Neogene Marine Mollusks of the Pacific Coast of North America: An Annotated Bibliography, 1797-1969

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Neogene Marine Mollusks of the Pacific Coast of North America: An Annotated Bibliography, 1797-1969

By WARREN O. ADDICOTT

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A compilation of reports for the period 1797–1969 dealing with marine mollusks of Miocene and Pliocene age

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NEOGENE MARINE MOLLUSKS OF THE PACIFIC COAST OF NORTH AMERICA: AN ANNOTATED BIBLIOGRAPHY

By Warren O. Addicott

ABSTRACT

Reports dealing with marine mollusks of Neogene (Miocene and Pliocene) age from the Pacific and Arctic coasts of North America are listed alphabetically by author and year of publication. This compilation covers the period 1797–1969. Geographic coverage is from the west coast of Central America to, and including, Arctic Alaska with comprehensive coverage from the west coast of Mexico northward. Each citation is accompanied by a brief annotation indicating the nature of information on Neogene mollusks and is referenced in a subject index, generally under two or more headings. Systematic description of Neogene mollusks and the utilization of paleontologic data in other geological reports have gone through a number of rather closely related cycles during the past 125 years. During the 5-year period 1965–69 both kinds of publications reached alltime highs.

INTRODUCTION

This bibliography includes reports dealing with marine molluscan fossils of Neogene (Miocene and Pliocene) age from the Pacific coast of North America and the Arctic coast of Alaska published prior to 1970. The citations are listed alphabetically by author. Each entry is accompanied by a brief annotation intended to indicate the nature of information on marine mollusks. There is a subject index in which almost all of the reports are listed under a geographic and a topical heading; some of the comprehensive reports are indexed under as many as eight headings.

Reports containing illustrations of fossils or systematic descriptions of new taxa are indicated by setting the author's names in capital letters; those in which only previously described fossils are illustrated are also indicated by capital letters but are accompanied by an asterisk following the year of publication. Lower case type is used for all other entries.

Although there are a number of bibliographies that deal with Tertiary stratigraphy and paleontology of individual States, no attempt

has been made to bring together reports on Neogene mollusks since Dall's (1909c) post-Eocene bibliography for the northwest coast of North America. This report differs from these earlier, less comprehensive bibliographies in including annotations and in having a subject index.

This bibliography is intended, in part, to complement two systematic catalogs of Tertiary mollusks of the Pacific Coast States: Keen and Bentson's (1944) checklist of Tertiary marine mollusks from California and Weaver's (1942) illustrated catalog of Tertiary marine invertebrates from Oregon and Washington. Although these reports are about 30 years old, a significant proportion of the systematic description of Neogene marine mollusks had been accomplished by the early 1940's. Both of these reports also contain comprehensive bibliographies although Keen and Bentson's (1944) is limited to reports in which Tertiary mollusks are illustrated or are newly described.

ACKNOWLEDGMENTS

Many people have cooperated and have provided assistance in the preparation of this bibliography. The project was initially suggested by Dwight W. Taylor, San Diego Museum of Natural History, in 1966, in connection with a review of the status of knowledge on malacology in western North America. The early stages of assembling bibliographic citiations were aided by Helen E. Bailey, formerly research librarian for the U.S. Geological Survey in Menlo Park. Ellen J. Moore, U.S. Geological Survey, and Wendell P. Woodring, Smithsonian Institution, furnished an unpublished chronological list of papers dealing with Tertiary invertebrate paleontology and stratigraphy of the Pacific Coast States through 1960. William Sanders and Ann H. Schwabecher, research librarians, U.S. Geological Survey, have provided assistance in securing bibliographic materials. Some 40 paleontologists and geologists, actively working Pacific coast Tertiary problems, have kindly reviewed lists of their reports for accuracy and completeness. Finally, Rose M. Trombley has contributed significantly to the preparation of the report, particularly in the preparation of the subject index.

SCOPE AND CRITERIA FOR INCLUSION

It is intended to include all reports, including abstracts, published prior to 1970 containing information on Neogene mollusks in this bibliography. The minimum criterion for inclusion is that molluscan fossils of Miocene or Pliocene age be mentioned in a report. Records of marine "fossils" in early reports, for example, have been taken to

indicate that marine mollusks may have been found. Most of these early records have been supplemented by subsequent faunal documentation but a few still stand as the only indication that marine mollusks of late Tertiary age may be present in areas that have as yet not received intensive geological study.

Foreign journals and paleontological reports in which molluscan taxa from other parts of the Pacific Ocean basin, or other oceans, have been compared with Pacific coast Neogene species have not been thoroughly searched, nor have trade journals dealing with the petroleum industry in California. Unpublished theses are not cited, but publications in which they are listed are included.

