen, 1958a, in being shorter anteriorly, more rostrate, and more shiny; it differs from *M.(P.) siliqua* (C. B. Adams, 1852a) in being larger, less inflated, less twisted and not so broadly truncate posteriorly, and more shiny. There are also Caribbean species that belong in this subgenus.

Macoma (Psammacoma) acolasta Dall, 1921
(Plate 9, Figures *47, 48*; Text figure 22)

Macoma acolasta Dall
Dall, 1921b: 21-22
Dall, 1925: 19, 36; plate 8, figures 2, 3
Grant & Gale, 1931: 371, 908, 922; plate 14, figure 7, plate 20, figures 4a, 4b, 10 [as a variety of *Macoma moesta* (Deshayes)]
Macoma morroensis T. Burch
T. Burch, 1945: 30, 33; plate 2, figures 46, 47

Explanation of Plate 9

Figure *47*: *Macoma acolasta,* lectotype (herein), USNM 333133; 22 mm
Figure *48*: *Macoma acolasta.* Holotype of *Macoma morroensis,* USNM 434051; 20 mm
Figure *49*: *Macoma carlottensis,* lectotype (herein), NMC 316; 13 mm
Figure *50*: *Macoma carlottensis.* Holotype of *Macoma inflatula,* USNM 107643; 23.8 mm
Figure *51*: *Macoma carlottensis.* Lectotype (herein) of *Macoma quadrana,* USNM 225421; 12.3 mm
Figure *52*: *Macoma leptonoidea,* holotype, USNM 125532; 16.5 mm
Figure *53*: *Macoma secta.* Holotype of *Tellina secta,* BM(NH) Nuttall collection 1861.5.21.161; 50 mm

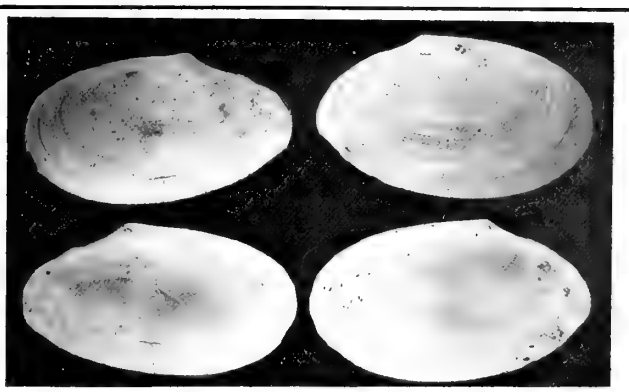


Figure *47*

Figure *48*

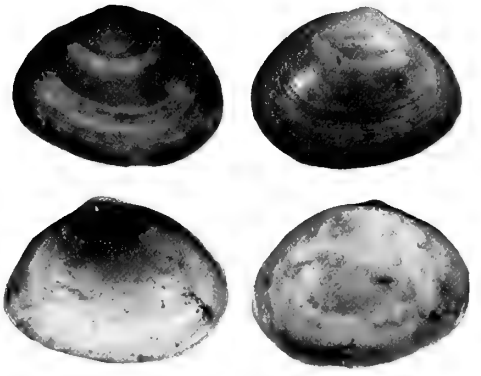


Figure *49*

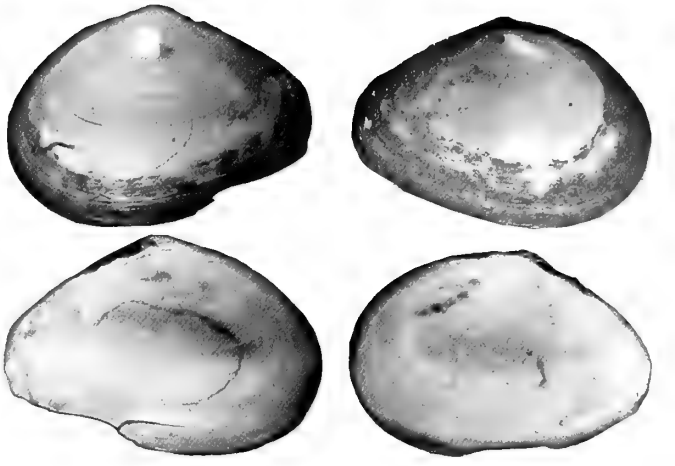


Figure *50*

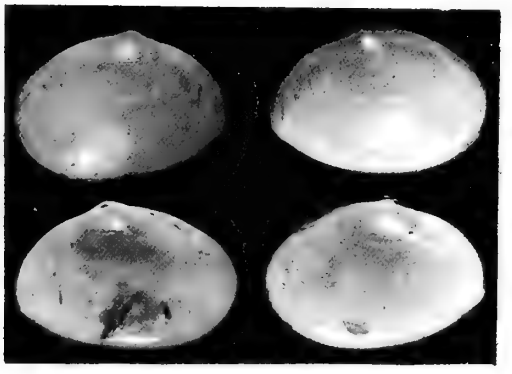


Figure *51*

Figure *53*

Figure *52*

Type Material:

Macoma acolasta – USNM 333113, lectotype herein, right valve, 22 mm; USNM 645418, paralectotype, left valve, 21.5 mm. Plate 9, Figure *47*.

Macoma morroensis – USNM 434051, holotype, pair, 20.0 mm; UCLA 20516, paratypes, 2 pairs. Plate 9, Figure *48*.

Type Localities:

Macoma acolasta – Bahía San Quintín, Baja California Norte; late Pleistocene [as "late Pliocene or early Pleistocene"]; C. R. Orcutt.

Macoma morroensis – Morro Bay, California; M. Caruthers, intertidal area.

Nomenclatural Commentary:

It is unfortunate that Tom Burch overlooked Dall's Pleistocene name. His description of *Macoma morroensis* and comparisons were thorough and well stated.

This species was confused by GRANT & GALE (1931) with *Macoma moesta*. It differs from the latter in being longer and less angular posteriorly, in having a thinner and less adherent periostracum, and in having more equal pallial sinuses.

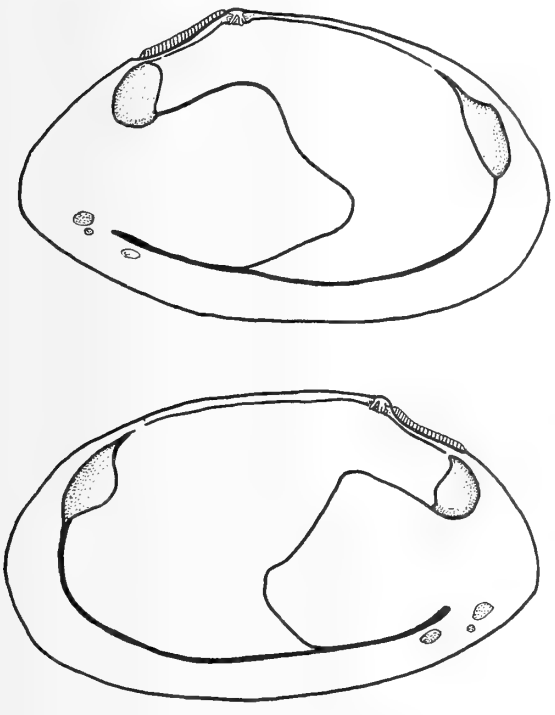


Figure 22

Macoma acolasta, internal view of valves
USNM 194311, Santa Barbara, California; 21 mm

Description:

Small (to 30 mm); elongate; inflated; thin; longer, rounded anteriorly; pointed to truncate posteriorly; periostracum adherent, shiny; pallial sinuses partly detached from pallial line, approximately equal in size. Other internal details as in Text figure 22.

Geographic Distribution and Ecology:

Bodega Bay, California (Roth Collection), to San Diego, California (SDNHM L2388), with several intermediate records. It has been collected in the intertidal area to 73 m, in sand.

Material seen: 20 lots.

Geologic Distribution and Biogeography:

In the late Pleistocene, *Macoma acolasta* is known from Goleta, California (GRANT & GALE, 1931), to Bahía San Quintín, Baja California Norte (DALL, 1921b; JORDAN, 1926; MANGER, 1934; VALENTINE & MEADE, 1961), with three intermediate localities.

My comments for the preceding species with regard to relationships also apply to the present one.

Macoma (?Psammacoma) carlottensis Whiteaves, 1880

(Plate 9, Figures *49 - 51*; Text Figure 23)

Macoma carlottensis Whiteaves
WHITEAVES, 1880: 196B-197B (text figure 1)
I. OLDROYD, 1925: 175-176
GRANT & GALE, 1931: 372, 922; plate 20, figures 1, 2
BURCH & BURCH, 1943: 21, 24, 25 (text figures)
BURCH, 1945a: 3, 4 (text figures), 13, 14; 1945b: 17; 1945c: 30
DUNNILL & ELLIS, 1969: 13-15, 21, 33; figures 6 (l), 9 (k)

Macoma inflatula Dall
DALL, 1897: 11-12; plate 1, figures 19, 20
DALL, 1900a: 307
OLDROYD, 1924: 54, 208; plate 4, figure 6
I. OLDROYD, 1925: 174; plate 1, figures 2, 8, plate 13, figure 15

Macoma quadrana Dall
DALL, 1916a: 37 [*nomen nudum*]
DALL, 1916b: 414
OLDROYD, 1924: 55
I. OLDROYD, 1925: 175; plate 3, figure 6
BURCH & BURCH, 1943: 20-21, 25 (text figure)
BURCH, 1945a: 3 (text figure), 14; 1945b: 17, 21

Type Material:

Macoma carlottensis – NMC 316, lectotype herein, largest pair, 13.0 mm; NMC 40577, paralectotypes, 6 pairs and 2 valves. Plate 9, Figure *49*.

Macoma inflatula – USNM 107643, holotype, pair, 23.8 mm. Plate 9, Figure *50*.

Macoma quadrana – USNM 225421, lectotype herein, pair, 12.3 mm; USNM 663891, paralectotypes, 6 pairs. Plate 9, Figure *51*.

Type Localities:

Macoma carlottensis – Virago Sound, Graham Island, Queen Charlotte Islands, British Columbia; G. M. Dawson, 15 to 27 m.

Macoma inflatula – Dutch Harbor, Captain's Bay, Unalaska Island, Aleutian Islands, Alaska; W. H. Dall, 9 m.

Macoma quadrana – South and slightly west of Point Conception, California, about halfway to San Miguel Island; USFC 2892, 519 m, in yellow mud.

Nomenclatural Commentary:

Grant & Gale (1931) were the first to discover what the true *Macoma carlottensis* was and to conclude that *M. inflatula* is a synonym of it. Whiteaves' specimens were juveniles and rather equilateral.

Populations of this species are found continuously along the entire West Coast, from Alaska to Baja California. In the northern portion of the range, large, inflated specimens are more common than they are in California, but one can find occasional southern Californian lots that contain large individuals. Young specimens are often more quadrate than adults, and I cannot see sufficient grounds for recognizing *Macoma quadrana*.

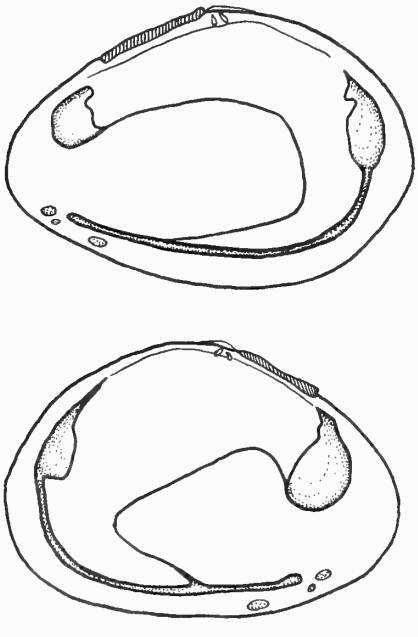


Figure 23

Macoma carlottensis, internal view of valves
USNM 108690, Captain's Bay, Unalaska, Aleutian Islands, Alaska
25 mm

Description:

Small (to 30 mm); ovate-elongate; inflated, most so anteriorly; thin; almost equilateral to longer anteriorly; rounded anteriorly; pointed to broadly truncate posteriorly; periostracum shiny, adherent, straw-colored; pallial sinuses detached from pallial line, that in left valve larger. Other internal details as in Text figure 23.

Geographic Distribution and Ecology:

Adak Island, Aleutian Islands, Alaska (USNM 108678), along the south coasts of Alaska, throughout British Columbia, Washington, Oregon, and California, and south to Islas Los Coronados, Baja California Norte (USNM 209263, 211233) and Isla Las Animas, Gulf of California (Berry Collection 35622, 35630). Dall's record from the Arctic Ocean proves to be based on specimens of *Macoma frigida* (Hanley). Other records from Baja California Sur are in error. It has been taken in from 5 to 1547 m, in silt to fine sand (Dunnill, 1968; Dunnill & Ellis, 1969) and occurs in shallower water in the northern portion of its range.

Material seen: 162 lots.

Geologic Distribution and Biogeography:

Specimens of this species (or its synonyms) have been reported in the late Pleistocene of Capistrano, California (Willett, 1938, as *"cf."*), from the early Pleistocene of the Santa Barbara area, California (Keen & Bentson, 1944; Dibblee, 1966, both as *"cf."*), and the San Pedro area, California (Willett, 1937; Burch, 1947).

I know of no close relatives in Asia nor in the Panamic province. Considering this lack of related species and its abundance in fine, offshore sediments, I would suggest that it be compared with *Macoma diabloensis* Clark, 1915, and *M. pabloensis* Clark, 1915, from the Miocene of central California.

Macoma (?Psammacoma) leptonoidea Dall, 1895

(Plate 9, Figure *52*; Text figure 24)

Macoma leptonoidea Dall
Dall, 1895: 33
Dall, 1900a: 308, 323, 325, 326; plate 4, figures 4, 9
I. Oldroyd, 1925: 175
Burch & Burch, 1943: 21
Burch, 1945a: 13-14; 1945b: 17

Type Material:
USNM 125532, holotype, pair, about 16.5 mm. Plate 9, Figure *52*.

Type Locality:
"Matagorda Bay, Texas," in error, probably from the larger of two USNM lots, USNM 108578, USFC 2903, north of the eastern end of Santa Rosa Island, about halfway between Santa Rosa Island and the mainland, Santa Barbara Channel, California, 589 m, in gravel and mud. How the locality confusion occurred is not clear.

Nomenclatural Commentary:
None necessary.

Description:
Small (to 20 mm); oval; inflated; very thin; slightly longer anteriorly; beaks and hinge minute; rounded anteriorly and posteriorly; periostracum very thin, adherent, shiny; pallial sinuses partially detached from pallial line, almost equal in size. Other internal details as in Text figure 24.

Geographic Distribution and Ecology:
This species has been taken only four times, and only off Santa Barbara, from about 483 to 594 m, in silt.

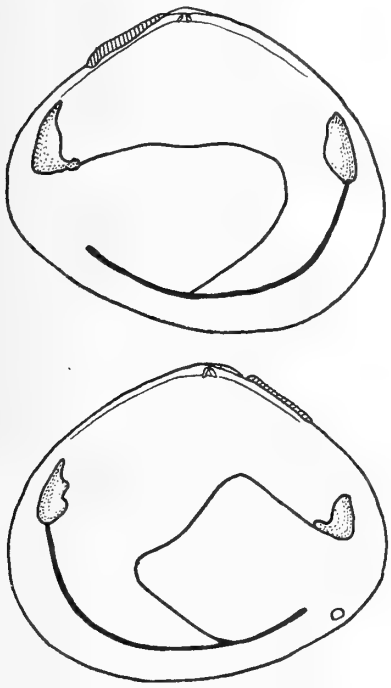


Figure 24
Macoma leptonoidea, internal view of valves
USNM 108579, probable paratype, Santa Barbara Channel, California; 22 mm

Material seen: 6 lots.

Geologic Distribution and Biogeography:
Most closely related to *Macoma carlottensis,* this species differs in being thinner and more rounded. It should be compared to *M. congesta* (Conrad, 1855), from the Miocene of California.

Rexithaerus Tryon, 1869,
ex Conrad MS

[Type species: *Tellina secta* Conrad, 1837, by subsequent designation of DALL, 1900a]

Medium to large in size (50 to 120 mm); thin to medium in thickness; inflated; equivalve or with right valve larger; equilateral to longer posteriorly or anteriorly; evenly to sharply rounded anteriorly; rounded, pointed, or broadly truncate posteriorly; often slightly flexed to right posteriorly; posterior slope often set off by a fold and postero-dorsal area often set off internally by a ridge forming a dorsal flange; periostracum thin, shiny; pallial sinuses high, usually wholly confluent with pallial line, but in some species partially detached for a quarter or more of their length, larger in left valve.

Macoma (Rexithaerus) secta (Conrad, 1837)

(Plate 9, Figure *53*; Plate 10, Figures *54, 55*; Text figure 25)

Tellina secta Conrad
CONRAD, 1837: 257
HANLEY, 1846: 327-328; plate 65, figures 245, 248
CARPENTER, 1857a: 213
CARPENTER, 1857b: 195, 211, 212, 213, 232, 234, 284, 302, 349, 351, 352
CARPENTER, 1864a: 526, 528, 536, 540, 600, 639, 665 [*Macoma*] [1872: 12, 14, 22, 26, 86, 125, 151]
DALL, 1900a: 309 [*Macoma (Rexithaerus)*]
DALL, 1900b: 1053
ARNOLD, 1903: 164, 394; plate 16, figure 5
PACKARD, 1918: 280; plate 25, figure 8
OLDROYD, 1924: 55-56, 214; plate 41, figure 8
I. OLDROYD, 1925: 178-179; plate 44, figure 8
GRANT & GALE, 1931: 374, 922; plate 20, figures 6a, 6b
BURCH & BURCH, 1943: 22-23, 25 (text figure)
BURCH, 1945a: 3 (text figure), 16; 1945b: 17
KEEN, 1966a: 170
DUNNILL & ELLIS, 1969: 28-30, 33; figures 8 (2), 9 (c)
Tellina ligamentina Deshayes
DESHAYES, 1843: plate 81
JAY, 1850: 26 [as a synonym of *Tellina secta*]
Macoma secta edulis Carpenter, *ex* Nuttall MS
CARPENTER, 1860: 2 [*nomen nudum*]
CARPENTER, 1864a: 526, 600, 639 [1872: 12, 86, 125]

Type Material:

Tellina secta – BM(NH) Nuttall collection, 1861.5.21.161, holotype, smaller pair, 50 mm. The larger pair, according to the label, is from the Columbia River area. Plate 9, Figure *53*.

Tellina ligamentina – Lost, according to Roger (in correspondence). The original figure, measuring 63 mm, is sufficient to identify the taxon. Plate 10, Figure *54*.

Macoma secta edulis – USNM 3426, lectotype herein, pair, 91.5 mm; USNM 663896, paralectotypes, 3 pairs. Plate 10, Figure *55*.

Type Localities:

Tellina secta – San Diego, California; T. Nuttall, in muddy marshes.

Tellina ligamentina – Unknown.

Macoma secta edulis – Puget Sound, Washington; C. B. R. Kennerly.

Nomenclatural Commentary:

PALMER (1958) overlooked Carpenter's name, *Macoma secta edulis*, which can hardly be considered a *nomen nudum*; he intended it to represent a northern variety. With a continuous distribution along the coast and only minor morphological differences between northern and southern specimens, I do not think the name is useful.

Description:

Large (to 120 mm); oval; right valve more inflated; moderate in thickness; longer, rounded anteriorly; broadly truncate posteriorly; postero-dorsal margin set off as a flange; periostracum thin, shiny; pallial sinuses meet pallial line at about a right angle, approximately equal in size. Other internal details as in Text figure 25.

Geographic Distribution and Ecology:

Marina Island, inner coast of Vancouver Island (NMC 40254), and Esperanza Inlet, outer coast of Vancouver Island (MCZ 235227), British Columbia, to Bahía Magdalena, Baja California Sur (SU 24063). Specimens in collections from Acapulco (UCLA 24180) and Oaxaca (MCZ 38394) probably represent labeling errors. It has been taken from the intertidal area in bays and offshore from 10 to 46 m on semi-protected coast, in sand (BURCH, 1945a; DUNNILL & ELLIS, 1969).

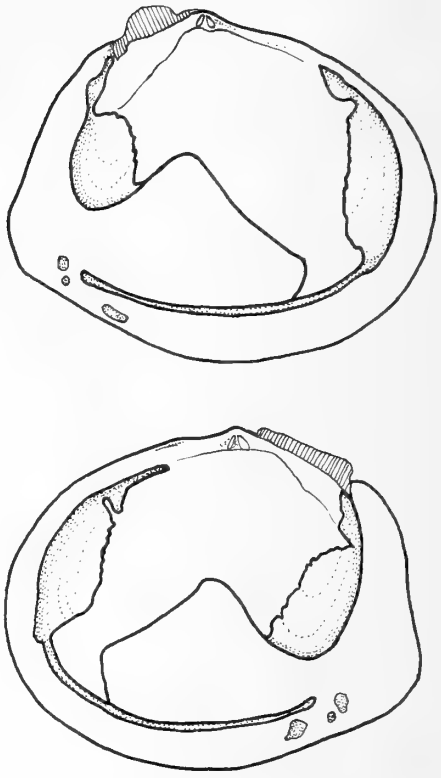


Figure 25

Macoma secta, internal view of valves
MCZ 199403, Mugu, California; 69 mm

Material seen: 235 lots.