During the 1920's and 1930's many abstracts of papers presented at the Geological Society of America's regional and national meetings were published in the Pan-American Geologist in addition to customary publication in the Bulletin of the Geological Society of America. Frequently, the abstract appeared first in the Pan-American Geologist, but some abstracts are not identical with the official version in the Bulletin of the Geological Society of America and presumably were not submitted to the Pan-American Geologist for publication by the authors. Accordingly, citations to abstracts published in the Pan-American Geologist are not included in the bibliography. There are, however, a few full-length reports appearing in the Pan-American Geologist and nowhere else, such as Carson (1925a) and Howe (1926), and these are included herein.

GEOGRAPHIC COVERAGE

The area covered by the bibliography is from the Pacific coast of Central America to and including the Arctic coast of Alaska. Coverage is intended to be comprehensive from the west coast of Mexico northward. Many of the reports dealing with Neogene mollusks from the Pacific coast of other Central American countries are, however, included.

STRATIGRAPHIC CONSIDERATIONS

Use of Miocene and Pliocene in this report is with reference to the provincial molluscan standard (Weaver and others, 1944) as subsequently modified by Durham (1954).

Because the recognition of European series and epoch boundaries along the Pacific coast continues to be controversial, many of the reports dealing with late Oligocene faunas in the sense of Weaver and others (1944) and Durham (1954) are included in this report. As recognized herein, the Oligocene-Miocene boundary in the Pacific

coast provincial molluscan chronology is placed at the base of the "Vaqueros Stage" of Weaver and others (1944) in California and northwestern Baja California and at or near the middle of the "Blakeley Stage" of Oregon, Washington, Canada, and southeastern Alaska. The "Blakeley" and "Vaqueros" are considered to be in part time-equivalent, according to evidence presented by Vanderhoof (1942) and Addicott (1967b). This boundary corresponds to the boundary between the lower and upper parts of the Zemorrian Stage (Kleinpell, 1938) of the provincial benthonic foraminiferal standard. It should be noted that the Oligocene-Miocene boundary is placed somewhat higher in the provincial microfaunal sequences by specialists in Foraminifera—usually in the lower part of the overlying Saucesian Stage.

The Pliocene-Pleistocene boundary is drawn at the base of the Lomita Marl of the Los Angeles basin, California, and correlative stratal units in California following Woodring (1952). This boundary is based upon significant faunal extinctions and the modern aspect of what are considered to be early Pleistocene molluscan faunas, as explained by Woodring. As in the case of the Oligocene-Miocene boundary, there are indications based upon plantktonic foraminiferal correlations that the boundary may not correspond to the European sections and should be placed considerably higher in the Pacific coast provincial section (W. A. Berggren, Nature, v. 224, no. 5224, p. 1072–1085, 1969).

ANNOTATIONS

All entries are annotated so as to indicate the nature of the data on Neogene mollusks. However, in some of the more comprehensive reports, it has not been possible to summarize all the significant data and conclusions. Although some of the abstracts of papers delivered at scientific meetings are later superseded by definitive published reports, many are not. Some reports were published several years after the abstract and may not present the same conclusions as the abstract. Moroever, it is sometimes difficult to identify an abstract with subsequently published reports by the same author. For these reasons, abstracts included in the bibliography are accompanied by annotations.

The use of formational nomenclature in the annotations is in the sense of the individual authors and does not imply formal acceptance by the U.S. Geological Survey. Brackets are commonly utilized to indicate current formational nomenclature or age assignment.

STYLE OF ENTRIES

Papers in which Neogene mollusks are illustrated or are described as new are indicated by setting the author's names in capital letters; if the capitalized names are followed by an asterisk (*) the report contains illustrations of fossil mollusks but does not contain descriptions of new taxa. The author's names in all other reports are set in lowercase type

INDEXING

Where possible, reports have been indexed under two first-order terms—one geographic, the other topical. The more comprehensive reports have as many as eight entries in the subject index. An effort has been made to key as many reports as possible to Neogene depositional basins of the Pacific Coast States through the use of third-order geographic index terms. These informally named basins are shown in figure 1.

The style of the subject index is patterned after the "Bibliography of North American Geology," with the addition of a few first- and second-order paleontologic terms designed to suit the needs of this bibliography. These terms should be self explanatory, with the possible exception of "Faunal records." This term is used for reports that merely record the occurrence of Miocene or Pliocene mollusks or that list only one or two species.