Geologic Distribution and Biogeography:

In the late Pleistocene, this species has been reported from southwestern British Columbia (DRAYCOT, 1951) to Bahía Magdalena, Baja California Sur (JORDAN, 1924, 1936), with many intermediate records. There are records in the early Pleistocene of the San Pedro area, California (CRICKMAY, 1929a; BURCH, 1947; VALENTINE & MEADE, 1961), and it has been reported from the Plio-

Explanation of Plate 10

Figure *54*: *Macoma secta*. Original illustrations of *Tellina ligamentina*; 63 mm

Figure *55*: *Macoma secta*. Lectotype (herein) of *Macoma secta edulis*, USNM 3426; 91.5 mm

Figure *56*: *Macoma indentata*. Lectotype (herein) of *Macoma indentata* and holotype of *Macoma indentata tenuirostris*, USNM 15229; 54.2 mm

Figure *57*: *Macoma indentata*, probable paralectotype, USNM "15630", Santa Barbara or San Pedro, California; 39.1 mm

Figure *58*: *Macoma expansa*, lectotype (herein), USNM 663886; 38.7 mm

Figure *59*: *Macoma expansa*. Lectotype (herein) of *Macoma liotricha*, USNM 107642; 44.8 mm

Figure 54

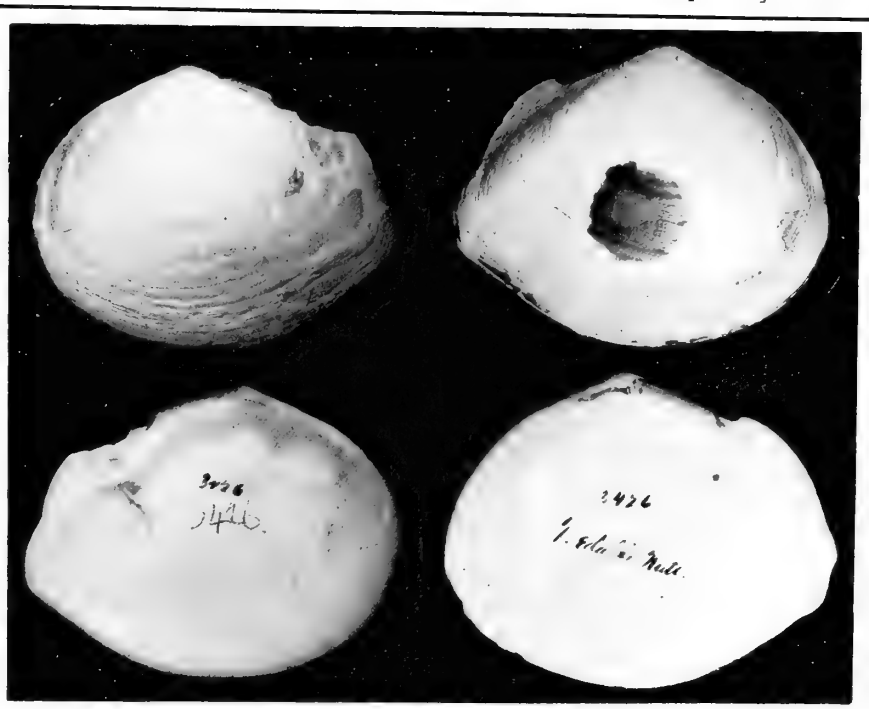


Figure 55

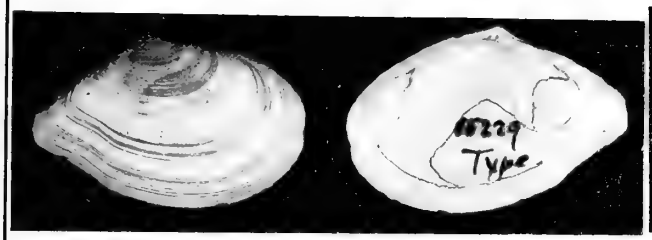


Figure 56

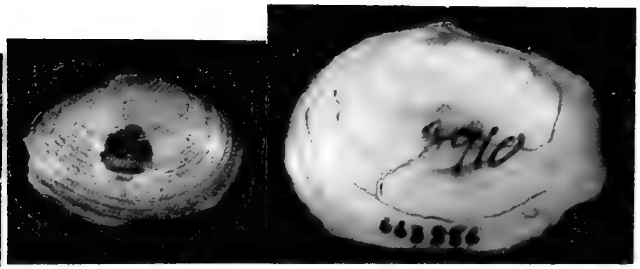


Figure 58

Figure 57

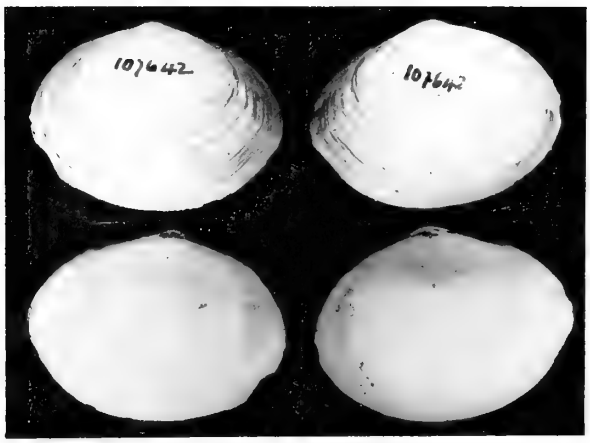


Figure 59

cene of California and the Miocene of Washington, Oregon, and California. *Macoma piercei* Arnold, 1910, from the Miocene of California may be a synonym.

There is an Asian homologue, *Macoma sectior* Oyama, 1950, which differs in being smaller, more elongate, less inflated, and thinner. One suspects that the species was of Asian origin, being introduced in the Miocene and isolated by cooling in the Pliocene or Pleistocene.

Macoma (Rexithaerus) indentata Carpenter, 1864

(Plate 10, Figures *56, 57*; Text figure 26)

Macoma indentata Carpenter
CARPENTER, 1864a: 611, 639 [1872: 97, 125]
CARPENTER, 1865a: 208
DALL, 1900a: 309 [*Macoma (Rexithaerus)*]
ARNOLD, 1903: 161-162, 394; plate 16, figure 1
PACKARD, 1918: 277-278; plate 25, figure 4
OLDROYD, 1924: 55, 214; plate 41, figure 4
I. OLDROYD, 1925: 178; plate 44, figure 4
GRANT & GALE, 1931: 374-375
BURCH & BURCH, 1943: 23, 25 (text figure)
BURCH, 1945a: 3 (text figure), 15; 1945b: 17; 1945c: 30
PALMER, 1958: 16, 22, 27, 34, 38, 48, 109-110, 341; plate 16, figures 1, 2
Macoma (Rexithaerus) indentata tenuirostris Dall
DALL, 1900a: 309, 324
I. OLDROYD, 1925: 178
BURCH & BURCH, 1943: 23
BURCH, 1945a: 16; 1945b: 17; 1945c: 30
Macoma (Rexithaerus) rickettsi Steinbeck & Ricketts, *ex* Rehder MS
STEINBECK & RICKETTS, 1941: 510 [*nomen nudum*; ICZN Article 13 (a) (i-ii)]

Type Material:

Macoma indentata – USNM 15229, lectotype herein, right valve, 54.2 mm, figured by PALMER (1958) as "holotype." It is the only remaining specimen in the USNM collection that is beyond question from Carpenter's original material. It also matches the measurements given by CARPENTER (1865a). Plate 10, Figure *56*.

Macoma indentata tenuirostris – USNM 15229, holotype, the same specimen.

Type Locality:

Macoma indentata and *Macoma indentata tenuirostris* – San Pedro, California; J. G. Cooper. CARPENTER's (1864a: 639) citation of San Diego was presumably in error.

Nomenclatural Commentary:

DALL (1900a) intended to distinguish an elongate form from a broader one by means of a varietal name, and there do, indeed, seem to be two such morphological varieties of this species. They seem equally common in collections. Unfortunately, the type specimen he chose for the elongate form was the only demonstrably original Carpenter specimen left in the USNM. There are also a number of intermediate specimens, and the two forms have been found throughout most of the range. I do not think that they can be regarded as distinct species, nor does the concept of a subspecies seem applicable. One can only speculate on the reasons for this dimorphism. The more elongate form seems to be more common offshore. The problem would be an interesting one for further study.

Description:

Medium-sized (to 63 mm); elongate, degree of elongation variable; moderately inflated; average in thickness; inequivalve, right valve more convex; almost equilateral to longer anteriorly; rounded anteriorly; elongate, pointed posteriorly; posterior slope set off by a distinct flexure; postero-dorsal are often set off as a wing; periostracum thin, adherent, shiny; pallial sinuses meeting pallial line at a right angle to partially detached, slightly longer in left valve (Plate 10, Figure *57*). Other internal details as in Text figure 26.

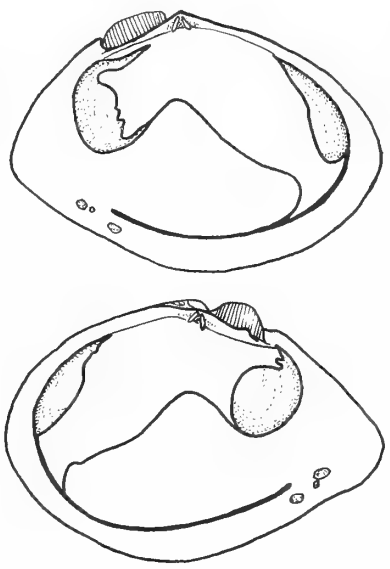


Figure 26

Macoma indentata, internal view of valves
Roth collection 6705, Monterey, California; 39 mm

Geographic Distribution and Ecology:

Trinidad, California (Talmadge Collection), to and through the Gulf of California, as far south as Isla Cerralvo, Baja California Sur, and Guaymas, Sonora. Specimens from Alaska (MCZ, no number) probably represent a labeling error. The record from Puget Sound (DALL,

1921a) cannot be verified, and may be based on young specimens of *Macoma secta*. It is found from the intertidal area in bays to from 10 to 91 m offshore on semiprotected coast, in silt to sand (BURCH, 1945a).

Material seen: 172 lots, including Gulf of California specimens.

Geologic Distribution and Biogeography:

There are a number of records in the late Pleistocene, from the Santa Monica area, California (HOOTS, 1931; GRANT & GALE, 1931; VALENTINE, 1956), to Bahía San Quintín, Baja California Norte (ORCUTT, 1921b; JORDAN, 1926; MANGER, 1934). In the early Pleistocene, the species is known from the Santa Barbara area, California (UPSON, 1951), to the San Pedro area, California (T. OLDROYD, 1925; BURCH, 1947; CLARK, *in* NATLAND, 1957).

There are records in southern California formations transitional between the Pliocene and Pleistocene and many records in the Pliocene of California. The species is probably synonymous with *Macoma vanvlecki* Arnold, 1910, described from the Pliocene of California. There are records from the Miocene of California which should be reconfirmed. *Macoma indentata flagleri* Etherington, 1931, from the Miocene of Washington may be a mactrid.

Panamic material differs from Californian material in being broader, although not as much so as in *Macoma secta*. I know of no Asian or Caribbean homologue.

Macoma (Rexithaerus) expansa Carpenter, 1864

(Plate 10, Figures *58, 59*; Text figure 27)

Macoma expansa Carpenter
- CARPENTER, 1864a: 602, 639 [1872: 88, 125]
- CARPENTER, 1865c: 56
- DALL, 1900a: 308
- I. OLDROYD, 1925: 176
- BURCH & BURCH, 1943: 21
- BURCH, 1945a: 15; 1945b: 17
- PALMER, 1958: 17, 22, 27, 38, 48, 108, 338; plate 13, figures 1-3
- DUNNILL & ELLIS, 1969: 16-18, 33; figures 5 (1, 2), 9 (g)

Macoma liotricha Dall
- DALL, 1897: 12; plate 1, figure 21
- DALL, 1900a: 308
- I. OLDROYD, 1925: 176; plate 22, figure 8
- BURCH, 1945a: 15; 1945b: 17

Type Material:

Macoma expansa – USNM 663886, formerly "3910" (not a USNM number), lectotype herein, right valve, 38.7 mm; USNM 663885, paralectotype, left valve; USNM 663887, paralectotype, pair, a specimen of *Macoma carlottensis*. Plate 10, Figure *58*.

Macoma liotricha - USNM 107642, lectotype herein, pair, 44.8 mm; USNM 663879, paralectotypes, 2 pairs and 1 valve. Plate 10, Figure *59*.

Type Localities:

Macoma expansa – Puget Sound, Washington; C. B. R. Kennerly.

Macoma liotricha – North side of Korovin Bay, Atka Island, Aleutian Islands, Alaska; W. H. Dall.

Nomenclatural Commentary:

The distribution of material seems continuous along the coast, and although southern material is slightly more elongate posteriorly than northern, I do not think subspecific rank is warranted.

Description:

Medium-sized (to 50 mm); ovate-elongate; inflated; thin; almost equilateral to longer posteriorly; rounded anteriorly; produced but rounded posteriorly; periostracum thin, adherent, shiny; pallial sinuses perpendicular to pallial line, approximately equal in size. Other internal details as in Text figure 27.

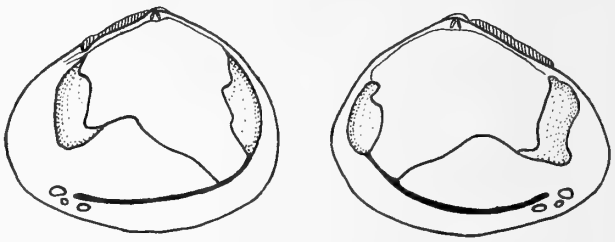


Figure 27

Macoma expansa, internal view of valves
USNM 663879, Atka Island, Aleutian Islands, Alaska; 45.5 mm

Geographic Distribution and Ecology:

Attu Island, Aleutian Islands, Alaska (USNM 108698), through the Aleutian Islands, along the southern coasts of Alaska, throughout British Columbia, Washington, Oregon, and in California as far south as Oceano (SU 30878). It occurs in the intertidal area in protected localities and just below the surf-influenced zone to 27 m, even on exposed coast, in sand (DUNNILL, 1968; DUNNILL & ELLIS, 1969).

Material seen: 52 lots.

Geologic Distribution and Biogeography:

In the late Pleistocene, this species is known from

Puget Sound, Washington (HENDERSON, 1927, as *"cf."*), Point Año Nuevo, California (ADDICOTT, 1966), and Bahía San Quintín, Baja California Norte (ORCUTT, 1921a; VALENTINE & MEADE, 1961). I would question the last records. DALL's (1874) record from the Pliocene of San Diego is incorrect (HERTLEIN & GRANT, 1944).

I know of no Asian homologue.

SUBGENERA UNCERTAIN

Into this category must be placed the following three unrelated species:

Macoma nasuta may be most closely related to the Indo-Pacific genera *Homalina* Stoliczka, 1870, and *Macomona* Finlay, 1927.

Macoma inquinata seems most closely related to *Austromacoma* Olsson, 1961, and less to *Gastrana* Schumacher, 1817, and *Heteromacoma* Habe, 1952. The last genus seems to be a senior synonym of *Sinomacoma* Yamamoto and Habe, 1959.

Finally, *Macoma balthica* is a mystery. It may be a brackish-water derivative of *Macoma (Macoma),* perhaps closest to *M. (M.) obliqua* and *M. (M.) middendorffi.*

Macoma nasuta (Conrad, 1837)

(Plate 11, Figures *60* - *62*; Text figure 28)

Tellina nasuta Conrad
- CONRAD, 1837: 258-259
- MIDDENDORFF, 1849: 577-578
- MIDDENDORFF, 1850: 256; plate 23, figures 8-11 (only) [in part]
- CARPENTER, 1857a: 213
- CARPENTER, 1857b: 192, 195, 211, 219, 221, 223, 232, 234, 283, 296, 302, 347, 351, 367
- CARPENTER, 1864a: 534, 536, 540, 585, 600, 639 [1872: 20, 22, 26, 71, 86, 125] [*Macoma*]
- DALL, 1900a: 307-308
- ARNOLD, 1903: 163, 394; plate 16, figures 2, 3
- PACKARD, 1918: 279-280, 378, 430; plate 23, figures 1a-1d, plate 49
- OLDROYD, 1924: 53, 213; plate 32, figures 1a-1d
- I. OLDROYD, 1925: 174; plate 45, figures 1a-1d
- GRANT & GALE, 1931: 365-366, 922; plate 20, figures 11a, 11b
- BURCH & BURCH, 1943: 17-18, 24-25 (text figures)
- BURCH, 1945a: 3-4 (text figures), 11-12; 1945b: 17
- KEEN, 1966a: 170
- DUNNILL & ELLIS, 1969: 27-29, 33; figures 8 (1), 9 (h)

Tellina tersa Gould
- GOULD, 1853: 398, 408 [reprint: 25, 35]; plate 16, figure 2
- GOULD & CARPENTER, 1857: 199
- CARPENTER, 1857b: 226, 229, 303
- GOULD, 1862: 188
- CARPENTER, 1864a: 532, 639 [1872: 20, 125] [as = *nasuta*]
- JOHNSON, 1964: 158

Macoma kelseyi Dall
- DALL, 1900b: 1052, 1622; plate 49, figure 7
- ARNOLD, 1903: 164
- OLDROYD, 1924: 53-54
- I. OLDROYD, 1925: 171-172
- GRANT & GALE, 1931: 366-367
- BURCH, 1945a: 14; 1945b: 17

Type Material:

Tellina nasuta – BM(NH) 1861.5.21.158, lectotype herein, pair, 76.5 mm. This is markedly larger than Conrad's stated measurement of 44.6 mm. The original lot must have consisted of several specimens. Plate 11, Figure *60*.

Tellina tersa – Lost (JOHNSON, 1964). Dr. Keen (verbal communication) was unable to locate the specimen at the BM(NH), and I could not find it among the Gould material at the USNM. Gould's figure is 27.5 mm long. Plate 11, Figure *61*.

Macoma kelseyi – USNM 147690, lectotype herein, left valve, figured by Dall, 92 mm; USNM 645417, paralectotype, a smaller, right valve. Plate 11, Figure *62*.

Type Localities:

Tellina nasuta – Near San Diego, California; T. Nuttall. According to KEEN (1966a), the label bears a notation by Nuttall, "eaten by Chinhooks at the estuary of the Oregon." This implies that he may also have collected specimens from the Columbia River estuary, so it is possible that material from two sources may have been mixed.

Tellina tersa – "Panama," presumably in error; E. Jewett.

Macoma kelseyi – City Park, San Diego, California; upper Pliocene (HERTLEIN & GRANT, 1944) [as "Pleistocene"]; R. E. C. Stearns.

Nomenclatural Commentary:

The synonymy of *Macoma nasuta* with Gould's *Tellina tersa* must remain uncertain as the type specimen of the latter is lost. The original figure does not seem to be any of the common Panamic species of *Macoma* and does seem close to young of *M. nasuta.*

The name *Macoma kelseyi* has been used in the Recent fauna for northern specimens with an especially elongate and truncate posterior end, although Dall's type specimen was not so much elongate posteriorly as pointed. It is also heavy for the species, not unlike specimens living subtidally on open coasts.

Description:

Large (to 110 mm); elongate-ovate; moderately inflated; average in thickness; equilateral to longer posteri-

orly; rounded anteriorly; pointed, truncate posteriorly; smooth or with sculpture of irregular, low concentric ribs; traces of brownish periostracum ventrally; pallial sinuses confluent with pallial line, larger in left valve, reaching anterior adductor muscle scar. Other internal details as in Text figure 28.