TRENDS IN NEOGENE MOLLUSCAN PALEONTOLOGY

A graph has been prepared to summarize trends in the systematic description and illustration of Neogene mollusks from the Pacific coast of North America as well as to depict the utilization of data on Neogene mollusks in other reports pertaining to this area (fig. 2). In this graph, reports in which new species are described or in which Neogene mollusks are illustrated are shown by vertical bars; reports incorporating information on Neogene mollusks are indicated by a solid line. Abstracts are indicated by a dashed line. The tabulation is by 5-year periods starting in 1840 and ending in 1969. A similar tabulation of reports illustrating marine Tertiary mollusks from California was presented by Keen and Bentson (1944, fig. 2) and subsequently commented upon by Keen (1968).

The initial description of Neogene mollusks of the Pacific Coast States took place during the late 1840's and the 1850's as a consequence of exploration of the Pacific margin of the United States. Much of this work was tied to the railroad surveys in the Pacific area. Nearly all of the descriptive paleontologic work during this period was done by T. A. Conrad. Additional description of

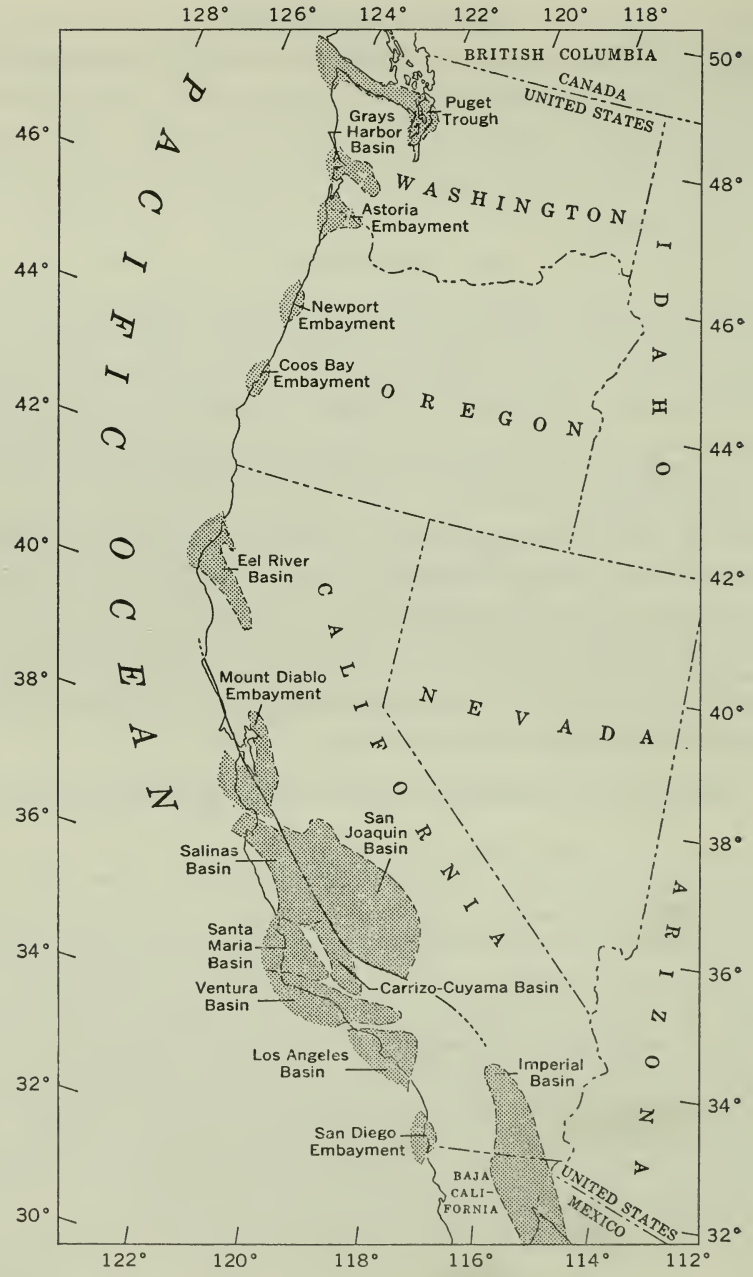

FIGURE 1.—Generalized outlines of some marine Neogene depositional basins of the Pacific Coast States.

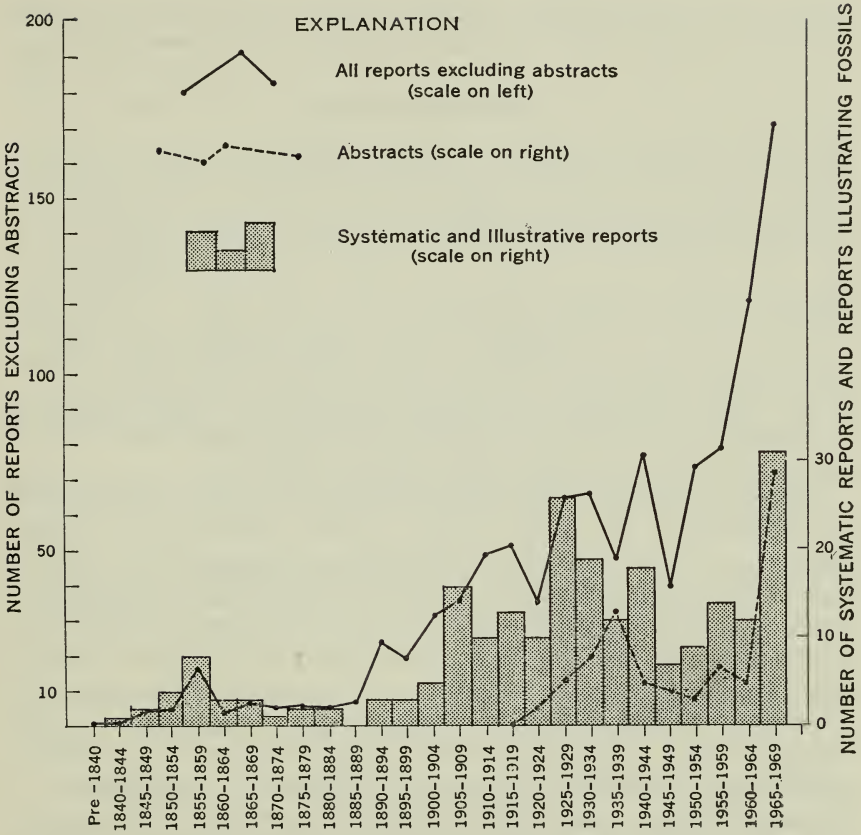

FIGURE 2.—Trends in the systematic description and illustration of Neogene mollusks of the west coast of North America and in the utilization of data on Neogene mollusks in other reports pertaining to this area.

Tertiary mollusks from California was completed by W. M. Gabb for the California Geological Survey in the 1860's.

During the last three decades of the 1800's, descriptive paleontologic studies reached a very low ebb, but toward the end of the period, paleontological support of heightened geological exploration of the California Coast Ranges and Alaska is evident from an increase in the number of reports containing paleontologic data (fig. 2).

A second, more refined phase of descriptive work got underway in the early 1900's, when the U.S. Geological Survey became more actively involved in geologic mapping of the Coast Ranges of California and Oregon. The peak in the number of descriptive paleontologic reports during the period 1905–09 reflects, in large part, the work of Ralph Arnold in California and, to a lesser extent, work on

Pacific coast and Alaskan Neogene Faunas by W. H. Dall. It was during this period and the following decade that invertebrate paleontology became one of the most important disciplines in the geological departments of the University of California, Berkeley, and Stanford University (Merriam, 1921). Although the level of paleontologic publication reached a plateau during the 15 years ending in 1924, possibly reflecting the effects of World War I, many important descriptive studies came out during this period. They were, in large part, the work of B. L. Clark, W. H. Dall, and C. E. Weaver, in addition to some of Clark's students at the University of California, Berkeley. Many, if not most, of the reports dealing with Neogene mollusks that were issued during this 15-year period can be ascribed, as previously indicated, to the training of many invertebrate paleontologists by J. P. Smith at Stanford University and by J. C. Merriam and B. L. Clark at the University of California.

The sharp increase in paleontologic studies, and in the utilization of paleontologic data in geological reports, beginning in the mid-1920's (fig. 2) was the result of heightened exploration for organic fuel resources along the Pacific coast, particularly in central and southern California. This period carried through into the mid-1940's with a slight decline during the late 1930's. The dip in the period 1935–39 probably can be ascribed to two factors—the economic depression in the United States and the gradual changeover from utilization of larger invertebrate fossils to Foraminifera in age determination and correlation in petroleum exploration. Continuation of this trend and the effects of World War II may have been responsible for the decline in publications dealing with Neogene mollusks during the late 1940's. A significant number of the systematic reports issued during the period 1930–49 were written by U. S. Grant, G D. Hanna, L. G. Hertlein, and W. P. Woodring.