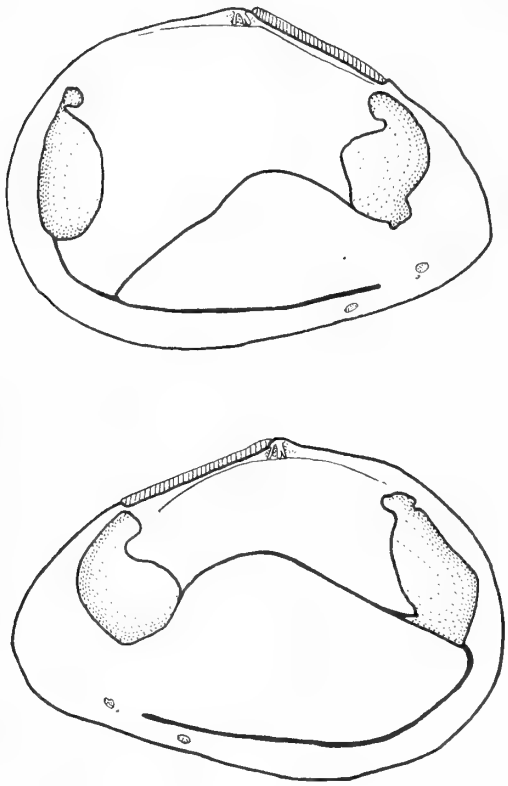


Figure 28

Macoma nasuta, internal view of valves
SU 305, Brown Island, San Juan Islands, Washington; 80 mm

Geographic Distribution and Ecology:
Sitkalidak Island, southeastern coast of Kodiak Island (USGS M2066), and Kodiak Island, Alaska (USNM 108718), throughout the entire West Coast to Cabo San Lucas, Baja California Sur (CAS 17663a), with many intermediate records. Middendorff (1849, 1851) reported it from the Bering Sea, but the record has never been confirmed. It is found in the intertidal area in bays and below wave line on more open coast to about 46 m, in sandy-silt (Burch, 1945a; Addicott, 1952; Filice, 1958; Jones, 1964). The species spawns in spring or early summer in Oregon (Edmondson, 1920).

Material seen: 310 lots.

Geologic Distribution and Biogeography:
This species is very common in the late Pleistocene; it has been reported from the Queen Charlotte Islands, British Columbia (Dawson, 1880), to Bahía Magdalena, Baja California Sur (Jordan, 1924, 1936), with many intermediate records. It is known in the early Pleistocene from the Elk River area, Oregon (Arnold & Hannibal, 1913), to San Pedro, California (Arnold, 1903; T. Oldroyd, 1925; Crickmay, 1929a; Burch, 1947; Clark, *in* Natland, 1957; Valentine & Meade, 1961). There are several records in southern Californian formations transitional between the Pliocene and the Pleistocene and in the Pliocene of California. *Macoma jacalitosana* Arnold, 1910, described from the Pliocene of central California, is probably synonymous. There are also records in the Miocene and one questionable one in the Oligocene.

An analogous Asian species is *Macoma tokyoensis* Makiyama, 1927 [*Tellina dissimilis* von Martens, 1865, *non* Deshayes, 1855], which differs in having a beveled escutcheon, being more regular in outline, and having a pallial sinus in the left valve which does not reach the anterior adductor muscle scar. It seems thicker and heavier on an average than the Californian species.

Macoma inquinata (Deshayes, 1855)
(Plate 11, Figures *63, 64*; Text figure 29)

Tellina inquinata Deshayes
Deshayes, 1855: 357
Carpenter, 1857b: 192, 302

Explanation of Plate 11

Figure *60*: *Macoma nasuta.* Lectotype (herein) of *Tellina nasuta,* BM(NH) 1861.5.21.158; 76.5 mm
Figure *61*: *Macoma nasuta.* Original illustrations of *Tellina tersa*; 27.5 mm
Figure *62*: *Macoma nasuta.* Lectotype (herein) of *Macoma kelseyi,* USNM 147690; 92 mm
Figure *63*: *Macoma inquinata.* Lectotype (herein) of *Tellina inquinata,* BM(NH) 1841.3.9.27; 45 mm
Figure *64*: *Macoma inquinata.* Holotype of *Macoma inquinata arnheimi,* USNM 122537; 36.9 mm
Figure *65*: *Macoma balthica.* Potential lectotype of *Tellina balthica,* Linnean Society of London; 15.5 mm

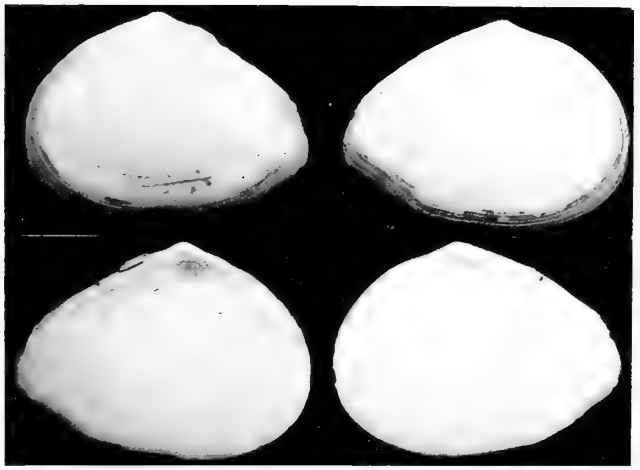


Figure 60

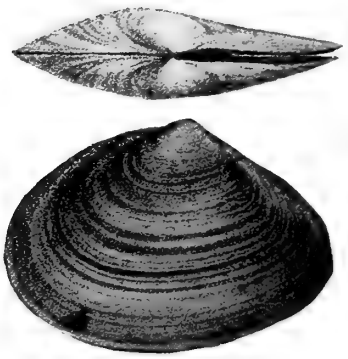


Figure 61

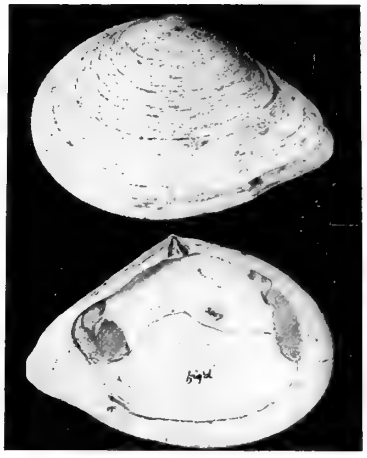


Figure 62

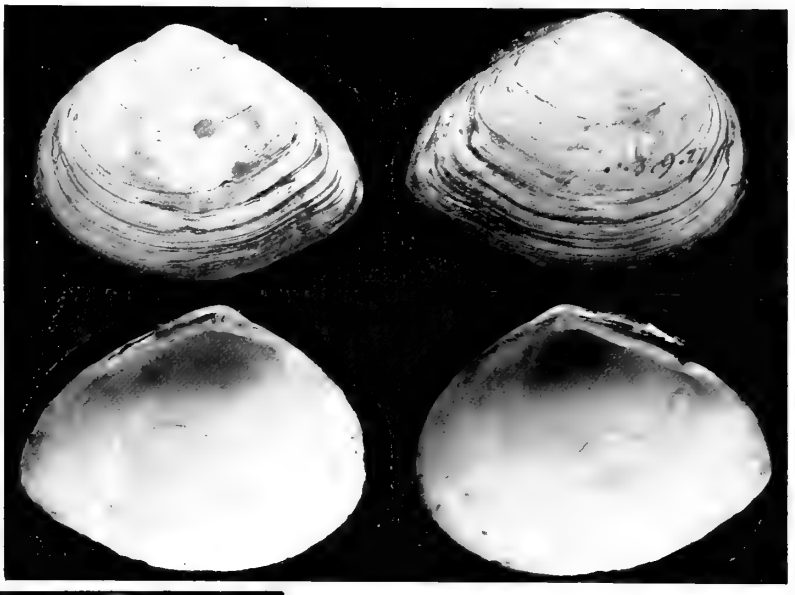


Figure 63

Figure 64

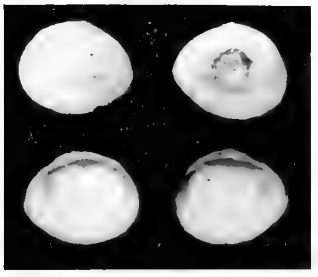


Figure 65

Carpenter, 1864a: 525, 594, 611, 627, 639, 682 [1872: 11, 80, 97, 113, 125, 168] [*Macoma*]
Sowerby, 1867: plate 30, figure 164 [*Tellina*]
Dall, 1900a: 307 [*Macoma*]
Arnold, 1903: 162, 394; plate 16, figure 4
Packard, 1918: 278, 378, 380; plate 23, figures 2a, 2b, 3a, 3b, plate 24, figures 1a, 1b, plate 48
Oldroyd, 1924: 54, 213; plate 32, figures 2a, 2b, 3a, 3b
I. Oldroyd, 1925: 172; plate 45, figures 2a, 2b, 3a, 3b
Grant & Gale, 1931: 367, 922; plate 20, figure 5
Burch & Burch, 1943: 18, 25 (text figure)
Dunnill & Ellis, 1969: 23-25, 33; figures 7 (1, 2), 9 (d)

Tellina irus Hanley, of authors, not of Hanley
[not Hanley, 1845: 166]
Salisbury, 1934: 85; plate 12, figures 5-8
Burch, 1945a: 3 (text figure), 12; 1945b: 17; 1945c: 30
Keen, 1962: 161

Macoma inquinata arnheimi Dall
Dall, 1916a: 36 [*nomen nudum*]
Dall, 1916b: 414
Oldroyd, 1924: 54, 209; plate 10, figure 3
I. Oldroyd, 1925: 172; plate 42, figure 9
Grant & Gale, 1931: 367-368
Burch & Burch, 1943: 19 [as a synonym of *Macoma incongrua*]
Burch, 1945a: 10 [as a synonym of *Macoma incongrua*]

Type Material:

Tellina inquinata – BM(NH) 1841.3.9.27, lectotype herein, pair, 45 mm. There are also two specimens in the BM (NH) from the Cuming collection from Puget Sound that were probably examined by Deshayes and are regarded as paralectotypes. Plate 11, Figure *63*.

Macoma inquinata arnheimi – USNM 122537, holotype, pair, 36.9 mm. Plate 11, Figure *64*.

Type Localities:

Tellina inquinata – "Columbia" [near mouth of Columbia River, Washington]; K. D. Wigram collection.

Macoma inquinata arnheimi – Kodiak Island, Alaska; J. S. Arnheim.

Nomenclatural Commentary:

Due to a superficial examination of type material in the BM(NH), Salisbury (1934) concluded that *Tellina irus* Hanley was a senior synonym of *T. inquinata* Deshayes. Further study (Keen, 1962) demonstrated that the two species belong in different genera and that *T. irus* is Japanese.

Dall described a rather short specimen of this species as *Macoma inquinata arnheimi*. Some workers suggested that this specimen may have been *M. obliqua* (Burch & Burch, 1943; Burch, 1945a), probably because I. Oldroyd (1924, 1925) illustrated a specimen of the latter as Dall's subspecies (SUPTC 6314). As short individuals occur throughout the range of the species, I do not feel that such specimens represent a subspecies.

Description:

Medium-sized (to 55 mm); rounded to rather elongate; moderately inflated; heavy; somewhat longer posteriorly; rounded anteriorly; pointed, only slightly truncate posteriorly; sculpture of conspicuous concentric undulations; periostracum in ventral patches only; pallial sinuses confluent with pallial line, that in left valve longer but not reaching anterior adductor muscle scar. Other internal details as in Text figure 29.

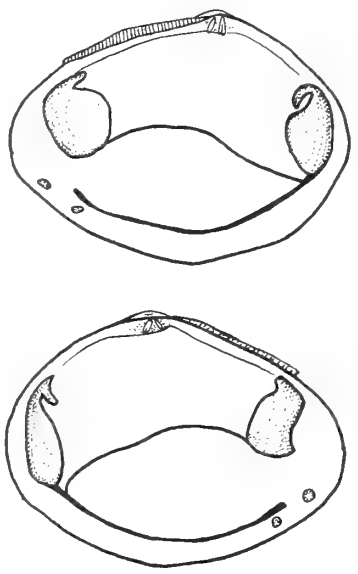


Figure 29
Macoma inquinata, internal view of valves
SU 299/6, Sitka, Alaska; 56 mm

Geographic Distribution and Ecology:

Siberia (USNM 108704, 223069), with no other records from the northern end of the Bering Sea; Atka Island, Aleutian Islands (ANSP 177975; MCZ 92210), and Hagenmeister Island, Alaska (USNM 219474), through the eastern Aleutian Islands, southern Alaska, British Columbia, Washington, Oregon, and in California as far south as San Pedro (SU 296/1; Burch, 1945a). It is rare south of Santa Barbara, California, and there may not normally be a population established south of that point. It occurs in the intertidal area in bays and to 48 m offshore, below the surf line, in silt (Burch, 1945a; Addicott, 1952; Filice, 1958; Dunnill, 1968; Dunnill & Ellis, 1969).

Material seen: 280 lots.

Geologic Distribution and Biogeography:

Macoma inquinata is known in the late Pleistocene from the southwestern portion of British Columbia (NEWCOMBE, 1914; CRICKMAY, 1925, 1929b; DRAYCOT, 1951; WAGNER, 1960) to Punta Baja, Baja California Norte (EMERSON & ADDICOTT, 1958; VALENTINE & MEADE, 1961). JORDAN's (1924) record from Laguna San Ignacio proved to be *M. nasuta* (HERTLEIN, 1934). In the early Pleistocene, there are records from Elk River, Oregon (ARNOLD & HANNIBAL, 1913), to the San Pedro area, California (ARNOLD, 1903; T. OLDROYD, 1925; CRICKMAY, 1929a; CLARK, 1931; DE LONG, 1941; BURCH, 1947; VALENTINE & MEADE, 1961). It has been reported in the Pliocene of California, although an ancestral Pliocene species is *Macoma affinis* Nomland, 1917, described from central California. It is not yet clear where *M. affinis plena* Stewart, *in* Woodring, Stewart, & Richards, 1941, fits into the picture.

Some workers have considered "*Mya?*" *subsinuata* Conrad, 1857a, from the Miocene (?) of Monterey County, California, a synonym of this species. As the type specimen is lost and the description and figure insufficient to identify Conrad's species, it must be regarded as a *nomen dubium.*

Macoma moliniana Dall, 1909, from the Oligocene of Oregon, may be ancestral to *M. affinis* and equivalent or related to: *Macoma sookensis* Clark & Arnold, 1923, and *Metis vancouverensis* Clark & Arnold, 1923, from the Oligocene of British Columbia; *Tellina gibsonensis* Palmer, 1918, and *Apolymetis twinensis* Durham, 1944, from the Oligocene of Washington; *Metis rostellata* Clark, 1918, from the Oligocene of California; *Macoma montesanoensis* Weaver, 1912, from the Miocene of Washington; *Macoma panzana* Wiedey, 1928; *Macoma sespeensis* Loel & Corey, 1932, and *Macoma menkeni* Hanna & Hertlein, 1938, all from the Miocene of California.

An Asian homologue is *Macoma contabulata* (Deshayes, 1855), which differs in being more rounded ventrally. It more closely resembles the extinct *M. affinis* than it does living *M. inquinata.* I would suggest that as this species-complex has had a long history in the northern Pacific, a study of its evolution might prove interesting and have stratigraphic utility.

Macoma balthica (Linnaeus, 1758)

(Plate 11, Figure *65*; Plate 12, Figures *66* to *69*; Text figure 30)

Tellina balthica Linnaeus
- LINNAEUS, 1758: 677
- LINNAEUS, 1767: 1120
- GMELIN, 1791: 3241
- CARPENTER, 1857b: 221
- CARPENTER, 1864a: 534 [*Macoma*] [1872: 20]
- DALL, 1900a: 308-309
- DALL, 1900b: 1051
- PACKARD, 1918: 277, 382, 426; plate 25, figures 1, 2, 9, plate 47
- OLDROYD, 1924: 54, 214; plate 41, figures 1, 2, 9
- I. OLDROYD, 1925: 172; plate 44, figures 1, 2, 9
- GRANT & GALE, 1931: 371-372, 908, 922; plate 14, figures 6a, 6b, plate 20, figures 7a, 7b
- BURCH & BURCH, 1943: 20
- DODGE, 1952: 51-52

Tellina solidula Pulteney [a European synonym; type not searched]
- PULTENEY, 1799: 29
- MIDDENDORFF, 1849: 577
- MIDDENDORFF, 1851: 260-263; plate 22, figures 3-6

Tellina solidula normalis Middendorff
- MIDDENDORFF, 1851: 262

Tellina petalum Valenciennes, in Humboldt & Bonpland
- VALENCIENNES, in HUMBOLDT & BONPLAND, 1821: 222; plate 48, figures 2a, 2b
- HANLEY, 1846: 317; plate 66, figure 263
- CARPENTER, 1857b: 170, 302
- KEEN, 1958b: 190 [as a synonym of *Heterodonax bimaculatus*]

Tellina inconspicua Broderip & Sowerby
- BRODERIP & SOWERBY, 1829: 363
- SOWERBY, in GRAY, 1839: 153; plate 41, figure 6
- CARPENTER, 1857b: 175, 221, 347
- CARPENTER, 1864a: 526, 532, 534, 576, 600, 639, 681 [*Macoma*] [1872: 12, 18, 20, 62, 86, 125, 167]
- BURCH, 1945a: 13; 1945b: 17; 1945c: 30
- DUNNILL & ELLIS, 1969: 20-23, 33; figures 6 (1), 9 (1)

Sanguinolaria californiana Conrad
- CONRAD, 1837: 231; plate 17, figure 7
- CARPENTER, 1857a: 212
- CARPENTER, 1857b: 195, 221, 301
- CARPENTER, 1864a: 526, 576, 600, 639 [as a synonym of *Macoma inconspicua*] [1872: 12, 62, 86, 125]
- KEEN, 1966a: 171

Explanation of Plate 12

Figure *66*: *Macoma balthica.* Lectotype (herein) of *Tellina petalum,* Musée d'Histoire Naturelle de Paris; 16 mm

Figure *67*: *Macoma balthica.* Original illustration of *Tellina inconspicua*; 23.3 mm

Figure *68*: *Macoma balthica.* Original illustration of *Sanguinolaria californiana*; 28.6 mm

Figure *69*: *Macoma balthica.* Holotype of *Tellina rotundata,* BM (NH) without registry number; 32.5 mm

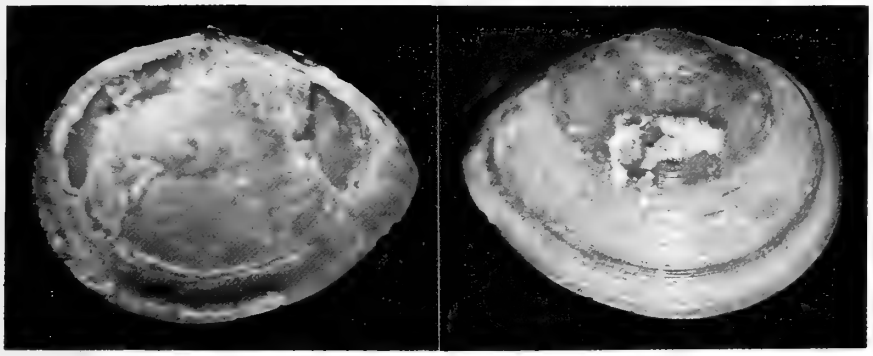


Figure 66

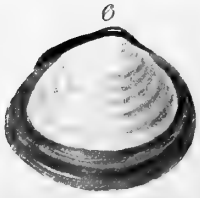


Figure 67

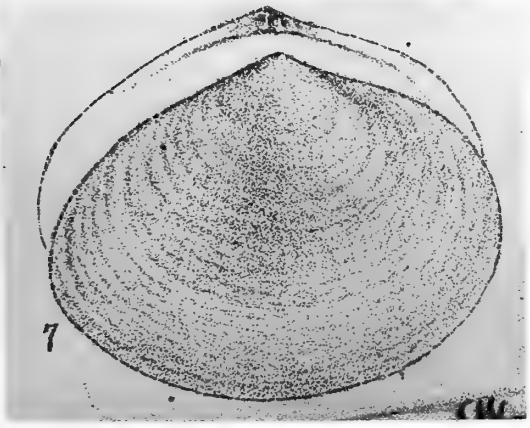


Figure 68

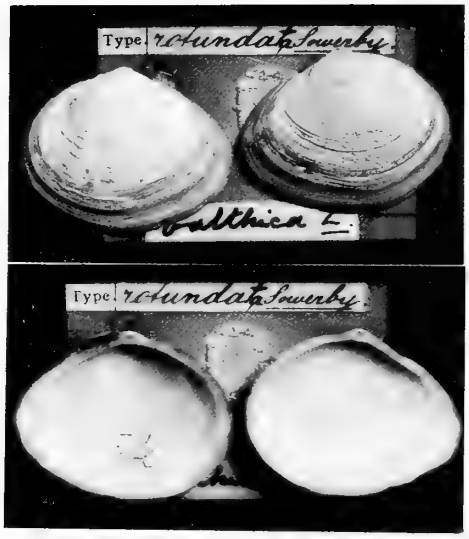


Figure 69

Tellina californica Carpenter, "*ex* Conrad MS" [misspelling for *Sanguinolaria californiana*]
CARPENTER, 1857b: 195, 211, 302 [*nomen nudum*]
CARPENTER, 1864a: 532 [as a synonym of *Macoma inconspicua*]
Tellina rotundata Sowerby, not Montagu
SOWERBY, 1867: plate 27, figure 146
[not MONTAGU, 1803: 71-72; plate 2, figure 3]
Tellina rotunda Salisbury,1934, new name for *Tellina rotundata* Sowerby, not Montagu
SALISBURY, 1934: 87

Type Material:

Tellina balthica – Linnean Society of London, potential lectotype, largest pair, 15.5 mm; potential paralectotypes, 4 pairs. It is for European workers to study the history of these specimens and designate a lectotype. Plate 11, Figure *65*.