A gradual increase in the rate of publication took place during the 1950's, followed by a greatly accelerated effort during the past decade, when the numbers of both systematic and of general reports reached alltime highs. This dramatic rise during the 10-year period ending in 1969 seems to be an index of the increasingly important role that molluscan paleontology is playing in deciperhing earth history. In addition to some of the more classical approaches that have been significantly refined through recent work, such as systematic description of faunas, paleontologic correlation, and biostratigraphy, molluscan paleontology is being increasingly employed in deciphering paleoclimatic history, structural evolution of ocean basin margins, and in paleoenvironmental analysis of depositional basins. The surprisingly large number of recent reports incorporating data on

molluscan paleontology is also related to the training of molluscan specialists at most of the larger universities on the Pacific coast during the past decade.

BIBLIOGRAPHY

Adams, B. C., 1932, An ecologic analysis of a Pliocene faunule from southern California: Stanford Univ. Micropaleontology Bull., v. 3, no. 4, p. 122–127.

Mollusks, including *Pecten healeyi* and *Area multicostata* var. *camulosensis*, from northwestern Orange County, Calif., are considered to be middle Pliocene.

Addicott, W. O., 1964, A late Pleistocene invertebrate fauna from southwestern Oregon: Jour. Paleontology, v. 38, no. 4, p. 650–661.

Elk River Beds of Diller (1902) of late Pliocene or early Pleistocene age characterized by very abundant *Psephidia* are distinguished from overlying upper Pleistocene terrace deposits carrying a different molluscan fauna.

Addicott, W. O., 1965a, The enigmatic late Cenozoic gastropod *Schizopyga californiana* Conrad [abs.]: Am. Malacol. Union Ann. Repts. for 1964, p. 44.

Nassarius [*Schizopyga*] *californianus* is a small, high-spired species characteristic of Pliocene strata in northwestern Santa Clara County. Seven late Tertiary and (or) Quaternary nassariids have been confused with this species.

ADDICOTT, W. O., 1965b*, Miocene macrofossils of the southeastern San Joaquin Valley, Calif.: U.S. Geol. Survey Prof. Paper 525–C, p. C101–C109, 4 figs.

Twenty-seven early to late Miocene mollusks from the Kern River area, northeast of Bakersfield, are figured. A stratigraphic range chart includes several important Miocene mollusks from this area. Twenty-nine middle Miocene mollusks from the northern Tejon Hills are listed.

ADDICOTT, W. O., 1965c*, On the identification of *Schizopyga californiana* Conrad, a California Pliocene gastropod: California Acad. Sci. Proc., ser. 4, v. 33, no. 2, p. 47–58, 11 figs.

Two species of *Nassarius* occur at or near the type locality of *N.* [*Schizopyga*] *californianus* in the northern part of Santa Clara County, Calif. A small, slender species is believed to represent *N. californianus*. A rotund, low-spired species is *N. grammatus*.

ADDICOTT, W. O., 1965d, Some western American gastropods of the genus *Nassarius*: U.S. Geol. Survey Prof. Paper 503–B, 24 p., 3 pls.

Fossil nassariid gastropods from the Pacific coast are figured and classified in three subgenera: *Catilon* n. subgenus, *Demondia* n. name, and *Caesia*. Included are keys for recognition of species of each subgenus. Two new species are described: *N. salinasensis* and *N. smooti*. A phylogenetic chart for species of *Caesia* is included.

ADDICOTT, W.O., 1966a*, Late Pleistocene marine paleoecology and zoogeography in central California: U.S. Geol. Survey Prof. Paper 523–C, p. C1–C21, 4 pls.

A specimen of *Macoma brota lipara* reworked from the Purisima Formation (Pliocene) into upper Pleistocene terrace deposits at Santa Cruz, Calif., is figured.

ADDICOTT, W. O., 1966b, New Tertiary marine mollusks from Oregon and Washington: Jour. Paleontology, v. 40, no. 3, p. 635–646, 3 pls.

Nine new gastropods and four pelecypods are described and figured from formations of late Oligocene to early Pliocene age. A correlation chart of Neogene formations of coastal Oregon [Newport embayment] and southwestern Washington is included.

Addicott, W. O., 1967a, Paleontologic evidence for large post-Early Miocene lateral slip on the San Andreas fault, California [abs.]: Geol. Soc. America Program, 63d Ann. Mtg., Santa Barbara, California, March 22–25, 1967, p. 17.

A newly reported occurrence of *Turritella inezana* Conrad near Point Arena, Mendocino County, west of the San Andreas fault, in relationshipp to occurrences of this species on the east side of the fault, suggests a minimum of 120 miles of post-early Miocene right-lateral slip.

Addicott, W. O., 1967b, Zoogeographic evidence for late Tertiary lateral slip on the San Andreas fault, California: U.S. Geol. Survey Prof. Paper 593–D, p. D1–D12.