Tellina solidula normalis – Presumably in the Zoologiche Institut, Leningrad.

Tellina petalum – Musée d'Histoire Naturelle de Paris, lectotype herein, largest specimen, right valve, probably figured by Valenciennes, 16 mm. (Salvat, in correspondence); paralectotypes, 2 large valves (possibly a pair), 2 small pairs. Plate 12, Figure *66*.

Tellina inconspicua – Lost; the original description and 23.3 mm-long figure (SOWERBY, in GRAY, 1839) are sufficient to identify the taxon. Plate 12, Figure *67*.

Sanguinolaria californiana – Lost; Conrad's description and 28.6 mm-long figure are satisfactory. Plate 12, Figure *68*.

Tellina rotundata – BM(NH) without registry number, holotype, pair, about 32.5 mm. Plate 12, Figure *69*.

Type Localities:

Tellina balthica – Baltic Sea; probably by Linnaeus.

Tellina solidula normalis – Bering Sea.

Tellina petalum – "Acapulco"; F. H. A. von Humboldt & A. J. A. Bonpland. This locality is probably in error, as the species does not occur in the Panamic province. Considering the travels of this expedition, it is more likely that the specimens came from the east coast of North America.

Tellina inconspicua – Icy Cape, Arctic Alaska; voyage of the *Blossom*.

Sanguinolaria californiana – Columbia River estuary, Washington; T. Nuttall, "muddy marshes near the limits of salt water."

Tellina rotundata – None given in original account. The name is mentioned here because this species has been regarded, in error, as a synonym of *Macoma obliqua* (see same, above). SALISBURY (1934) cites the unlikely localities of India and Ceylon.

Nomenclatural Commentary:

A study of a great deal of material has convinced me that there is no easy way to separate Pacific from Atlantic specimens of this variable species. A world-wide statistical study might be of significance. Until a project of this sort is attempted it is probably best to consider this as one circum-arctic species.

Description:

Small (to 30 mm, rarely to 45 mm); rotund; moderately inflated; usually heavy, but bay specimens occasionally thin; longer posteriorly; rounded anteriorly; rounded to somewhat pointed posteriorly; beaks usually worn; periostracum as ventral traces; often reddish; pallial sinuses approximately equal in size, confluent with pallial line, difficult to distinguish against internal gleam. Other internal details as in Text figure 30.

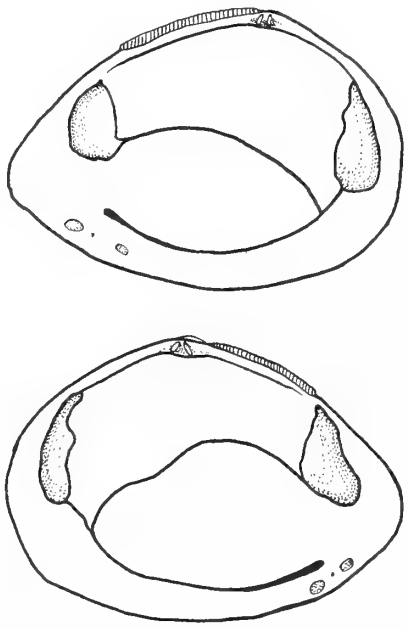


Figure 30
Macoma balthica, internal view of valves
SU 47236, Unalakleet, Alaska; 30 mm

Geographic Distribution and Ecology:

Circum-arctic. In the eastern Pacific it is found throughout the Alaskan coast, British Columbia, Washington, Oregon, and commonly as far south as San Francisco Bay, California (many records). There are isolated records from Santa Cruz, Monterey, Pismo Beach, Santa Barbara, San Pedro, and San Diego. These may, in part, represent transport in crevices of ships. I was not successful in locating living or dead specimens in Elkhorn Slough, Monterey Bay, and there seem to be no living populations

south of San Francisco. It is found in the upper intertidal area in bays, especially brackish areas, to about 37 m in quiet offshore areas, in silt (Burch, 1945a; Filice, 1958; Vassallo, 1969).

Material seen: 327 lots from area studied.

Geologic Distribution and Biogeography:

There are records from the Pleistocene of the Northwest Territories (Dall, 1919, 1924), southeastern Alaska (Dall, 1904; Smith, 1919; Buddington & Chapin, 1929; Twenhofel, 1952), southwestern British Columbia (Newcombe, 1914; Armstrong & Brown, 1954; Wagner, 1960), and Puget Sound, Washington (Henderson, 1927). Records from the Goleta terrace (Oldroyd & Grant, 1931; Grant & Gale, 1931), prove to be based on a juvenile specimen of *Macoma inquinata,* and the same may be true of the record from the Ventura terrace (Putnam, 1942). The species is also known in the Pleistocene of the East Coast (Richards, 1962) and of Europe (British Museum [Natural History], 1963).

Japanese workers have renamed the species *Macoma takahokoensis* Yamamoto & Habe, 1959.

OTHER SPECIES

A few other specific names were encountered during this study which have not yet been discussed.

(1) *Tellina diegoana* Conrad, 1855, described from either the Pleistocene or Pliocene of San Diego, is a *nomen dubium.* The type specimen is lost, and the description and illustration are insufficient to identify the taxon.

(2) *Tellina pedroana* Conrad, 1855, from the Pleistocene of San Pedro, is a *nomen dubium* for the same reasons.

(3) *Tellina ulloana* Hertlein, 1968, was reported as *Tellina declivis* Sowerby, 1868, by Dall (1916a) and others from Catalina Island, California, based on a single lot (USNM 198897). This lot was catalogued in 1907 with other material from the same station, but neither the name of the collector nor what were the other species in the material is given in the catalogue. It has not been taken in California since, and the most northerly documented material available is from Bahía Magdalena, Baja California Sur. Thus, the Californian record of this species is regarded with much question.

(4) *Tellina miniata* Gould, 1851, and *Tellina gemma* Gould, 1853, were incorrectly attributed to California by Johnson (1964). Gould's San Juan locality is in Baja California Sur at about 27° N on the Gulf of California (C. B. Adams, 1852a, b).

(5) *Tellina rubescens* Hanley, 1844a, has been reported in the late Pleistocene of southern California but as it does not occur in the Recent fauna, it is more properly considered in the Panamic fauna. I have not seen Pleistocene material, and possibly these records are based on specimens of *Tellina simulans* C. B. Adams, 1852a, because of the confusion between the two species.

(6) *Tellina lamellata* Carpenter, 1857c, was reported from California by Carpenter (1864a). The type specimen of this species proved to be a juvenile specimen of *Semele* (Keen, 1968), and the Californian specimen (USNM 15579) proves to be a juvenile *Cumingia.*

(7) *Macoma truncaria* Dall, 1916b [1916a, *nomen nudum*], was based on a specimen of *Thracia* (Coan, 1969b).

ECOLOGIC AND BIOGEOGRAPHIC CONCLUSIONS

ECOLOGY

Ecologic trends become apparent when the ecologic information about each species is presented in tabular form.

(Table, see next page)

The data available for most tellinid species are difficult to interpret because it is not easy to correlate the various pieces of ecologic information, both what has been published and what one finds on collection labels, especially as to bottom type and coastal exposure. Also, the depths and bottom types listed are ranges, not averages. What is necessary to compare the environment of one species with others is more specific information about the area in which each is most abundant.

One can, however, see certain trends and arrive at some generalizations. Within the family, only two species of *Tellina* can be termed characteristic of sandy substrates on open beaches, *T. lutea alternidentata* and *T. bodegensis.* They therefore are comparable to those of the *Tellina* communities described by Thorson (1961) for the northern Atlantic, the Mediterranean, and Australia.

Most of the species seem more characteristic of what might be termed protected or semi-protected conditions. They have been regarded as characteristic of bays, but also occur offshore below the area of wave action in the appropriate substrates. Paleontologists attempting to interpret fossil assemblages must take this into account. Those species more abundant offshore often have records of maximum depth greater than those more common in bays. The following tables list the species in these two categories:

Table 1

Species	Depth range, meters	Bottom type	Coastal exposure
Tellina lutea alternidentata	0 - 84	sand	exposed, beaches
Tellina bodegensis	0 - 96	sand	exposed, beaches
Tellina idae	0 - 91	sand	protected, bays and offshore
Tellina nuculoides	0 - 73	various	protected, bays and offshore
Tellina meropsis	0 - 48	sand	protected, bays and offshore
Tellina carpenteri	0 - 441	various	protected, bays and offshore
Tellina modesta	0 - 91	silty-sand to sand	protected, bays and offshore
Leporimetis obesa	0 - 46	sand	protected, bays and offshore
Macoma calcarea	2 - 320	silt	protected, offshore
Macoma elimata	15 - 435	silty-sand to sand	protected, offshore
Macoma brota	14 - 260	silt to sand	protected, offshore
Macoma lipara	26 - 259	silt to fine sand	protected, offshore
Macoma middendorffi	27 - 32	sand	protected? offshore
Macoma obliqua	0 - 183	sand to gravel	protected, offshore
Macoma frigida	unknown	unknown	unknown
Macoma moesta moesta	0 - 260	silt	protected, offshore
Macoma moesta alaskana	11 - 260	various	protected, offshore
Macoma crassula	16 - 161	gravel	protected, offshore
Macoma loveni	4 - 816	coarse	protected, offshore
Macoma lama	0 - 183	sand	exposed? offshore
Macoma yoldiformis	0 - 93	silt to sand	protected, bays and offshore
Macoma acolasta	0 - 73	sand	protected, bays and offshore
Macoma carlottensis	5 - 1547	silt to fine sand	protected, offshore
Macoma leptonoidea	483 - 594	silt	protected, offshore
Macoma secta	0 - 46	sand	semi-protected, bays and offshore
Macoma indentata	0 - 91	silt to sand	semi-protected, bays and offshore
Macoma expansa	0 - 27	sand	semi-protected, bays and offshore
Macoma nasuta	0 - 46	sandy-silt	protected, bays and offshore
Macoma inquinata	0 - 48	silt	protected, bays and offshore
Macoma balthica	0 - 37	silt	protected, bays, including brackish ones, and offshore

Table 2

Species more common in bays

Species	Depth range meters
Tellina meropsis	0 - 48
Leporimetis obesa	0 - 46
Macoma secta	0 - 46
Macoma nasuta	0 - 46
Macoma inquinata	0 - 48
Macoma balthica	0 - 37

Table 3

Species more common offshore

Species	Depth range meters
Tellina idae	0 - 91
Tellina nuculoides	0 - 73
Tellina carpenteri	0 - 441
Tellina modesta	0 - 91
Macoma yoldiformis	0 - 93
Macoma acolasta	0 - 73
Macoma indentata	0 - 91
Macoma expansa	0 - 27

Finally, a few species are characteristic of the offshore environment, rather than that of shallow beaches or bays. These are mainly members of *Macoma (Macoma).*

Table 4

Species	Depth range meters
Macoma (Macoma) calcarea	2 - 320
Macoma (Macoma) elimata	15 - 435
Macoma (Macoma) brota	14 - 260
Macoma (Macoma) lipara	26 - 259
Macoma (Macoma) middendorffi	27 - 32
Macoma (Macoma) obliqua	0 - 183
Macoma (Macoma) moesta moesta	0 - 260
Macoma (Macoma) moesta alaskana	11 - 260
Macoma (Macoma) crassula	16 - 161
Macoma (Macoma) loveni	4 - 816
Macoma (Macoma) lama	0 - 183
Macoma (?Psammacoma) carlottensis	5 - 1547
Macoma (?Psammacoma) leptonoidea	483 - 594

Within each ecologic group, one may expect species to differ from one another in geographic distribution, depth and sediment preference, and feeding method.

The abundance of species is reflected in their frequency in collections. The number of lots studied may well be a better indication of relative abundance than the total number of specimens, because the latter quantity varies in collections with the average size of individuals. Curators tend to retain in museums fewer specimens of larger species.

Table 5

	Number of lots seen
Macoma balthica	327
Macoma nasuta	310
Macoma inquinata	280
Macoma secta	235
Macoma obliqua	203
Tellina lutea alternidentata	193
Macoma indentata	172
Macoma calcarea	169
Tellina bodegensis	164
Macoma carlottensis	164
Tellina modesta	151
Tellina carpenteri	143
Tellina nuculoides	118
Macoma lama	104
Macoma brota	102
Macoma yoldiformis	100
Tellina idae	100
Leporimetis obesa	92
Tellina meropsis	82
Macoma elimata	65
Macoma expansa	52
Macoma moesta alaskana	35
Macoma lipara	32
Macoma moesta moesta	30
Macoma middendorffi	28
Macoma acolasta	20
Macoma loveni	6
Macoma leptonoidea	6
Macoma crassula	2
Macoma frigida	1

Members of the genus *Macoma* represent the five most common species, reflecting the success of this group in shallow, protected areas. The eleven least common species are also members of the genus *Macoma* and are mostly Arctic or deep-water forms.

BIOGEOGRAPHY

The species of the Tellinidae may be grouped geographically in terms of the so-called molluscan provinces. There is some controversy as to how provinces should best be defined, whether by percent endemism or by degree of faunal change at their borders. There is no one paper that gives a balanced definition or final terminology with which I can agree. A recent review is provided by VALENTINE (1966). For present purposes, I will define the molluscan provinces mentioned here by the following geographic boundaries:

Arctic – Arctic Ocean and the Bering Sea to Bristol Bay, Alaska

Aleutian – Eastern Aleutian Islands to Cape Flattery, Washington

Oregonian – Cape Flattery, Washington, to Point Conception, California

Californian – Point Conception, California, to Punta Eugenio, Baja California Sur

Panamic – Punta Eugenio, Baja California Sur, to Punta Aguja, northern Peru.

The following table (Table 6) demonstrates the predominance of the genus *Macoma* in colder water. If a series of such tables were available for other molluscan groups, they could provide paleontologists with a readily usable means of comparing fossil assemblages with generalized information about Recent species.

Table 6

Arctic	Aleutian	Oregonian	Californian	Panamic
1. *M. middendorffi* *M. frigida* *M. crassula* *M. loveni*	4. *T. bodegensis* *T. carpenteri* *M. secta* *M. carlottensis*			
2. *T. lutea alternidentata* *M. calcarea* *M. brota* *M. obliqua* *M. moesta moesta – M. moesta alaskana* *M. lama*		3. *M. indentata*		
3. *M. balthica*			2. *T. meropsis* *L. obesa*	
	2. *M. lipara* *M. expansa*		1. *T. idae* *M. leptonoidea*	
	3. *T. nuculoides* *T. modesta* *M. elimata* *M. yoldiformis* *M. nasuta* *M. inquinata*			
		2. *M. acolasta*		

In this table, the following abbreviations are used:

1. Species occurring in one province only, that is, narrowly restricted
2. Species occurring in two provinces
3. Species occurring in three provinces
4. Species occurring in four provinces, that is, widely ranging

T. – *Tellina*
L. – *Leporimetis*
M. – *Macoma*

Distributions in the late Pleistocene are substantially the same as those in the Recent fauna. Most exceptions are probably due either to the lack of information about the Pleistocene north of California or about the Recent fauna on the Pacific coast of Baja California. An exception to this is the presence of *Leporimetis obesa* in the Pleistocene of Tomales Bay, which may be explained by the isolation there of populations during one of the warm interglacial periods.

Putting together our knowledge of the relationships of certain Recent West American species with their published fossil records can demonstrate some relationships, of which I would like to discuss here the most conspicuous.

As explained by GHISELIN (1969), the terms "homology" and "analogy" refer to correspondence between elements or features of some larger unit. They are not to be confused with "similarity," which refers to the overall property of larger units. Homology implies close correspondence of particular elements which are presumed to have a common ancestry. Analogy refers to a looser correspondence not based on a common ancestry.

Thus, the term which should be used for species pairs within given genera between biogeographic provinces, presumably as a result of common ancestry, is "homologues." Species which are presumed to be homologous are ones which are morphologically similar to one another in features of shell morphology. Analogous species, on the other hand, might either be similar species of unrelated taxa or species occupying the same ecological "niche" within different faunas, but belonging to different taxa.

The species having closest affinities with the Panamic or Caribbean provinces are:

Tellina meropsis – Panamic province with a Caribbean homologue; earliest fossil record in northwest America, Pleistocene.

Tellina carpenteri – Panamic province, with a possibly related Caribbean form; earliest fossil record in northwest America, Pleistocene.

Leporimetis obesa – closely related species in the Panamic and Caribbean provinces; earliest fossil record in northwest America, Miocene.

Macoma yoldiformis and *M. acolasta* – Related species in Panamic and Caribbean provinces; possibly related species in Miocene of northwest America.
Macoma indentata – Panamic province; earliest fossil record in northwest America, Miocene.

Among Arctic species, a significant story is that of the *Macoma obliqua* group (Coan, 1969a), which is discussed in the text under that species and under *M. middendorffi*.

Macoma calcarea is a trans-arctic species and seems to have relatives in the Oligocene of northwestern America. It probably reached the Atlantic and the Arctic from the Pacific. It does not occur in Asia but seems closely related to *M. orientalis,* which does.

Macoma balthica is a trans-arctic species and has West American and European fossil records only as far back as the Pleistocene. One suspects that it is recently evolved.

Finally, *Macoma moesta, M. crassula,* and *M. loveni* are trans-arctic but have no substantial fossil records, so that it is difficult to establish their origins. I suspect that *M. moesta* and *M. lama* may be related.

The following are non-trans-arctic species that are most closely related to Asian forms or that also occur in Asia:

Table 7

Species	Asian homologue	Earliest northwest American record (or that of probable ancestral species)
Tellina lutea alternidentata	*T. lutea lutea*	Miocene
T. nuculoides	*T. lubrica*	early Pleistocene; ?Miocene
Macoma lama	also occurs in Asia	no record
M. secta	*M. sectior*	Miocene
M. nasuta	*M. tokyoensis*	Miocene; ?Oligocene
M. inquinata	*M. contabulata*	Miocene

A few other species that are not predominantly arctic seem to have no close relatives in other provinces:

Table 8

Species	Earliest northwest American record (or that of probable ancestral species)
Tellina bodegensis	Oligocene
T. idae	Oligocene
T. modesta	Miocene
Macoma elimata	Miocene
M. brota	Miocene
M. lipara	Pliocene
M. carlottensis	Pleistocene; ?Miocene
M. leptonoidea	Recent; ?Miocene
M. expansa	Pleistocene

These relationships suggest modes of isolation that may have provided so many tellinid species, especially of *Macoma,* on the west coast of North America.

First, there are closely related temperate species on the coasts of Asia and North America. These may be remnants of species once occurring all the way across the North Pacific along the Aleutian Islands that were subsequently isolated at some point during the Cenozoic by cooling. On the other hand, currents in the northern Pacific are assumed to have run mainly from the west to the east throughout the Cenozoic. It would not be surprising for products of Asian evolution to have been brought occasionally to western North America and become established.

Secondly, Bering Strait has been submerged during two main periods in the Cenozoic, as outlined by Hopkins (1967) and Coan (1969a). This has provided an absolute isolating mechanism that may account for the large number of species of *Macoma.*

Thirdly, the closing of the long-open sea passage across Panama in the late Miocene isolated species in the Caribbean from closely related species in the Panamic province.

Finally, populations may have become established in bays substantially north of their normal occurrences. The protection of such embayments may cause water temperatures to reach the proper level for gonad ripening, spawning, and larval development and settling. For example, *Leporimetis* lived in Tomales Bay in the late Pleistocene, where it does not now occur. If such a situation continued for some time and gene flow with the main population were interrupted, speciation might have taken place.

LITERATURE CITED

[All works cited in the text including sources of taxonomic units are listed. Volume, bulletin, monograph, memoir, professional paper, and special paper numbers are in **bold** face; series numbers precede volume numbers in parentheses; issue numbers follow volume numbers in parentheses; supplementary information, such as secondary methods of listing volumes, part numbers and parenthetical statements, are given in brackets. Plates, portraits, text figures, maps, and charts are listed, but not tables. Exact dates are given when possible.]

ADAMS, CHARLES BAKER

1852 [1852a]. Catalogue of shells collected at Panama, with notes on synonymy, station and habitat ... Lyc. Nat. Hist. New York, Ann. **5**: 229 - 296 (June); 297 - 549 (July) [reprinted: (1852b). Catalogue of shells collected at Panama, with notes on their synonymy, station, and geographical distribution. New York (Craighead) viii+334 pp.] [see also TURNER, 1956]

ADDICOTT, WARREN OLIVER

1952. Ecological and natural history studies of the pelecypod genus *Macoma* in Elkhorn Slough, California. Master of Arts thesis, Dept. Biol. Sci., Stanford Univ. 89 pp.; 33 text figs. (August 1952)

1966. Late Pleistocene marine paleoecology and zoogeography in central California. U. S. Geol. Surv. Prof. Paper **523C**: 21 pp.; 4 plts;. 5 text figs.