The distributional pattern of the early Miocene species *Turritella inezana* is in agreement with earlier postulates of large post-early Miocene right-lateral slip along the San Andreas fault. Several other warm-water and cool-water mollusks of early and middle Miocene age support this paleogeographic reconstruction. The "Blakeley Stage" of Oregon and Washington and the "Vaqueros Stage" of California are shown to be in part time-equivalent.

ADDICOTT, W. O., 1967c* Age of the Skooner Gulch Formation, Mendocino County, California: U.S. Geol. Survey Bull. 1254–C, p. C1–C11, 4 figs.

Three mollusks from near Point Arena, Calif., including *Turritella inezana* forma *hoffmani*, are figured. Included are a geologic sketch map with localities, data on associated benthonic foraminifers, and a marine vertebrate. The small molluscan assemblage is suggestive of subtropical marine climate at this latitude during the early Miocene.

Addicott, W. O., 1968a, Mid-Tertiary zoogeographic and paleogeographic discontinuities across the San Andreas Fault, California, *in* Dickinson, W. R., and Grantz, Arthur, eds., Proceedings of conference on geologic problems of San Andreas Fault system: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 11, p. 144–165.

Includes four paleogeographic maps showing distribution of middle Oligocene and early to late Miocene shorelines in central California. Also shown are the location and relative size of molluscan faunal assemblages for each of these intervals. A correlation chart shows the relationship of provincial megafaunal "stages" and microfaunal stages. Faunal correlations tend to support paleogeographic matches across fault suggesting large cumulative right-lateral offsets ranging from 190 miles for Oligocene strata to about 80 miles for late Miocene strata.

Addicott, W. O., 1968b, Neogene molluscan zoogeography and climatic change in the northeastern Pacific Ocean [abs.]: Geol. Soc. America, 1968 Ann. Mtgs., Program with abstracts, P. 2–3.

A discussion of molluscan zoogeography in the middle latitudes of the northeastern Pacific Ocean and inferred climatic changes in the shallow-water, nearshore marine environment indicating a Miocene warming trend.

Addicott, W. O., 1969a, Late Pliocene mollusks from the northeastern Santa Cruz Mountains, California [abs.]: Geol. Soc. America, Abstracts with Programs for 1969, pt. 3, p. 1.

An assemblage of 39 mollusks occurs in the Merced (?) Formation of northern Santa Clara County. A shallow-water depositional environment in uppermost part of inner sublittoral zone and water conditions somewhat warmer than occur at this latitude today are inferred.

ADDICOTT, W. O., 1969b*, Late Pliocene mollusks from San Francisco Peninsula and their paleogeographic significance: California Acad. Sci. Proc., . 37, no. 3, p. 57–93, 4 pls.

A faunal assemblage of 39 mollusks occurs in exposures of Pliocene sandstone mapped as the Merced (?) Formation in northernmost Santa Clara County east of the San Andreas fault. Most of the species are illustrated and discussed in an abridged systematic section. The assemblages are indicative of shallow-water, level-bottom depositional site high in the inner sublittoral zone. *Anadara* s.s. and *Cancellaria* s.s. suggest shallow-water climate somewhat warmer than occurs at this latitude today.

Addicott, W. O., 1969c, Tertiary climatic change, in the marginal Northeastern Pacific Ocean: Science, v. 165, no. 3893, p. 583–586.

Analysis of molluscan genera in Oligocene to Pliocene faunas of the eastern North Pacific indicates a middle Oligocene climatic deterioration followed by warming that culminated during the middle Miocene. The analysis is based on cumulative percentages of warm-water genera in faunas of several Tertiary basins and upon tracing northern limits of certain warm-water genera from the Oligocene to the Pliocene.

Addicott, W. O., and Kanno, Saburo, 1969, Current paleontologic investigations on Cenozoic marine mollusks of the West Coast of North America: Veliger, v. 12, no. 1, p. 135–139.

A résumé of current research and recent publications on fossil marine mollusks of the eastern North Pacific Ocean. Mailing addresses of molluscan specialists are included.

Addicott, W. O., and Vedder, J. G., 1963, Paleotemperature inferences from late Miocene mollusks in the San Luis Obispo-Bakersfield area, California: U.S. Geol. Survey Prof. Paper 475–C, p. C63–C68.

Mollusks of tropical affinities occurring in upper Miocene strata near Bakersfield, Calif., suggest a marine climate warmer than existed in the San Luis Obispo area, 100 miles to the west. A late Miocene temperature regime analogous to that of the present-day outer coast of southwestern Baja California, Mexico, is indicated.