ANDERSON, FRANK MARION & BRUCE MARTIN

1914. Neocene record in the Temblor Basin, California, and Neocene deposits of the San Juan District, San Luis Obispo County. Calif. Acad. Sci., Proc. (4) **4**: 15 - 112; plts. 1 - 10 (30 December 1914)

ARMSTRONG, JOHN EDWARD & WILLIAM L. BROWN

1954. Late Wisconsin marine drift and associated sediments of the Lower Fraser Valley, British Columbia, Canada. Geol. Soc. Amer., Bull. **65** (4): 349 - 364; ptls. 1, 2; 3 text figs. (13 April 1954)

ARNOLD, RALPH

1903. The paleontology and stratigraphy of the marine Pliocene and Pleistocene of San Pedro, California. Mem. Calif. Acad. Sci. **3**: 420 pp.; 37 plts. (27 June 1903) [dating HERTLEIN, 1964]

1908. Descriptions of new Cretaceous and Tertiary fossils from the Santa Cruz Mountains, California. Proc. U. S. Nat. Mus. **34** (1617): 345 - 390; plts. 31 - 37 (8 August 1908)

1910. Paleontology of the Coalinga District, Fresno and Kings Counties, California. U. S. Geol. Surv. Bull. **396**: 173 pp.; 30 plts. (15 January 1910)

ARNOLD, RALPH & HAROLD HANNIBAL

1913. The marine Tertiary stratigraphy of the North Pacific coast of America. Proc. Amer. Philos. Soc. **52** (212): 559 - 605; plts. 37 - 48 (December 1913)

BANDY, ORVILLE LEE

1958. Dominant molluscan faunas of the San Pedro Basin, California. Journ. Paleont. **32** (4): 703 - 714; 4 text figs. (July 1958)

BARNARD, JERRY LAURENS

1963. Relationship of benthic Amphipoda to invertebrate communities of inshore sublittoral sands of southern California. Pacif. Naturalist **3** (15): 439 - 469; 7 text figs. (8 April 1963)

BARTSCH, PAUL

1929. Report upon the collection of marine mollusks made by Professor Dr. K. Derjugin in the Gulf of Peter the Great. Inst. Hydrol. Russ. Explor. des Mers d'U. R. S. S. **10**: 129 - 140; plts. 1 - 4

BARTSCH, PAUL, HARALD ALFRED REHDER & BEULAH E. SHIELDS

1946. A bibliography and short biographical sketch of William Healey Dall. Smithson. Inst. Misc. Coll. **104** (15): 96 pp.; 1 portr. (30 January 1946)

BERTIN, VICTOR

1878. Révision des tellinidés du Muséum d'Histoire Naturelle . . . Nouv. Arch. Mus. Nat. Hist. Nat. Paris (2) **1**: 201 - 361; plts. 8, 9 [issued in parts?]

1881. Révision des donacidées du Muséum d'Histoire Naturelle. Nouv. Arch. Mus. Natl. Hist. Nat. Paris (2) **4**: 57 - 121; plts. 3, 4 [issued in parts?]

BLAINVILLE, HENRI MARIE DUCROTAY DE

1814. Sur la classification méthodique des animaux mollusques, et établissement d'une nouvelle considération pour y parvenir. Soc. Philom. Paris, Bull. Sci. (2) **4** [for 1814]: 175 - 180

BOSS, KENNETH J.

1964. New species of *Tellina* from the western Atlantic. Occ. Pap. on Moll. **2** (29): 309 - 324; plts. 54 - 55 (7 August 1964)

1966. The subfamily Tellininae in the western Atlantic. The genus *Tellina* (Part I). Johnsonia **4** (45): 217 - 272; plts. 127 - 142 (31 October 1966)

1968. The subfamily Tellininae in the western Atlantic. The genera *Tellina* (Part II) and *Tellidora*. Johnsonia **4** (46): 273 - 344; plts. 143 - 163 (17 April 1968)

BOSS, KENNETH J., JOSEPH ROSEWATER & FLORENCE A. RUHOFF

1968. The zoological taxa of William Healey Dall. U. S. Nat. Mus. Bull. **287**: 1 - 427

BOWDEN, JOHN & DAVID HEPPELL

1968. Pulteney's 'Dorset Catalogues' with special reference to the Mollusca. Journ. Conchol. **26** (5): 321 - 328 (October 1968)

BRANN, DORIS C.

1966. Illustrations to "Catalogue of the Collection of Mazatlan Shells" by Philip P. Carpenter. Paleo. Res. Inst. Ithaca, N. Y.; pp. 1 - 111; plts. 1 - 60 (1 April 1966)

BRITISH MUSEUM (NATURAL HISTORY)

1963. British Caenozoic fossils, 2ND ed. London (Brit. Mus.) pp. i - vii+1 - 133; plts. 1 - 44

BRODERIP, WILLIAM JOHN & GEORGE BRETTINGHAM SOWERBY

1829. Observations on new or interesting Mollusca contained, for the most part in the Museum of the Zoological Society. Zool. Journ. **4** (15): 359 - 376; plt. 9 (post January, 1829)

1832. [Characters of new species of Mollusca and Conchifera, collected by Mr. Cuming.] [one section only] Proc. Zool. Soc. London [for 1832] [2] (17): 50 - 61 (5 June 1832)

BUDDINGTON, ARTHUR FRANCIS & THEODORE SHEFFIELD CHAPIN

1929. Geology and mineral deposits of southeastern Alaska. U. S. Geol. Surv. Bull. **800**: x+398 pp.; 22 plts. 3 text figs.

BURCH, BEATRICE LARUE

1947. Comparison of the molluscs of three Pleistocene beds with the Recent fauna of Los Angeles County, California. Min. Conch. Club South. Calif. no. **73**: 1 - 18 (Sept. 1947)

BURCH, BEATRICE LARUE & THOMAS ADAMS BURCH

1943. A survey of western North American marine molluscs. Tellinidae. Min. Conch. Club South. Calif. no. **25**: 9 - 25 (July 1943)

BURCH, JOHN QUINCY (ed.)

1945. Superfamily Tellinacea [& Solenidae]. *In*: Distributional list of the West American marine mollusks from San Diego, California, to the Polar Sea. Part I. Pelecypoda. Min. Conch. Club South. Calif. 1945a: no. **43**: 3 - 33 (January); 1945b: no. **45**: 3 - 21 [index, corrections and additions] (March); 1945c: no. **46**: 30 [corrections and additions]. (March)

BURCH, THOMAS ADAMS

1945. A new *Macoma* from California. Min. Conch. Club South. Calif. no. **47**: 30, 33; plt. 2 [part] (April 1945)

CARPENTER, PHILIP PEARSALL

[see also COAN, 1969c]

1856. Descriptions of (supposed) new species and varieties of shells, from the Californian and west Mexican coasts, principally in the collection of Hugh Cuming, Esq. Proc. Zool. Soc. London (for 1855) [pt. 23] (298): 228 - 232 (5 February); (299): 233 - 235 (23 February)

1857a. Monograph of the shells collected by T. Nuttall, Esq., on the Californian coast, in the years 1834-5. Proc. Zool. Soc. London (for 1856) [pt. 24] (314): 209 - 224; (315): 225 - 229 (26 January 1857)

1857 b. Report on the present state of our knowledge with regard to the Mollusca of the west coast of North America. Rept. Brit. Assoc. Adv. Sci. **26** (for 1856): 159 - 368; plts. 6 - 9 (pre-22 April) [dating: CARPENTER, 1857c: iv]

1857c. Catalogue of the collection of Mazatlan shells, in the British Museum: collected by Frederick Reigen, ... London (British Museum). iv+ix - xvi+552 pp. (Preface by J. E. GRAY) (1 August) [Warrington (Oberlin) edition: viii+xii+552 pp., with author's preface, published simultaneously] [dating: CARPENTER, 1872: xi; SHERBORN, 1934] [reprinted by Paleo. Res. Instit. Ithaca, New York, 1967]

1860. Check lists of the shells of North America: No. 1 (a). West Coast: Oregonian and Californian province. 4 pp. No. 2 (b): West Coast: Mexican and Panamic province. 13 pp. Smithson. Inst. Misc. Coll. 2 (128) [art. 6]: 44 pp. by several authors (June)

1864a. Supplementary report on the present state of our knowledge with regard to the Mollusca of the west coast of North America. Brit. Assoc. Adv. Sci., Rept. **33** (for 1863): 517 - 686 (post 1 August) [reprinted in CARPENTER, 1872 (A): 1 - 172]

1864b. see under 1864-1865.

1864-1865. Diagnoses of new forms of Mollusca from the Vancouver District. Ann. Mag. Nat. Hist. (3) **14** (84): 423 to 429 (Dec. 1864); **15** (85): 28 - 32 (Jan. 1865) [reprinted in CARPENTER, 1872 (E): 233 - 246 (also pp. 1 - 12)]

1865a. see under 1865-1866.

1865-1866. Descriptions of new marine shells from the coast of California. Part III. Proc. Calif. Acad. Sci. **3**: 207 - 208 (post 4 September 1865); 209 - 224 (February 1866)

1865b. Diagnoses de mollusques nouveaux provenant de Californie et faisant partie du Musée de l'Institution Smithsonienne. Journ. Conchyl. **13** [(3) 5] (2): 129 - 149 (4 April) [reprinted in CARPENTER, 1872 (M): 295 - 317]

1865c. Diagnoses specierum et varietatum novarum Moluscorum [sic], prope Sinum Pugetianum a Kennerlio Doctore, nuper decesso, collectorum. Acad. Nat. Sci. Philadelphia, Proc. **17** (2): 54 - 64 (7 August 1865)

1872. The mollusks of western North America. Embracing the second report made to the British Association on this subject, with other papers; reprinted by permission, with a general index. Smithson. Instit. Misc. Coll. **10** (252): xii+325+13 - 121 pp. (December 1872)

CHAPIN, THEODORE SHEFFIELD

1918. The structure and stratigraphy of Gravina and Revillagigedo Islands, Alaska. U. S. Geol. Surv. Prof. Pap. **120D**: 81 - 100; plt. 8; 2 text figs.

CHEMNITZ, JOHANN HIERONYMUS

1782. Neues systematisches Conchylien-Cabinet fortgesetzet durch Johann Hieronymus Chemnitz ... **6**. Nürnberg (Raspe) [xii]+375 pp.; 36 plts.; 7 text figs. (post 3 August) [see also International Commission on Zoological Nomenclature, 1954]

CHILDREN, JOHN GEORGE

1823 [1822-1823]. Lamarck's genera of shells. Quart. Journ. Sci. Lit. Arts (London) **14** (27): 64 - 87; plts. 3, 4 (October 1822); **14** (28): 298 - 322; plts. 5, 6 (January 1823); **15** (29): 23 - 52; plts. 2, 3 (April 1823); **15** (30): 216 - 258; plts. 7, 8 (July 1823); **16** (31): 49 - 79; plt. 5 (October 1823); **16** (32): 241 - 264; plt. 6 (December 1823, as "January 1824") [see also KENNARD, SALISBURY & WOODWARD, 1931]

CLARK, ALEX

1931. The cool-water Timms Point Pleistocene horizon at San Pedro, California. Trans. San Diego Soc. Nat. Hist. **7** (4): 25 - 42; 1 map (19 December 1931)

1957. see under NATLAND, 1957

CLARK, BRUCE LAWRENCE

1915. Fauna of the San Pablo group of middle California. Univ. Calif. Publ. Geol. Sci. **8** (22): 385 - 572; plts. 42 - 71 (30 August 1915)

1918. The San Lorenzo series of middle California. Univ. Calif. Publ. Geol. Sci. **11** (2): 45 - 234; plts. 3 - 24; 4 text figs. (16 July 1918)

1925. Pelecypoda from the marine Oligocene of western North America. Univ. Calif. Publ. Geol. Sci. **15** (4): 69 - 136; plts. 8 - 22 (5 January 1925)

CLARK, BRUCE LAWRENCE & RALPH ARNOLD

1923. Fauna of the Sooke Formation, Vancouver Island ... with a description of a new coral by T. Wayland Vaughan. Univ. Calif. Publ. Geol. Sci. **14** (5): 123 - 234; plts. 14 - 42 (6 November 1923)

COAN, EUGENE VICTOR

1966. Charles Russell Orcutt, pioneer Californian malacologist, and *The West American Scientist*. Trans. San Diego Soc. Nat. Hist. **14** (8): 85 - 96; 1 text fig. (29 April 1966)

1968a. Some thoughts on the West American Tellinacea. Amer. Malacol. Union, Reprts. Bull. **34** [for 1967]: 74 [abstract] (20 March 1968)

1968b. A biological survey of Bahía de los Angeles, Gulf of California, Mexico, III. Benthic Mollusca. Trans. San

Diego Soc. Nat. Hist. **15** (8): 108 - 132; 2 text figs. (25 September 1968)

1969a. Recognition of an eastern Pacific *Macoma* in the Coralline Crag of England and its biogeographic significance. The Veliger **11** (3): 277 - 279 (1 January 1969)

1969b. What is *Macoma truncaria* DALL? The Veliger **11** (3): 281 - 282; 1 text fig. (1 January 1969)

1969c. A bibliography of the biological writings of PHILIP PEARSALL CARPENTER. The Veliger **12** (2): 222 - 225 (1 October 1969)

1970. The date of publication of GOULD'S "Descriptions of Shells from the Gulf of California." The Veliger **13** (1): 109 (1 July 1970)

COAN, EUGENE VICTOR & D. L. F. SEALY

1969. *Tellina obliqua* J. SOWERBY, 1817 (Bivalvia): proposed conservation under the Plenary Powers. Z. N. (S). 1849. Comm. Zool. Nomencl. Bull. **25** (4/5): 166 (17 Jan. 1969)

CONRAD, TIMOTHY ABBOTT

[see also MOORE, 1962]

1833. Fossil shells of the Tertiary formations of North America **1** (4): 39 - 46. Philadelphia (Dobson) (26 November 1833) [reprinted by HARRIS, 1893: 63 - 74]

1837. Descriptions of new marine shells from Upper California, collected by Thomas Nuttall, Esq. Journ. Acad. Nat. Sci. Philadelphia **7** (2): 227 - 268; plts. 17 - 20 (21 Nov. 1837) [see also KEEN, 1966a]

1848. Fossil shells from Tertiary deposits on the Columbia River. Amer. Journ. Sci. **55** [(2) 5] (15): 432 - 433; 14 text figs. (May 1848)

1849. Fossils from northwestern America. *In* J. D. Dana "Geology: United States Exploring Expedition, during the years . . . , under the command of Charles Wilkes, . . ." **10:** 723 - 728; plts. 17 - 21 [reprinted in DALL, 1909: 153 - 156]

1855. Report ... on the fossil shells collected in California by W. P. Blake, geologist of the Expedition under the command of Lieutenant R. S. Williamson ... 1852. *In*: W. P. BLAKE, "Preliminary Geological Report," U. S. Pacif. Railroad Explor.: Appendix [Paleontology]: 5 - 21 [pp. 20 - 21, "Remarks in Conclusion" by W. P. BLAKE] (July) [U. S. 33rd Congress, 1st Session, House Execut. Docum. 129] [partially reprinted in DALL, 1909: 163 - 171] [species also in CONRAD, 1857b]

1857a. Descriptions of three new genera, twenty-three new species of middle Tertiary fossils from California, and one from Texas. Proc. Acad. Nat. Sci. Philadelphia **8** (6): 312 - 316 (post 25 April 1857) [reprinted in DALL, 1909: 173 - 175] [species also in CONRAD, 1857c]

1857b. Descriptions of the fossil shells. *In*: Report on the Geology of the Route. U. S. Pacif. Railroad Explor. Reprts. **5** (2) [Appendix]: 317 - 329; plts. 2 - 9 (post 6 April 1857) [U. S. 33rd Congress, 1st Session, Senate Exec. Docum. 78 and House Exec. Docum. 91] [discussed in DALL, 1909: 163 (footnote)] [species also in CONRAD, 1855]

1857c. Descriptions of the Tertiary fossils collected on the survey [Williamson's survey in California and Oregon]. *In*: Geological Report. U. S. Pacif. Railroad Explor. Reprts. **6** (2): 69 - 73; plts. 2 - 5 [U. S. 33rd Congress, 1st Session, Senate Exec. Docum. 78 and House Exec. Docum. 91] [reprinted in DALL, 1909: 176 - 179] [species also in CONRAD, 1857a]

1857d. Report on the paleontology of the survey [Parke's surveys in California]. *In*: T. ANTISELL, Geol. Report, U. S. Pacif. Railroad Explor. Reprts. **7** (2): 189 - 196; plts. 1 - 10 [U. S. 33rd Congress, 1st Session, Senate Exec. Docum. 78 and House Exec. Docum. 91] [reprinted in DALL, 1909: 180 - 185]

COWAN, C. F.

1969. Notes on Griffith's *Animal Kingdom of Cuvier* (1824-1835). Journ. Soc. Bibl. Nat. Hist. **5** (2): 137 - 140 (April 1969)

COWAN, IAN MCTAGGART

1964. New information on the distribution of marine Mollusca on the coast of British Columbia. The Veliger **7** (2): 110 to 113 (1 October 1964)

CRICKMAY, COLIN HAYTER

1925. A Pleistocene fauna from the south-western mainland of British Columbia. Canad. Field-Natur. **39** (6): 140 - 141 (30 September 1925)

1929a. The anomalous stratigraphy of Deadman's Island, California. Journ. Geol. **37** (7): 617 - 638 (Nov. 1929)

1929b. A Pleistocene fauna from British Columbia. Canad. Field-Natur. **43** (?): 205 - 206 (December 1929)

DALL, WILLIAM HEALEY

[see also BARTSCH, REHDER & SHIELDS, 1946, and BOSS, ROSEWATER & RUHOFF, 1968]

1874. Notes on some Tertiary fossils from the California coast, with a list of the species obtained from a well at San Diego, California, with descriptions of two new species. Proc. Calif. Acad. Sci. **5:** 296 - 299 (December) ["pre-printed," 26 March]

1884. Report on the Mollusca of the Commander Islands, Bering Sea, collected by Leonard Stejneger in 1882 and 1883. (Contributions to the history of the Commander Islands, no. 3). Proc. U. S. Nat. Mus. **7** (22): 340 - 349; plt. 2 (3 October 1884)

1886. Report on Bering Island Mollusca collected by Mr. Nicolas Grebnitzki. Contributions to the natural history of the Commander Islands, no. 6. Proc. U. S. Nat. Mus. **9** (14): 209 - 219 (22 October 1886)

1891. Scientific results of explorations by the U. S. Fish Commission steamer *Albatross*. XX. – On some new or interesting West American shells obtained from the dredgings of the U. S. Fish Commission steamer *Albatross* in 1888 and from other sources. Proc. U. S. Nat. Mus. **14** (849): 174 - 191; plts. 5 - 7 (24 July 1891)

1894. Notes on the Miocene and Pliocene of Gay Head, Martha's Vineyard, Mass., and on the "land phosphate" of the Ashley River district, South Carolina. Amer. Journ. Sci. (3) **48** [148] (286) [art. 42]: 296 - 301 (Oct. 1894)

1895. Three species of *Macoma* from the Gulf of Mexico. The Nautilus **9** (3): 32 - 34 (8 July 1895)

1897. Notice of some new or interesting species of shells from British Columbia and the adjacent region. Nat. Hist. Soc. Brit. Columbia, Bull. **2** (1): 1 - 18; plts. 1, 2 (Jan. 1897)

1899. The mollusk fauna of the Pribilof Islands. *In*: The fur seals and the Fur-seal Islands of the North Pacific Ocean. prt. **2:** 539 - 546. Washington, D. C. Govt. Print. Office (Nov. 1899)

DALL, WILLIAM HEALEY (continued)

1900a. Synopsis of the family Tellinidae and of the North American species. Proc. U. S. Nat. Mus. **23** (1210): 285 to 326; plts. 2 - 4 (14 November 1900)

1900b. see under 1900 - 1903

1900-1903. Contributions to the Tertiary fauna of Florida with especial reference to the Silex Beds of Tampa and the Pliocene beds of the Caloosahatchie River including in many cases a complete revision of the generic groups treated and their American Tertiary species. Trans. Wagner Free Inst. **3** (5) [Teleodesmacea: *Solen* to *Diplodonta*]: i - x + 949 - 1218; plts. 36 - 47 (December 1900); **3** (6) [concluding the work]: xiv + 1219 - 1654; plts. 48 - 60 (October 1903)

1904. Neozoic invertebrate fossils. Harriman Alaska Exp. **4**: 99 - 122; plts. 9, 10 (March 1904) [reprinted Smithson. Instit. 1910]

1909. Contributions to the Tertiary paleontology of the Pacific coast. I. The Miocene of Astoria and Coos Bay, Oregon. U. S. Geol. Surv. Prof. Paper **59**: 279 pp.; 23 plts.; 14 text figs.; 13 appendices reprinting scarce papers on West American paleontology (2 April 1909)

1916a. Checklist of the Recent bivalve mollusks (Pelecypoda) of the northwest coast of America from the Polar Sea to San Diego, California. Los Angeles, Calif. (Southwest Mus.). pp. 1 - 44; 1 portrait (28 July 1916)

1916b. Diagnoses of new species of marine bivalve mollusks from the northwest coast of America in the collection of the United States National Museum. Proc. U. S. Nat. Mus. **52** (2183): 393 - 417 (27 December 1916)

1918. Pleistocene fossils of Magdalena Bay, Lower California, collected by Charles Russell Orcutt. The Nautilus **32** (1): 23 - 26 (20 July 1918)

1919. The Mollusca of the Arctic coast of America collected by the Canadian Arctic Expedition west from Bathurst Inlet with an appended report on a collection of Pleistocene fossil Mollusca. Repts. Canad. Arctic Exped., 1913-18, **8** [mollusks, echinoderms, coelenterates, etc.] (A.: Mollusks: Recent and Pleistocene): 29 pp.; plts. 1 - 3 (24 September 1919)

1921a. Summary of the marine shellbearing mollusks of the northwest coast of America, from San Diego, California, to the Polar Sea, mostly contained in the collection of the United States National Museum, . . . Smithson. Inst., U. S. Nat. Mus. Bull. **112**: 1 - 217; plts. 1 - 22 (24 February 1921)

1921b. New shells from the Pliocene or early Pleistocene of San Quentin Bay, Lower California. West Amer. Sci. **19** (3): 21 - 23 (15 June 1921)

1924. Report on Tertiary and Quaternary fossils from the Canadian Arctic coast. Repts. Canad. Arctic Exp., 1913-18, **11** [Geology and Geography] (A: The geology of the Arctic coast of Canada west of the Kent Peninsula): 27A - 33A; plt. 35 (8 July 1924)

1925. Illustrations of unfigured types of shells in the collection of the United States National Museum. Proc. U. S. Nat. Mus. **66** (2554): 1 - 41; plts. 1 - 36 (22 September 1925)

DALL, WILLIAM HEALEY, PAUL BARTSCH & HARALD REHDER

1938. A manual of the Recent and fossil marine pelecypod mollusks of the Hawaiian Islands. B. P. Bishop Mus. Bull. **153**: i - iv + 3 - 233; plts. 1 - 58; 28 text figs. (25 July 1938)

DANCE, STANLEY PETER

1966. Shell collecting: an illustrated history. Univ. Calif. Press, Berkeley & Los Angeles, 344 pp.; 35 plts.; 31 text figs.

DAVIS, CHARLES H.

1913. New species from the Santa Lucia Mountains, California, with a discussion of the Jurassic Age of the slates at Slate's Springs. Journ. Geol. **21** (5): 453 - 458; 7 text figs. (August 1913)

DAWSON, GEORGE MERCER

1880. Report on the Queen Charlotte Islands, 1878. Geol. Surv. Canada, Rept. Progr. [for 1878-79]: 239 pp.; 23 plts.; 3 maps (post 1 May 1880)

DAWSON, JOHN WILLIAM

1872. Notes on the Post-Pliocene geology of Canada. III. – Revision of Post-Pliocene fossils of Canada: Sub-kingdom Mollusca. IV [as "III"]. – General conclusions. Canad. Natur. Quart. Journ. Sci. (n. s.) **6** (4): 369 - 416; plts. 4 - 7 (August 1872) [plts. possibly part of **6** (3), publ. in April]

DE LONG, JAMES H.

1941. The paleontology and stratigraphy of the Pleistocene at Signal Hill, Long Beach, California. Trans. San. Diego Soc. Nat. Hist. **9** (25): 229 - 252; 4 text figs. (30 April 1941)

DESHAYES, GÉRARD PAUL

1843. [*Tellina ligamentina* Deshayes]. Mag. Zool. (2) [for 1843] **5**: Mollusques plt. 81

1855. Descriptions of new shells from the collection of Hugh Cuming, Esq. Proc. Zool. Soc. London [for 1854] [22] (279: 317 - 320 (8 May 1855); (280): 321 - 336; (281): 337 - 352; (282): 353 - 368; (283): 369 - 371 (16 May 1855)

DIBBLEE, THOMAS WILSON, Jr.

1966. Geology of the central Santa Ynez Mountains, Santa Barbara County, California. Calif. Div. Mines & Geol. Bull. **186**: 99 pp.; 4 plts.; 25 text figs.

DICKERSON, ROY ERNEST

1922. Tertiary and Quaternary history of the Petaluma, Point Reyes and Santa Rosa quadrangles. Proc. Calif. Acad. Sci. (4) **11** (19): 527 - 601; plts. 17 - 41 (10 July 1922)

DODGE, HENRY

1952. A historical review of the mollusks of Linnaeus. Part 1. The classes Loricata and Pelecypoda. Bull. Americ. Mus. Nat. Hist. **100**: 1 - 263 (19 December 1952)

DRAYCOT, WALTER MACKAY

1951. The Pleistocene, or Ice Age, of southwestern British Columbia, part II. Art. Hist. & Sci. Assoc., Mus. & Art Notes (2) **2** (1): 14 - 22 (November 1951)

DUNNILL, ROBERT MILLTHORPE

1968. A taxonomic and ecological investigation of the genus *Macoma* (Pelecypoda) in southern British Columbia. Master of Sci. thesis, Dept. Biol., Univ. Victoria ix + 155 pp.; 19 text figs.; 2 appendices (April 1968)

DUNNILL, ROBERT MILLTHORPE & EUGENE VICTOR COAN

1969. A new species of the genus *Macoma* (Pelecypoda) from west American coastal waters, with comments on *Macoma calcarea* (GMELIN, 1791). National Mus. Canada, Nat. Hist. Papers **43**: 19 pp.; 10 text figs. (9 December 1969)

DUNNILL, ROBERT MILLTHORPE & DEREK V. ELLIS

1969. Recent species of the genus *Macoma* (Pelecypoda) in British Columbia. National Mus. Canada, Nat. Hist. Pap. **45**: 34 pp.; 9 text figs. (10 January 1969)

DURHAM, JOHN WYATT

1944. Megafaunal zones of the Oligocene of northwestern Washington. Univ. Calif. Publ. Geol. Sci. **27** (5): 101 to 212; plts. 13 - 18; 7 text figs.; 1 map (14 November 1944)

1950. 1940 E. W. Scripps cruise to the Gulf of California. Pt. II. Megascopic paleontology and marine stratigraphy. Mem. Geol. Soc. Amer. **43:** viii+216 pp.; 48 plts.; 3 text figs. (10 August 1950)

EDMONDSON, CHARLES HOWARD

1920. Edible Mollusca of the Oregon coast. B. P. Bishop Mus. Occ. Pap. **7** (9): 177 - 291; 6 text figs.

EMERSON, WILLIAM KEITH & WARREN OLIVER ADDICOTT

1958. Pleistocene invertebrates from Punta Baja, Baja California, Mexico. Amer. Mus. Novit. **1909:** 11 pp.; 2 text figs. (13 August 1958)

EMERSON, WILLIAM KEITH & LEO GEORGE HERTLEIN

1964. Invertebrate megafossils of the Belvedere Expedition to the Gulf of California. Trans. San Diego Soc. Nat. Hist. **13** (7): 333 - 368; 6 text figs. (30 December 1964)

ETHERINGTON, THOMAS JOHN

1931. Stratigraphy and fauna of the Astoria Miocene of southwest Washington. Univ. Calif. Publ. Geol. Sci. **20** (5): 31 - 142; plts. 1 - 14 (20 May 1931)

FILICE, FRANCIS P.

1958. Invertebrates from the estuarine portion of San Francisco Bay and some factors influencing their distribution. Wasmann Journ. Biol. **16** (2): 159 - 211; 3 text figs.

FINLAY, HAROLD JOHN

1927. A further commentary on New Zealand molluscan systematics. Trans. New Zealand Inst. **57:** 320 - 485; plts. 18 to 23 (10 March 1927)

[see also ICZN, 1957: 402]

FISCHER, PAUL HENRI

1887 [1880-1887]. Manuel de conchyliologie et de paléontologie conchyliologique ou histoire naturelle des mollusques vivants et fossiles ... Paris (Savy) xxiv+1369 pp.; 23 plts.; 1138 text figs. [Pelecypoda: (10): 897 - 1008 (30 April 1886); (11): 1009 - 1187 (15 January 1887)]

GARDNER, JULIA ANNA

1943. Mollusca from the Miocene and Lower Pliocene of Virginia and North Carolina. Part I. Pelecypoda. U. S. Geol. Surv. Prof. Paper **199A:** i - iv+1 - 178; plts. 1 - 23

GHISELIN, MICHAEL TENANT

1969. The distinction between similarity and homology. System. Zool. **18** (1): 148 - 149 (March 1969)

GMELIN, JOHANN FREDERICH

1791. Caroli Linnaei systema naturae per regna tria naturae. Ed. 13, aucta, reformata, Vermes Testacea Lipsiae **1** (6). pp. 3021 - 3910 (pre 14 May 1791) [dating: HOPKINSON, 1908]

GOLIKOV, A. N. & O. A. SCARLATO

1967. [Mollusks of Possiet Bay (Sea of Japan) and their ecology]. *In*: [Mollusks and their role in biocenoses and fauna formation.] Akad. Nauk S. S. S. R., Leningrad, Zool. Inst., Trudy **42:** 5 - 154; plts. 1 - 14; 128 text figs.

GOULD, AUGUSTUS ADDISON

[see also JOHNSON, 1964]

1851. [Descriptions of a number of California shells, collected by Maj. William Rich and Lieut. Thomas P. Green, United States Navy, ...] Boston Soc. Nat. Hist., Proc. **4** (6): 87 - 93 (November 1851)

1853. Descriptions of shells from the Gulf of California and the Pacific coasts of Mexico and California. Boston Journ. Nat. Hist. **6** (3): 374 - 408; plts. 14 - 16 (October 1853) [also issued separately: 35 pp.; plts. 14 - 16] [dating: COAN, 1970]

1861. Descriptions of shells in the North Pacific Exploring Expedition under Captains Ringgold and Rogers. [one section only] Proc. Boston Soc. Nat. Hist. **8** (1): 14 - 32 (March 1861)

1862. Otia Conchologia: descriptions of shells and mollusks from 1839 to 1862. Boston (Gould & Lincoln) [iv]+256 pp.

GOULD, AUGUSTUS ADDISON & PHILIP PEARSALL CARPENTER

1857. Descriptions of shells from the Gulf of California, and the Pacific coasts of Mexico and California. Part II. Proc. Zool. Soc. London (for 1856) [pt. 24] (313): 198 - 208 (7 January 1857)

["Part I" by GOULD alone, published elsewhere] [concerning the species described in this paper, see JOHNSON, 1964]

GRANT, ULYSSES S., IV & HOYT RODNEY GALE

1931. Catalogue of the marine Pliocene and Pleistocene Mollusca of California and adjacent regions... Mem. San Diego Soc. Nat. Hist. **1:** 1 - 1036; plts. 1 - 32; 15 text figs. (3 November 1931)

GRAY, JOHN EDWARD

1847. A list of the genera of Recent Mollusca, their synonyma and types. Proc. Zool. Soc. London (for 1847) **15** [part 15] (178): 129 - 219 (November 1847)

GRAY, JOHN EDWARD & GEORGE BRETTINGHAM SOWERBY (1st of name)

1839. Molluscous animals and their shells. *in* The Zoology of Captain Beechey's voyage ... in His Majesty's Ship *Blossom*. ... H. G. Bohn, London, pp. 101 - 155; plts. 33 to 44 [by J. E. GRAY; continued by G. B. SOWERBY]

[pp. 143 - 155 only by G. B. SOWERBY, 1st of name] (post July) [see also ROSEWATER, 1968]

GREWINGK, CONSTANTIN

1850. Beitrag zur Kenntniß der orographischen und geognostischen Beschaffenheit der Nord-West-Küste Amerikas mit den anliegenden Inseln ... Verhandl. Russ.-Kais. Mineral. Gesellsch. St. Petersburg [for 1848-1849]: 76 - 424; plts. 1 - 7; 2 text figs. [later reprinted: ix+351 pp.]

GRIFFITH, EDWARD & EDWARD PIDGEON

1833 [1833-1834]. The animal kingdom arranged in conformity with its organization, by Baron Cuvier, with additional descriptions of all the species hitherto named and of many not before noticed. **12:** The Mollusca and Radiata. Arranged by the Baron Cuvier, with supplementary additions to each order. London (Whittaker) viii+601 pp.; 41+20 plts. [part **38:** 1-192; Mollusca plts. 1-27, 29-35, 38-39; Zoophytes plt. 1 (December 1833); part **39:** 193 - 384 (March 1834); part **40:** i-viii+385-601 (June 1834); Mollusca plts. 28*, 36*, 37*, 40-41; Zoophytes plts. 2-20 (either March or June 1834)] [dating: COWAN, 1969]

HABE, TADASHIGE

1952. Genera of Japanese shells, Pelecypoda no. **3:** ii+187 to 278; text figs. 429 - 730 (May 1952)

1964. Shells of the western Pacific in color. Osaka, vol. II, [viii]+233 pp.; 66 plts. (2nd, English edit.) (post 30 August)

HABE, TADASHIGE & KIYOSHI ITO
1965. Shells of the world in colour **1**: the northern Pacific. Osaka (Hoikusha) xi+176 pp.; 56 plts.; 31 text figs.; 1 map (post 15 April 1965)

HALL, E. B. & A. W. AMBROSE
1916. Descriptions of new species from the Cretaceous and Tertiary of the Tesla, Pleasanton, San Jose, and Mt. Hamilton quadrangles, California. [one section only] The Nautilus **30** (7): 77 - 82 (4 December 1916)

HANLEY, SYLVANUS CHARLES THORPE
1844a, 1844b, 1844c, 1845 - see under 1844-1845.
1844-1845. On new species of the genus *Tellina,* chiefly collected by H. Cuming, Esq., in the Philippine Islands and Central America. Proc. Zool. Soc. London [for 1844] [12] (134): 59 - 64, 68 - 72 (September 1844); (138): 140 - 144 (December 1844); (139): 146 - 149 (December 1844); (141): 164 to 166 (February 1845)
1846. A monograph of the genus *Tellina. In*: G. B. SOWERBY (2nd of name), ed. Thesaurus Conchyliorum; or, Monographs of genera of shells. **1** (6): 221 - 336; plts. 56 - 66 (21 January 1846) [dating: WOODWARD, 1915]

HANNA, G DALLAS
1924. Rectifications of nomenclature. Proc. Calif. Acad. Sci. **13** (10): 151 - 186 (18 March 1924)

HANNA, G DALLAS & LEO GEORGE HERTLEIN
1938. New Tertiary mollusks from western North America. Journ. Paleont. **12** (1): 106 - 110; plt. 21 (January 1938)

HARRIS, GILBERT DENNISON
1893. Republication of Conrad's *Fossil Shells of the Tertiary Formations of North America.* Washington (Harris) 121 pp.; 20 plts. (April 1893)

HATAI, KOTORA M. & SYOZO NISHIYAMA
1938. Remarks on certain fossils from the borderland of the Japan Sea. Japan. Journ. Geol. & Geogr. **16** (1/2): 123 to 153; plt. 9

HENDERSON, JUNIUS
1927. A Pleistocene fossil locality on Big Hope Island, Puget Sound. Univ. Colorado Stud. **16** (1): 1 - 3 (June '27)

HERTLEIN, LEO GEORGE
1934. Pleistocene mollusks from the Tres Marias Islands, Cedros Island, and San Ignacio Lagoon, Mexico. Bull. So. Calif. Acad. Sci. **33** (2): 59 - 73; plt. 21 (31 August 1934)
1957. Pliocene and Pleistocene fossils from the southern portion of the Gulf of California. South. Calif. Acad. Sci. Bull. **56** (2): 57 - 75; plt. 13
1964. Note concerning the date of issue of ARNOLD's monograph on the Pliocene and Pleistocene of San Pedro. The Veliger **6** (3): 172 (1 January 1964)
1968. *Tellina ulloana,* a new species from Magdalena Bay, Baja California, Mexico. The Veliger **11** (1): 80 (1 July 1968)

HERTLEIN, LEO GEORGE & COLIN HAYTER CRICKMAY
1925. A summary of the nomenclature and stratigraphy of the marine Tertiary of Oregon and Washington. Proc. Amer. Philos. Soc. **64** (2): 224 - 282

HERTLEIN, LEO GEORGE & ULYSSES SIMPSON GRANT, IV
1944. The geology and paleontology of the marine Pliocene of San Diego, California. Part I: Geology.. San Diego Soc. Nat. Hist., Mem. **2**: 72 pp.; 18 plts.; 7 text figs. (30 August 1944)

HERTLEIN, LEO GEORGE & ARCHIBALD MCCLURE STRONG
1949-1950. [Superfamily Tellinacea] *In*: Mollusks from the west coast of Mexico and Central America, parts 7 - 9. Eastern Pacific Expeditions, New York Zoological Society, 40 - 42 Zoologica **34** (2): 63 - 97; plt. 1 (10 August 1949); **34** (4): 239 - 258; plt.1 (30 December 1949); **35** (4): 217 - 252; plts. 1, 2 (30 December 1950)
1955. Marine mollusks collected during the "Askoy" Expedition to Panama, Colombia, and Ecuador in 1941. Bull. Amer. Mus. Nat. Hist. **107** [article 2]: 159 - 318; plts. 1 - 3 (28 November 1955)

HINDS, RICHARD BRINSLEY
[see also KEEN, 1966b]
1844-1845. The zoology of the voyage of H. M. S. *Sulphur,* under the command of Capt. Sir Edward Belcher ... during the years 1836-42, **2**[Mollusca]. 72 pp.; 21 plts. London (Smith, Elder) [part 1: 1 - 24; plts. 1 - 7 (July 1844); part 2: 25 - 48; plts. 8 - 14 (October 1844); part 3: 49 - 72; plts. 15 - 21 (January 1845)] [dating: HERTLEIN & STRONG, 1955]

HOFFSTETTER, ROBERT
1952. Moluscos subfósiles de los estanques de sal de Salinas (Pen. de Santa Elena, Ecuador). Comparición con la fauna actual de Ecuador. Bol. Inst. Equator. Cienc. Nat. (Quito) **1** (1):5 - 79; 19 text figs. (June 1952)

HOOTS, HAROLD WILLIAM
1931. Geology of the eastern part of the Santa Monica Mountains, Los Angeles, California. U. S. Geol. Surv. Prof. Paper **165C**: iv+83 - 134; plts. 16 - 34; 2 text figs.

HOPKINS, DAVID M., (ed.)
1967. The Bering land bridge. Stanford, Calif. (Stanford Univ.): i - xiii+1 - 495; illust.

HOPKINSON, JOHN
1908. Dates of publication of the separate parts of Gmelin's edition (13th) of the 'Systema Naturae' of Linnaeus. Proc. Zool. Soc. London [for 1907] [69] (4): 1035 - 1037 (4 June 1908)

HUMBOLDT & BONPLAND, see under VALENCIENNES, 1821

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE
1954. Direction 1. Opinions and declarations rendered by the International Commission on Zoological Nomenclature **3** (3): 401 - 416 (21 April 1954)
1957. Opinion 479. Opinions and declarations rendered by the International Commission on Zoological Nomenclature **16** (22): 365 - 416 (3 September 1957)

IREDALE, TOM
1922. Book notes. Proc. Malacol. Soc. London **15** (2/3): 78 - 92 (December 1922)
1930. Queensland molluscan notes, No. 2. Mem. Qld. Mus., **10** (1): 73 - 88; plt. 9 (28 August 1930)

JAY, JOHN CLARKSON
1850. A catalogue of the shells arranged according to the Lamarckian system ... contained in the collection of John C. Jay ..., 4th edition. New York (Craighead) 460 pp. (December 1850)

JENSEN, ADOLF SEVERIN
1905a. Studier over nordiske Mollusker. III. *Tellina (Macoma).* [Dansk] Naturhistor. foren. i Kjøbenh. Videnskab. Meddel. [for 1905] **57** [(6) **7**]: 21 - 52; plt. 1

1905b. Tillaeg til studier over nordiske Mollusker. III. *Tellina* (*Macoma*). [Dansk] Naturhistor. foren i Kjøbenh. Vidensk. Meddel. [for 1905] **57** [(6) **7**]: 149 - 151

1905c. On the Mollusca of East-Greenland. I. Lamellibranchiata. With an introduction on Greenland's fossil mollusc-fauna from the Quaternary time. Meddel. Grönland **29:** 289 - 362; 5 text figs.

JOHNSON, RICHARD IRWIN

1964. The Recent Mollusca of Augustus Addison Gould. Bull. U. S. Nat. Mus. **239:** 1 - 182; plts. 1 - 45 (28 July 1964)

JOHNSTRUP, JOHANNES FREDERICK

1882. Om de geologiske Forhold i den nordlige Del af Vendsyssel. Indbydelsesskr. Kjøbenh. Univ. Aarsfest: 1 - 43; 4 text figs.