Adegoke, O. S., 1966a, Biostratigraphic subdivision of the marine Neogene formations of the Coalinga region [Fresno County], California [abs.]: Geol. Soc. America Program, 1966 Ann. Mtg., San Francisco, Calif., p. 2.

The Miocene and Pliocene marine sequence of the Coalinga region, California, is divided into eight faunizones (A–H) based upon stratigraphic occurrences of more than 300 taxa of larger invertebrates, mostly mollusks.

ADEGOKE, O. S., 1966b*, Silicified sand-pipes belonging to *Chaceia* (?) (Pholadidae: Martesiinae) from the late Miocene of California: Veliger, v. 9, no. 2, p. 233–235, pl. 21.

Upper Miocene silicified sand and mud-filled burrows attributed to *Chaceia* occur in the Pismo Formation near Huasna, San Luis Obispo County.

ADEGOKE, O. S., 1967a*, Bryozoan-mollusks relationships: Veliger, v. 9, no. 3, p. 298–300, pl. 40.

Bryozoan encrusted fragments of a pectinid, *Pseudochama exogyra*, and undetermined gastropods are described from the Santa Margarita Formation.

ADEGOKE, O. S., 1967b*, California late Miocene records of *Swiftopecten* Hertlein, 1935 (Pelecypoda: Pectinidae): Veliger, v. 9, no. 3, p. 337–339, pl. 47.

A late Miocene record of *Swiftopecten* from the Santa Margarita Formation near Coalinga, Calif., is reported. Twelve other mollusks occurring with this pectinid are listed.

ADEGOKE, O. S., 1967c, Earliest Tertiary west American species of *Platyodon* and *Penitella*: California Acad. Sci. Proc., ser. 4, v. 35, no. 1, pp. 1–22, figs. 1–26.

Five species of boring pelecypods from the Pacific coast Tertiary are reviewed. New species of *Platyodon* and *Penitella* are described from the San Ramon Formation of the San Francisco Bay area and a new species of *Platyodon* is described from the upper Miocene San Pablo Group of the same area.

Adegoke, O. S., 1967d, Neogene faunal succession of the west-central San Joaquin Valley and its bearing on the Miocene-Pliocene boundary problem [abs.]: Geol. Soc. America Spec. Paper 115, p. 307.

Presents molluscan evidence suggesting that a faunal break in the upper part of his Santa Margarita Formation is of series-epoch magnitude and can be taken as the provincial Miocene-Pliocene boundary. Ten mollusks are listed from the upper part of the Santa Margarita Formation; four from the lower part.

ADEGOKE, O.S., 1967e*, New and oldest records of pelecypod *Mya* from western North America, south of Alaska: Nautilus, v. 80, no. 3, p. 91–95, figs. 1–3.

Miocene assemblages from localities on Reef Ridge and on Coalinga Anticline in the San Joaquin basin, California, are listed; *Mya fujiei* MacNeil is figured.

ADEGOKE, O. S., 1969, Stratigraphy and paleontology of the marine Neogene formatons of the Coalinga region, California: California Univ. Pubs. Geol. Sci., v. 80, 241 p., 13 pls.

A comprehensive biostratigraphic treatment of Miocene and Pliocene faunas of the Coalinga and Reef Ridge areas of the San Joaquin basin. Faunal assemblages are arranged into eight faunizones and 16 zonules. Many of the mollusks are figured, 16 new molluscan taxa are named and described. Most of the formations were deposited in depths of between 10 and 100 fathoms. The invertebrate faunas indicate a gradual and continuous cooling from tropical conditions during the middle Miocene to temperate conditions during the late Pliocene. Fossil localities are shown on geologic maps.

Aguilera, J. G., 1907, Aperçu sur la géologie du Mexique pour servir d'explication à la carte géologique de l'Amérique du nord: Congrès Géol. International (10), Compte Rendu (Mexico, 1906), p. 227–252.

Upper Miocene strata at Boleo and at Santa Rosalia, Baja California, contain a molluscan fauna that is correlative with the fauna of the Carrizo Creek Beds in southeastern California; five species from these beds are listed. Marine Pliocene strata occur near Tijuana and on Cedros Island, Baja California; three pectinids from Cedros Island are listed.

Allen C. R., 1957, San Andreas fault zone in San Gorgonio Pass, southern California: Geol. Soc. America Bull., v. 68, no. 3, p. 315–350.

The Imperial Formation (Pliocene) near Painted Hill includes fossiliferous coquinalike beds.

Allen, J. E., 1946, Geology of the San Juan Bautista quadrangle, California: California Div. Mines Bull. 133, p. 9–75.