JONES, GILBERT FRED

1964. The distribution and abundance of subtidal benthic Mollusca on the mainland shelf of southern California. Malacologia **2** (1): 43 - 68; 5 text figs. (September 1964)

JORDAN, ERIC KNIGHT

1924. Quaternary and Recent molluscan faunas of the west coast of Lower California. Bull. South. Calif. Acad. Sci. **23** (5): 145 - 156 (25 October 1924)

1926. Molluscan fauna of the Pleistocene of San Quintin Bay, Lower California. (Expedition to Guadalupe Island, Mexico, in 1922 – No. 4) Proc. Calif. Acad. Sci. (4) **15** (7): 241 - 255; 1 fig.; plt. 25 (26 April 1926)

1936. The Pleistocene fauna of Magdalena Bay, Lower California. Stanford Univ. Contrib. Dept. Geology **1** (4): 103 - 173; plts. 17 - 19 (13 November 1936)

KEEN, A. MYRA

1937. An abridged checklist and bibliography of west North American marine mollusca. Stanford Univ. Press, Stanford, Calif. 87 pp.; 3 text figs. (29 September 1937)

1958a. New mollusks from tropical West America. Bull. Amer. Paleontol. **38** (172): 235 - 255; plts. 30, 31 (23 May 1958)

1958b. Sea shells of tropical West America; marine mollusks from Lower California to Colombia. i - xi + 624 pp.; illus. Stanford, Calif. (Stanford Univ. Press) (8 December 1958)

1962. Reinstatement of the specific name *Macoma inquinata* (DESHAYES). The Veliger **4** (3): 161 (1 Jan. 1962)

1966a. West American mollusk types at the British Museum (Natural History), I. T. A. CONRAD and the NUTTALL collection. The Veliger **8** (3): 167 - 172; 1 text fig. (1 January 1966)

1966b. West American mollusk types in the British Museum (Natural History), II. Species described by R. B. HINDS. The Veliger **8** (4): 265 - 275; plts. 46, 47; 6 text figs. (1 April 1966)

1968. West American mollusk types at the British Museum (Natural History) IV. Carpenter's Mazatlan collection. The Veliger **10** (4): 389 - 439; plts. 55 - 59; 171 text figs. (1 April 1968)

1969. Family Tellinidae pp. 613 - 628 *in*: R. C. MOORE (ed.): Treatise on Invertebrate Paleontology, part **N** [Bivalvia]: 491 - 952; illust. Geol. Soc. Amer. & Univ. Kansas

KEEN, A. MYRA & HERDIS BENTSON

1944. Check list of California Tertiary marine Mollusca. Geol. Soc. Amer. Spec. Pap. **56:** i - viii + 1 - 280; 4 text figs.; 2 tab. (30 August 1944)

KENNARD, ALFRED SANTER, ALBERT EDWARD SALISBURY & BERNARD BARHAM WOODWARD

1931. The types of Lamarck's genera of shells as selected by J. G. Children in 1823. Smithson. Instit. Misc. Coll. **82** (17): 1 - 40 (11 July 1931)

KIRA, TETSUAKI

1962. Shells of the western Pacific in colour **1**. 3rd ed., in English. Osaka (Hoikusha) [vi] + 224 pp.; 72 plts. (post July)

KNOPF, ADOLPH

1912. The Eagle River region, southwestern Alaska. Bull. U. S. Geol. Survey **502:** 61 pp.; 5 plts.; 3 text figs.

KRAUSE, ARTHUR

1885. Ein Beitrag zur Kenntniß der Mollusken-Fauna des Beringsmeeres. I. Brachiopoda et Lamellibranchiata. Arch. f. Naturgesch. **51** (1): 14 - 41; plt. 3

KÜSTER, HEINRICH CARL & EDUARD RÖMER

1841-1873. Die Familie der Tellmuscheln. Tellinidae. Systematisches Conchylien-Cabinet von Martini und Chemnitz **10** (4): 292 pp.; 52 plts. Nürnberg (Bauer & Raspe) [plts. 1 - 3 (1841) – KÜSTER; pp. 1 - 32, plts. 4 - 6, 8, 10, 16 (1870); pp. 33 - 176; plts. 7, 9, 11 - 15, 17 - 33 (1871); pp. 177 - 256; plts. 34 - 38, 40 - 52 (1872); pp. 257 - 291; plt. 39 (1873) – RÖMER] [dating PRASHAD, 1932, and SMITH & ENGLAND, 1937]

LAMARCK, JEAN-BAPTISTE PIERRE ANTOINE DE MONET DE

1818 [1815-1822]. Histoire naturelle des animaux sans vertèbres ... Paris (Verdière, Deterville, and "chez l'auteur") 7 vols. [5: 612 pp. (25 July 1818)] [dating: IREDALE, 1922]

LEACH, WILLIAM ELFORD

1819. Descriptions des nouvelles espèces d'animaux découvertes par le vaisseau *Isabelle* dans un voyage au pôle boréal ... Journ. Phys., Chim., Hist. Nat., et Arts (Paris) **88** (6): 462 - 467 (June 1819)

LINNAEUS, CAROLUS

[see also DODGE, 1952]

1758. Systema naturae per regna tria naturae ... editio decima, reformata **1** [Regnum animale] Stockholm (Salvii) 824 + iii pp.

1767. Systema naturae per regna tria naturae ... editio duodecima reformata **1** [Regnum animale] (2). Stockholm (Salvii) pp. 533 - 1327

LISTER, MARTIN

1687 [1685 - 1692]. Historiae conchyliorum ... London (Lister). About 1253 figs. on 996 unnumbered plts. on 468 pp. [Liber **1** (1685); **2** (1686); **3** (1687); **3** Appendix (1688); **4** (1688); **4** Appendix (1692)] [see also WILKINS, 1957]

LOEL, WAYNE & WILLIAM HENRY COREY

1932. The Vaqueros formation, Lower Miocene of California. I. Paleontology. Univ. Calif. Publ. Geol. Sci. **22** (3): 31 - 410; plts. 5 - 65; 2 maps (31 December 1932)

MACGINITIE, GEORGE EBER

1935. Ecological aspects of a California marine estuary. Amer. Midl. Natur., **16** (5): 629 - 765; 21 text figs. (September 1935)

MacGinitie, Nettie
1959. Marine Mollusca of Point Barrow, Alaska. Proc. U. S. Nat. Mus. **109** (3412): 59 - 208; plts. 1 - 27

MacNeil, Francis Stearns, John Beaver Mertie, Jr. & Henry Augustus Pilsbry
1943. Marine invertebrate faunas of the buried beaches near Nome, Alaska. Journ. Paleont. **17** (1): 69 - 96; plts. 10 - 16 (January 1943)

Maddren, Alfred Geddes
1919. The beach placers of the west coast of Kodiak Island, Alaska. Bull. U. S. Geol. Surv. **692:** 299 - 319; plt. 8

Manger, George Edward
1934. The geology of San Quintín Bay. Johns Hopkins Univ. Stud. Geol. **11:** 273 - 303; plt. 21

Martens, Eduard Carl von
1865. Description of new species of shells. Ann. Mag. Nat. Hist. (3) **16** (96): 428 - 432 (December 1865)

Mattox, Norman T.
1955. A list of the Mollusca identified from samples of the benthos of San Pedro basin, California. Appendix B: 154 - 158. *In*: O. Hartman, Quantitative survey of the benthos of San Pedro basin, southern California, part I: Preliminary results. Allan Hancock Pacif. Exped. **19** (1): iv+187 pp.; 7 plts.; 2 charts (31 January 1955)

Maurer, Don
1967 a. Filtering experiments on marine pelecypods from Tomales Bay, California The Veliger **9** (3): 305 - 309 (1 January 1967)
1967 b. Burial experiments on marine pelecypods from Tomales Bay, California. The Veliger **9** (4): 376 - 381 (1 April 1967)
1967 c. Mode of feeding and diet, and synthesis of studies on marine pelecypods from Tomales Bay, California. The Veliger **10** (1): 72 - 76 (1 July 1967)
1969. Pelecypod-sediment association in Tomales Bay, California. The Veliger **11** (3): 243 - 249; 1 text fig. (1 January 1969)

Mayr, Ernst
1963. Animal species and evolution. Cambridge, Mass. (Belknap-Harvard Univ.) xiv+797 pp.; 65 text figs.
1969. Principles of systematic zoology. New York (McGraw-Hill) xi+428 pp.; illust.

McLean, James Hamilton
1966. West American prosobranch Gastropoda: superfamilies Patellacea, Pleurotomariacea, and Fissurellacea. i - x+255 pp.; plts. 1 - 7 Ph. D. thesis, Stanford Univ. (June 1966)

Meek, Charles Elwood
1923. Notes on the stratigraphy and Pleistocene fauna from Peard Bay, Arctic Alaska. Univ. Calif. Publ. Geol. Sci. **14** (13): 409 - 422; plts. 75 - 79; 1 text fig. (23 Nov. 1923)

Megerle von Mühlfeld, Johann Carl
1811. Entwurf eines neuen System's der Schalthiergehäuse. Gesell. naturf. Freunde Berlin **5**: 38 - 72

Melvill, James Cosmo
1893. Descriptions of twenty-five new species of marine shells from Bombay collected by Alexander Abercrombie, Esq. Manchester Lit. & Philos. Soc. Mem. & Proc. (4) **7** [**37**]: 52 - 67; plt. 1

Middendorff, Alexander Theodor (von)
1849. Beiträge zu einer Malacozoologie Rossica **III.** Aufzählung und Beschreibung der zur Meeresfauna Russlands gehörigen Zweischalen. Acad. Imp. Sci. St. Petersburg, Mém. (6) [Sci. Nat.]. **6** (2 – Zoologie et Physiologie): 517 to 610; plts. 11 - 21 (post August 1849)
1851. Mollusken *In* "Dr. A. Th. v. Middendorff's Reise in den äussersten Norden und Osten Sibiriens" **2** [Zoologie] (1 – Wirbellose Thiere): 163 - 464, 505 - 508, 512 - 516; plts. 8 - 30. Saint Petersburg (Kaiserl. Akad. Wissensch.) (30 Sept. 1851)

Mikiyama, Jiro
1927. Molluscan fauna of the lower part of the Kakegawa series in the province of Totomi, Japan. Kyoto [Imp.] Univ. Mem. Coll. Sci. (B) **3** (1): 147 pp.; 6 plts. (March 1927)

Miller, Don John
1953. Late Cenozoic marine glacial sediments and marine terraces of Middleton Island, Alaska. Journ. Geol. **61** (1): 17 - 40; plts. 1, 2; 4 text figs.

Mörch, Otto Andreas Lowson
1853. Catalogus conchyliorum quae reliquit D. Alphonso d'Aguirra et Gadea, Comes de Yoldi. ... **2** [Acephala, Annulata, Cirripedia, Echinodermata]. Hafniae (Klein) [iv]+76 pp. (post 1 April 1853)

Moffit, Fred Howard
1913. Geology of the Nome and Grand Central quadrangles, Alaska. Bull. U. S. Geol. Surv. **533:** 140 pp.; 7 plts.; 13 text figs.

Montagu, George
1803. Testacea Britannica or natural history of British shells, marine, land and fresh-water, including the most minute: systematically arranged and embellished with figures. Romsey (J. S. Hollis). pp. i-xxxvii + 1 - 606; plts. 1 - 16

Moore, Ellen James
1962. Conrad's Cenozoic fossil marine mollusk type specimens at the Academy of Natural Sciences of Philadelphia. Proc. Acad. Nat. Sci. Philadelphia **114** (2): 23 - 120; plts. 1, 2 (6 July 1962)

Natland, Manley Leonard
1957. Paleoecology of West Coast Tertiary sediments. *In*: H. S. Ladd, ed., Treatise on marine ecology and paleoecology **2** [Paleoecology]. Mem. Geol. Soc. Amer. **67, 2:** 543 - 571; 5 plts.; 2 text figs. (25 March 1957)

Newcombe, Charles Frederick
1914. Pleistocene raised beaches at Victoria, British Columbia. Ottawa Natural. **28** (?): 106 - 110; 2 text figs. (Nov. 1914)

Nomland, Jorgen O.
1917. The Etchegoin Pliocene of Middle California. Univ. Calif. Publ., Bull. Dept. Geol. **10** (14): 191 - 254; plts. 6 - 12; 2 text figs. (19 April 1917)

Nyst, Pierre Henri Joseph & Gérard Daniel Westendorp
1839. Nouvelles recherches sur les coquilles fossiles de la province d'Anvers. Bull. Acad. Roy. Sci., Lett. et Beaux-Arts Belg. Bruxelles **6** (2): 393 - 414; illust.

Ockelmann, Kurt W.
1959. The zoology of East Greenland. Marine Lamellibranchiata. Medd. Grönland **122** (4): 1 - 256; plts. 1 - 3; 28 text figs. (post 20 January 1959)

Oldroyd, Ida Shepard
1924. Marine shells of Puget Sound and vicinity. Publ. Puget Sound Biol. Sta. **4:** 1 - 272; plts. 1 - 49 (March 1924)
1925. The marine shells of the west coast of North America. Stanford Univ. Publ. Geol. Sci., **1:** 1 - 247; plts. 1 - 57 [Pelecypoda] (September 1925) [dating: Keen, 1958b: 576]

Oldroyd, Ida Shepard & Ulysses Simpson Grant, IV
1931. A Pleistocene molluscan fauna from near Goleta, Santa Barbara County, California. The Nautilus **44** (3): 91 - 94 (27 January 1931)

Oldroyd, Thomas Shaw
1925. The fossils of the lower San Pedro fauna of the Nob Hill cut, San Pedro, California. Proc. U. S. Nat. Mus. **65** (2535): 1 - 39; plts. 1, 2 (16 January 1925)

Olsson, Axel Adolf
1961. Mollusks of the tropical eastern Pacific particularly from the southern half of the Panamic-Pacific faunal province (Panama to Peru). Panamic-Pacific Pelecypoda. Paleont. Res. Instit. Ithaca, N. Y.: 574 pp.; 86 plts. (10 March 1961)

Olsson, Axel Adolf & Anne Harbison
1953. Pliocene Mollusca of Southern Florida with special reference to those from North Saint Petersburg . . . with special chapters on Turridae by William G. Fargo and Vitrinellidae and fresh-water mollusks by Henry A. Pilsbry. Monogr. 8, Acad. Nat. Sci. Philadelphia pp. i - v + 1 - 457; plts. 1 - 65 (6 November 1953)

Omori, Masae
1966. Study on the variation of Japanese *Peronidia venulosa* (Schrenck) and its allied species. Part I: On the form of sinus and colour pattern of the inner side of shell Venus **24** (4): 304 - 311; 3 text figs. (May 1966)

Orcutt, Charles Russell
[see also Coan, 1966]
1921a. Paradise lost [Bahía San Quintín Pleistocene fossils]. West Amer. Sci. **19** (2): 18 - 20 (27 April 1921)
1921b. Pleistocene beds of San Quintín Bay, Lower California. West Amer. Sci. **19** (3): 23 - 24 (15 June 1921)

Oyama, Katura
1950. Remarks on Japanese fossil molluscan names. Miner. & Geol. **3** (6): 1 - 4 (10 November 1950)

Packard, Earl Leroy
1918. Molluscan fauna from San Francisco Bay. Univ. Calif. Publ. Zool. **14** (2): 199 - 452; plts. 14 - 60 (12 September 1918)

Palmer, Katherine Evangeline Hilton (Van Winkle)
1918. Paleontology of the Oligocene of the Chehalis Valley, Washington. Univ. Wash. Publ. Geol. **1** (2): 69 - 97; plts. 6, 7 (January 1918)
1945. Mollùscan types in the Carpenter collection in the Redpath Museum. The Nautilus **58** (3): 97 - 102 (19 Feb.)
1951. Catalog of the first duplicate series of the Reigen collection of Mazatlan shells in the State Museum at Albany, New York. New York State Mus. Bull. **342:** 79 pp.; 1 plt. (Jan.)
1958. Type specimens of marine mollusca described by P. P. Carpenter from the West Coast (San Diego to British Columbia). Memoir 76, Geol. Soc. Amer. i - viii + 1 - 376; plts. 1 - 35. New York, N. Y. (8 December 1958)
1963. Type specimens of marine Mollusca described by P. P. Carpenter from the west coast of Mexico and Panama. Bull. Amer. Paleo. **46** (211): 285 - 408; plts. 58 - 70 (22 Oct.)

Petrov, O. M.
1966. [Stratigraphy and fauna of marine mollusks in the Quaternary deposits of the Chukotsk Peninsula.] Akad. Nauk S. S. S. R.. Geolog. Inst., Trudy (Moscow) **155:** 290 pp.; 23 plts.; 133 text figs.

Pilsbry, Henri Augustus & Edward Guirey Vanatta
1902. Papers from the Hopkins Stanford Galapagos Expedition, 1898-1899. XIII. Marine Mollusca. Proc. Acad. Sci. Wash. (D. C.) **4:** 549 - 560; plt. 35 (30 September 1902)

Prashad, Baini
1932. The Lamellibranchia of the Siboga Expedition. Systematic Part II. Pelecypoda (exclusive of the Pectinidae). Siboga-Exped. Monogr. **53C:** 353 pp.; 9 plts.; 1 map (July '32)

Pulteney, Richard
1799. Catalogue of the birds, shells, and some of the more rare plants of Dorsetshire. London (Nichols) 92 pp. (pre 2 July 1799)
[concerning this work: see Bowden & Heppell, 1968]

Purchon, Richard Denison
1960. The stomach in the Eulamellibranchia; Stomach Types IV and V. Proc. Zool. Soc. London **135** (3): 431 - 489; 19 text figs. (20 October 1960)

Putnam, William Clement
1942. Geomorphology of the Ventura region, California. Bull. Geol. Soc. Amer. **53** (?): 691 - 754; plts. 1 - 5; 11 text figs. (1 May 1942)

Reagan, Albert B.
1908. Some notes on the Olympic Peninsula, Washington. Trans. Kansas Acad. Sci. **22:** 131 - 238; plts. 1 - 6; 1 map

Reeve, Lovell Augustus
1854-1855. Monograph of the genus *Donax*. Conch. Icon.; or Illustr. shells mollusc. animals **8:** plts. 1 - 9 [plts. 1 - 6 (September 1854); plts. 7, 8 (October 1854); plt. 9 (June 1855)]

Reynell, Alexander
1910. Further notes on the dates of issue of the parts of Sowerby's *Conchological Illustrations*. Proc. Malacol. Soc. London **9** (3): 212 - 213 (26 September 1910)

Richards, Horace Gardiner
1962. Studies on the marine Pleistocene. I & II. Trans. (n. s.) Amer. Philos. Soc. **52** (3): 1 - 141; plts. 1 - 21; 35 text figs. (July 1962)

Rodda, Peter Ulisse
1957. Paleontology and stratigraphy of some marine Pleistocene deposits in northwest Los Angeles basin, California. Bull. Amer. Assoc. Perol. Geol. **41** (11): 2475 - 2492; 12 text figs. (November 1957)

Römer, see under Küster & Römer, 1841 - 1873

Rosewater, Joseph
1968. Itinerary of the voyage of H. M. S. *Blossom*, 1825 to 1828. The Veliger **10**(4): 350 - 352 (1 April 1968)

Salisbury, Albert Edward
1934. On the nomenclature of Tellinidae, with descriptions of new species and some remarks on distribution. Proc. Mal. Soc. London **21** (2): 74 - 91; plts. 9 - 14. (14 July 1934)

Say, Thomas
1830 - 1834. American conchology, or descriptions of the shells of North America. Prts. 1 - 7; 258 pp., 68 plts. New Harmony, Indiana [There are several articles about this work.]

Schenck, Hubert Gregory
1945. Geologic applications of biometrical analysis of molluscan assemblages. Journ. Paleont. **19** (5): 504 - 521; plts. 66 - 67; 3 text figs. (4 October 1945)

SCHRENCK, LEOPOLD IVANOVICH (VON)
1861. Vorläufige Diagnosen einiger neuer Molluskenarten aus der Meerenge der Tartarei und dem nordjapanischen Meere ... Bull. Akad. Imp. Sci. St. Petersburg (3) **4**(7): 408 to 413 (post 18 October 1861)
1867. Mollusken des Amur-Landes und des Nordjapanischen Meeres. Reisen und Forschungen im Amur-Lande in den Jahren 1854 - 1856 im Auftrage der Kaiserl. Akad. Wissensch. zu St. Petersburg ... **2** [Zoologie] (Mollusken): 259 - 976; plts. 12 - 30 (post-October 1867)

SCHUMACHER, CHRÉTIEN FRÉDÉRIC
1817. Essai d'un nouveau système des habitations des vers testacés. Copenhagen (Schultz). [iv]+287 pp.; 22 plts. (post 1 March 1817)

SHERBORN, CHARLES DAVIES
1899. A note on the date of the parts of 'Humboldt and Bonpland's Voyage: Observations de Zoologie.' Ann. Mag. Nat. Hist. (7) **3** (17): 428 (May 1899)
1934. Dates of publication of catalogues of natural history (post 1850) issued by the British Museum. Ann. Mag. Nat. Hist. (10) **13** (74): 308 - 312 (February 1934)

SMITH, ALLYN G., & MACKENZIE GORDON, JR.
1948. The marine mollusks and brachiopods of Monterey Bay, California, and vicinity. Proc. Calif. Acad. Sci., 4th Ser., **26** (8): 147 - 245; plts. 3 - 4; text figs. 1 - 4 (15 December 1948)

SMITH, EDGAR ALBERT & H. W. ENGLAND
1937. Martini and Chemnitz (Kuester's Edition) *Systematisches Conchylien-Cabinet,* 1837-1918. Journ. Soc. Bibliogr. Nat. Hist. **1** (4): 89 - 99 (8 December 1937)

SMITH, JAMES PERRIN
1919. Climatic relations of the Tertiary and Quaternary faunas of the California region. Proc. Calif. Acad. Sci. (4) **9** (4): 123 - 173; plt. 9 (12 July 1919)

SOOT-RYEN, TRON
1932. Pelecypoda, with a discussion of possible migrations of Arctic pelecypods in Tertiary times. The Norwegian North Polar Expedition with the "*Maud*" 1918-1925. Sci. Res. **5** (12): 36 pp.; 2 plts. Bergen (Geofys. Inst.)
1958. Pelecypods from East-Greenland. Norsk Polarinst. Skrift. **113:** 1 - 32; 2 text figs.; 1 map

SOWERBY, GEORGE BRETTINGHAM (1ST of name)
1839. see under GRAY & SOWERBY, 1839

SOWERBY, GEORGE BRETTINGHAM (2ND of name)
1866a. Monograph of the genus *Donax,* Linnaeus. *In* Thesaurus Conchyliorum; or Monographs of genera of shells **3** (24-25): 305 - 317; plts. 1 - 4 [dating: WOODWARD, 1915]
1866b, 1867. see under 1866-1869
1866-1869. Monograph of the genus *Tellina.* *In* L. A. REEVE, ed.: Conchologia Iconica; or, Illustrations of shells of molluscous animals **17** (2): [v]; 58 plts. [plts. 2 - 9 (July 1866); plt. 10 (August 1866); plts. 11 - 18 (November 1866); plts. 19 - 27 (March 1867); plts. 28 - 34 (June 1867); plts. 35 - 42 (September 1867); plts. 43 - 44 (March 1868); plt. 45 (September 1868); plts. 46 - 54 (October 1868); plts. 1, 55 - 58 (April 1869)]

SOWERBY, JAMES
1817 [1815 - 1818]. The mineral conchology of Great Britain; or coloured figures and descriptions of those remains of testaceous animals or shells, which have been preserved at various times and depths in the earth 2. London (Sowerby) 251 pp.; plts. 103 - 203 [(part 28): 129 - 140; plts. 157 - 162 (1 April)] [dating: SYKES, 1906]

SPENGLER, LORENZ
1798. Over det toskallede slaegt Tellinerne. Skriv. Naturhist.-Gelskab. (Kjøbenhaven) **4** (2): 67 - 127; plt. 12

STEINBECK, JOHN ERNST & EDWARD FLANDERS RICKETTS
1941. Sea of Cortez: A leisurely journal of travel and research with a scientific appendix comprising materials for a source book on the marine animals of the Panamic province. Viking Press, New York, x+598 pp.; 40 plts.; 2 charts; 1 map (December 1941)

STEWART, see under WOODRING, STEWART & RICHARDS, 1941

STOLICZKA, FERDINAND
1870 [1870-1871]. Cretaceous fauna of southern India 3. The pelecypoda, with a review of all known genera of this class, fossil and Recent. ... Geol. Surv. India, Mem. Paleont. Indica (6): xii+538 pp.; 50+[4] plts. [parts 1 - 4: 1 - 222; plts. 1 - 12 (1 September 1870); parts 5 - 8: 223 - 408; plts. 13 - 28 (1 March 1871); parts 9 - 13: i - xxii+409 - 537; plts. 29 - 50 (1 August 1871)]

STOLL, NORMAN RUDOLPH, *et al.*
1964. International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology, ed. 2. London (Internat. Trust f. Zool. Nomencl.) pp. i - xx+ 1 - 176; 5 appendices & Glossary

SYKES, ERNEST RUTHVEN
1906. On the dates of publication of Sowerby's "Mineral Conchology" and "Genera of Recent and Fossil Shells." Proc. Malacol. Soc. London **7** (3): 191 - 194 (5 Oct. 1906)

TEGLAND, NELLIE MAY
1933. The fauna of the type Blakeley upper Oligocene of Washington. Univ. Calif. Publ. Geol. Sci. **23** (3): 81 - 174; plts. 2 - 15; 2 maps (11 October 1933)

THORSON, GUNNAR
1950. Reproductive and larval ecology of marine bottom invertebrates. Biol. Rev. **25** (1): 1 - 45; **6** text figs. (January 1950)
1957. Bottom communities (sublittoral or shallow shelf). *In*: J. W. HEDGPETH, ed., Treatise on marine ecology and paleoecology. **1** [Ecology]. Mem. Geol. Soc. Amer. **67, 1:** 461 - 534; 20 text figs. (30 December 1957)
1961. Length of pelagic larval life in marine bottom invertebrates as related to larval transport by ocean currents. *In*: M. SEARS, ed., Oceanography. 455 - 474; 3 text figs. Amer. Assoc. Adv. Sci., Washington, D. C.

TOKUNAGA, SHIGEYASU
1906. Fossils from the environs of Tokyo. Journ. Coll. Sci. Imp. Univ. Tokyo **21:** 1 - 96; plts. 1 - 6 (13 July 1906)

TOWNSEND, C. H. (compiler)
1901. Dredging and other records by the U. S. Fish Commission steamer *Albatross* with the bibliography relative to the work of the vessel. U. S. Comm. on Fish & Fisheries, Rprt. [for 1899-1900] [26] [Appendix] (472): 387 - 562; plts. 1 - 7

TRYON, GEORGE WASHINGTON, JR.
1969. Catalogue of the family Tellinidae. *In* Catalogue and synonymy of the genera, species and varieties of Recent Mollusca, described prior to January 1st, 1867, with dates of publication, references to plates. and localities. Part 2 Amer. Journ. Conchol. **4** (5) [Appendix]: 72 - 126 (6 May)

TURNER, RUTH DIXON
1956. The eastern Pacific marine mollusks described by C. B. Adams. Occ. Pap. Moll., Mus. Comp. Zool., Harvard Univ., **2** (20): 21 - 135; plts. 5 - 21 (22 September 1956)

TWENHOFEL, WILLIAM STEPHENS
1952. Recent shore-line changes along the Pacific coast of Alaska. Amer. Journ. Sci. **250** (7): 523 - 548 (July '52)

UPSON, JOSEPH EDWIN
1951. Former marine shore lines of the Gaviota quadrangle, Santa Barbara County, California. Journ. Geol. **59** (5): 415 - 446; plts. 1, 2; 3 text figs. (September 1951)

VALENCIENNES, ACHILLE
1821. Coquilles marines bivalves de l'Amérique Équinoxiale, recueillies pendent le voyage de MM. de Humboldt et Bonpland .... pp. 217 - 224; plts. 48 - 50 *In* F. H. A. VON HUMBOLDT & A. J. A. BONPLAND, Voyage aux régions équinoxiales du nouveau continent. Part 2. Recueil d'observations de zoologie et d'anatomie comparée faites dans l'Océan Atlantique, dans l'intérieur du nouveau continent et dans La Mer de Sud. ... **2.** Paris (Smith & Gide) [dating: SHERBORN, 1899, and WALKER, 1928]

VALENTINE, JAMES WILLIAM
1956. Upper Pleistocene Mollusca from Portrero Canyon, Pacific Palisades, California. Trans. San Diego Soc. Nat. Hist. **12** (10): 181 - 205; plt. 13; 1 map (2 July 1956)
1958. Late Pleistocene megafauna of Cayucos, California, and its zoogeographic significance. Journ. Paleont. **32** (4): 687 - 696; 2 text figs. (22 July 1958)
1959. Pleistocene molluscan notes. II: Faunule from Huntington Beach Mesa, California. The Nautilus **73** (2): 51 - 57 (3 October 1959)
1961. Paleoecologic molluscan geography of the Californian Pleistocene. Univ. Calif. Publ. Geol. Sci. **37** (7): 309 - 442; 16 text figs. (17 May 1961)
1966. Numerical analysis of marine molluscan ranges on the extratropical northeastern Pacific shelf. Limnol. Oceanogr. **11** (2): 198 - 211; 7 text figs. (April 1966)

VALENTINE, JAMES WILLIAM & ROBERT F. MEADE
1961. Californian Pleistocene paleotemperatures. Univ. Calif. Publ. Geol. Sci. **40** (1): 1 - 46; 4 text figs. (14 July '61)

VASSALLO, MARILYN T.
1969. The ecology of *Macoma inconspicua* (BRODERIP & SOWERBY, 1829) in central San Francisco Bay. Part I. The vertical distribution of the *Macoma* community. The Veliger **11** (3): 223 - 234; plt. 44; 6 text figs.; 2 tables (1 January 1969)

VON MARTENS, see under MARTENS

WAGNER, FRANCES JOAN ESTELLE
1960. Palaeoecology of the marine Pleistocene faunas of southwestern British Columbia. Bull. Geol. Surv. Canada **52:** ix+67 pp.; 1 plt.; 3 text figs. (1 March 1960)

WALKER, BRYANT
1928. The date of publication of *Unio dombeyana* Val. The Nautilus **41** (4): 131 (25 April 1928)

WEAVER, CHARLES EDWIN
1912. A preliminary report on the Tertiary paleontology of western Washington. Bull. Wash. Geol. Surv. **15:** 80+iii; 15 plts.
1943. Paleontology of the marine Tertiary formations of Oregon and Washington, prts. 1 - 3. Univ. Wash. Publ. Geology **5:** 790 pp.; 104 plts. (31 December 1943)

WHITEAVES, JOSEPH FREDERICK
1880. On some marine invertebrata from the Queen Charlotte Islands (in) G. M. DAWSON. Report on the Queen Charlotte Islands. Report of Progress, Geol. Surv. of Canada 1878 - 79, [Appendix C]: 190 - 205; 2 text figs. (post May 1880)

WIEDEY, LIONEL WILLIAM
1928. Notes on the Vaqueros and Temblor formations of the California Miocene with descriptions of new species. Trans. San Diego Soc. Nat. Hist. **5** (10): 95 - 182; plts. 9 - 12 (30 March 1928)

WILKINS, GUY L.
1957. Notes on the *Historia Conchyliorum* of Martin Lister (1638 - 1712). Journ. Soc. Bibliogr. Nat. Hist. **3** (4): 196 - 205; 1 plt. (January 1957)

WILLETT, GEORGE
1937. Additions to knowledge of the fossil invertebrate fauna of California. Bull. South. Calif. Acad. Sci. **36** (2): 60 to 64; plts. 24, 25 (30 September 1937)
1938. Report on the Pleistocene molluscan fauna at Capistrano Beach, Orange County, Calif. Bull. South. Calif. Acad. Sci. **36** (3): 105 - 107 (25 January 1938)

WOOD, SEARLES VALENTINE
1848. A monograph of the Crag Mollusca, with descriptions of shells from the upper Tertiaries of the British Isles **2** (Bivalves). Palaeo. Soc. **9:** 217 - 342; plts. 21 - 31
1874. Supplement to the monograph of the Crag Mollusca, with descriptions of shells from the upper Tertiaries of the east of England. Palaeo. Soc. **27:** 99 - 231; plts. 8 - 11 +1 more

WOOD, WILLIAM
1815. General conchology; or, a description of shells, arranged according to the Linnean system, and illustrated with plates drawn and coloured from nature, . . . **1.** London (John Booth). [only one volume ever issued]: i - lxi+1 - 7+1 - 246; plts. 1 - 59, 4* (issued in as-yet undated parts, from 1814 to 1815, *fide* IREDALE, 1922]
1828. Supplement to the Index Testaceologicus or a catalogue of shells, British and foreign. London, W. Wood. vi+59 pp.; 8 plts. (post 17 May 1828)

WOODRING, WENDELL PHILLIPS, MILTON NUNN BRAMLETTE & WILLIAM STEPHEN WEBSTER KEW
1946. Geology and paleontology of Palos Verdes Hills, California. U. S. Geol. Surv. Prof. Pap. **207:** i - v+1 - 145; plts. 1 - 37; 16 text figs.

WOODRING, WENDELL PHILLIPS, RALPH B. STEWART & RALPH WEBSTER RICHARDS
1941. Geology of the Kettleman Hills Oil Field, California: stratigraphy, paleontology, and structure. U. S. Geol. Surv. Prof. Paper **195:** v+170 pp.; 57 plts.; 15 text figs. (7 June 1941)

WOODWARD, BERNARD BARHAM
1913, 1915 [1903-1915]. Catalogue of the books, manuscripts and drawings in the British Museum (Natural History). London (Brit. Mus.). 5 volumes [**1:** i - viii+1 - 500 (1903); **2:** 501 - 1038 (1904); **3:** 1039 - 1494 (1910); **4:** 1495 - 1956 (1913); **5:** 1957 to 2403 (1915)]

Woodward, Samuel
1833. An outline of the geology of Norfolk. Norwich (Stacy) and London (Longman). pp[ii]+60; 5 plts.; 2 charts (post 1 May 1833)

Yamamoto, Gotaro & Tadashige Habe
1959. Fauna of shell-bearing mollusks in Mutsu Bay. Lamellibranchia (2). Bull. Tohoku Univ., Asamushi Mar. Biol. Sta. 9 (3): 85 - 122; plts. 6 - 14

Yonge, Charles Maurice
1949. On the structure and adaptations of the Tellinacea, deposit-feeding Eulamellibranchia. Phil. Trans. Roy. Soc. London (B) **234** (609): 29 - 76; 29 text figs. (5 Sept. 1949)

Received too late for inclusion:

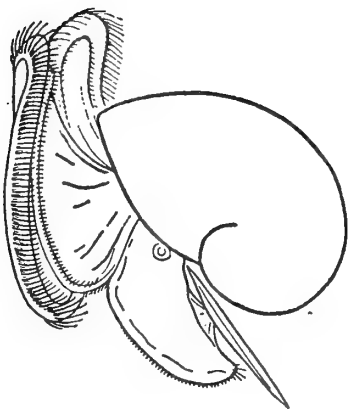
Afshar, Freydoun
1969. Taxonomic revision of the superspecific groups of the Cretaceous and Cenozoic Tellinidae. Mem. Geol. Soc. America **119:** 215 pp.; 45 plts.

Dunnill, Robert Millthorpe & Derek V. Ellis
1969. The distribution and ecology of sub-littoral species of *Macoma* (Bivalvia) off Moresby Island and in Satellite Channel, near Victoria, British Columbia. The Veliger **12** (2): 207 - 219; 9 text figs. (1 October 1969)

INDEX

The following is an index to the major accounts of all specific and generic names.

(Manuscript accepted for publication: September, 1969)



THE VELIGER is open to original papers pertaining to any problem concerned with mollusks.

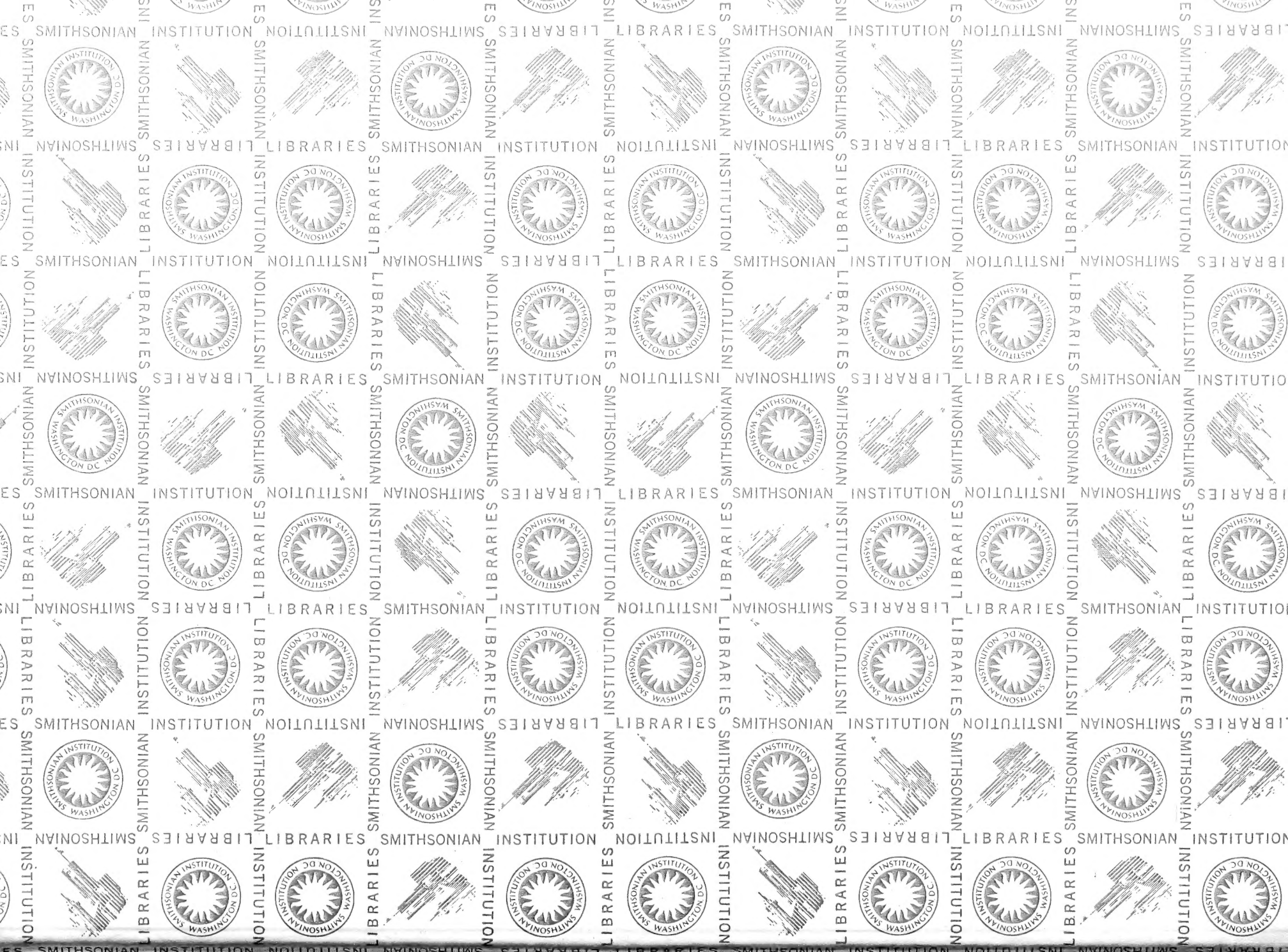
This is meant to make facilities available for publication of original articles from a wide field of endeavor. Papers dealing with anatomical, cytological, distributional, ecological, histological, morphological, physiological, taxonomic, etc., aspects of marine, freshwater or terrestrial mollusks from any region, will be considered. Even topics only indirectly concerned with mollusks may be acceptable.

It is the editorial policy to preserve the individualistic writing style of the author; therefore any editorial changes in a manuscript will be submitted to the author for his approval, before going to press.

Short articles containing descriptions of new species or other taxa will be given preferential treatment in the speed of publication provided that arrangements have been made by the author for depositing the holotype with a recognized public Museum. Museum numbers of the type specimens must be included in the manuscript. Type localities must be defined as accurately as possible, with geographical longitudes and latitudes added.

Short original papers, not exceeding 500 words, may be published in the column "NOTES and NEWS"; in this column will also appear notices of meetings of regional, national and international malacological organizations, such as A. M. U., U. M. E., W. S. M., etc., as well as news items which are deemed of interest to our Members and subscribers in general. Articles on "METHODS and TECHNIQUES" will be considered for publication in another column, provided that the information is complete and techniques and methods are capable of duplication by anyone carefully following the description given. Such articles should be mainly original and deal with collecting, preparing, maintaining, studying, photographing, etc., of mollusks or other invertebrates. A third column, entitled "INFORMATION DESK," will contain articles dealing with any problem pertaining to collecting, identifying, etc., in short, problems encountered by our readers. In contrast to other contributions, articles in this column do not necessarily contain new and original materials. Questions to the editor, which can be answered in this column, are invited. The column "BOOKS, PERIODICALS, and PAMPHLETS" will attempt to bring reviews of new publications to the attention of our readers. Also, new timely articles may be listed by title only, if this is deemed expedient.

Manuscripts should be typed in final form on a high grade white paper, not exceeding 8½″ by 11″, at least double spaced and accompanied by a clear carbon or photo copy. A pamphlet with detailed suggestions for preparing manuscripts intended for publication in THE VELIGER is available to authors upon request. A self-addressed envelope, sufficiently large to accommodate the pamphlet (which measures 5½″ by 8½″), with double first class postage, should be sent with the request to the Editor.


SMITHSONIAN INSTITUTION LIBRARIES