Lists two mollusks from the Vaqueros Formation and one from the Purisima Formation. Refers to work by A. M. Keen on collections made by the author, and earlier investigators, from the Purisima Formation that number more than 80 taxa. The list is contained in the author's Ph. D. dissertation at the University of California, Berkeley.

ALLEN, J. E., and BALDWIN, E. M., 1944*, Geology and coal resources of the Coos Bay quadrangle, Oregon: Oregon Dept. Geology and Mineral Industries Bull. 27, 160 p., 31 pls.

Illustrate exposures of fossil conglomerate in Empire formation including photography of a chain of *Crepidula*. Stratigraphic work on the Pliocene Empire and Port Orford Formations is reviewed.

Allen, J. E., Kinsley, Elinor, Quasdorf, Hazel, and Treasher, R. C., 1947, Bibliography of the geology and mineral resources of Oregon (supplement), July 1, 1936, to December 31, 1945: Oregon Dept. Geology and Mineral Industries Bull. 33, 108 p.

A useful, well-indexed compilation including several reports on Neogene mollusks.

Allison, E. C., 1964, Geology of areas bordering Gulf of California, *in* van Andel, R. H., and Shor, G. G., Jr., eds., Marine geology of the Gulf of California: Am. Assoc. Petroleum Geologists Mem. 3, p. 3–29.

Includes a review of Neogene paleontology and stratigraphy of Baja California, the Peninsular Ranges, and the Transverse Ranges. The Imperial Formation of southeastern California is most nearly comparable with the San Diego Formation of southwestern California coast; its age may be early Pleistocene. *Ostrea-Anomia* assemblages of the Palm Springs Formation of southeastern California are considered middle Pleistocene on basis of associated mammals.

Allison, E. C., 1965, Post-Miocene faunas of northwestern Baja California and adjacent Alta California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1078.

Post-Miocene faunas [molluscan?] occur on the lowest two or three terraces of northern Baja California at elevations of 200 meters or less. The highest (oldest) faunas include species and genera with nonoverlapping modern bathymetric and geographic ranges. The faunas from the lowest terraces are more compatible with modern assemblages.

Allison, E. C., Durham, J. W., and Zullo, V. A., 1962, Cold-water Late Cenozoic faunas of northern California and Oregon [abs.]: Geol. Soc. America Spec. Paper 68 [Abstracts for 1961], p. 2.

Late Cenozoic faunas from Moonstone Beach, near Trinidad, Calif. and near Cape Blanco, Oreg., numbering approximately 100 and 80 species, respectively, are reported. The Moonstone Beach assemblage characterized by a *Balanus*, *Mytilus*, and *Polytropa* association is the older of the two.

ALLISON, R.C., 1965*, Apical development in turritellid classification with a description of *Cristispira pugetensis* gen. et sp. nov.: Palaeontology, v. 8, pt. 4, p. 666–680, pl. 92.

Figures a specimen of *Turritella temblorensis* from the middle Miocene Topanga Formation, southern California.

Anderson, C. A., 1950, Geology of islands and neighboring land areas, pt. I *in* 1940 E. W. Scripps cruise to the Gulf of California: Geol. Soc. America Mem. 43, p. 1–53.

Provides stratigraphic framework for paleontologic report on Miocene and Pliocene mollusks of Gulf of California by Durham (1950b) in same volume. Included are geologic maps of islands showing fossil localities. A few characteristic mollusks are mentioned in stratigraphic descriptions

Anderson, D. N., and Land, P. E., 1969, Cymric oil field, California: California Oil Fields, v. 55, no. 1, p. 5–21.

A few "marker fossils", mostly pectinids, for members of the Temblor Formation, Monterey Shale, and Etchegoin Formation are listed in a composite stratigraphic column.

Anderson, F. M., 1903, Stratigraphy of the southern Coast Ranges of California [abs.]: Geol. Soc. America Bull., v. 15, p. 581–582.

*** "The sandy beds at the base of the series [Miocene] contain fossil invertebrates, among which the characteristic forms are *Amuseum*, *Pecten crassicardo*, *Pecten discus* Conrad, *Scutella brewerianus*? Gabb, *Leda* sp. *Cardium*, *Terebratella* (*Laqueus*), etc. In some districts, as in the vicinity of Temblor, Kern County, there is more shale and sandstone below the beds characterized by these fossils."

ANDERSON, F. M., 1905, A stratigraphic study in the mount Diablo Range of California: California Acad. Sci. Proc., ser. 3, v. 2, no. 2, p. 155–248, 23 pls.

The initial account of Neogene formations and mollusks of the western margin of the San Joaquin basin. Describes and illustrates 23 new species of Miocene and Pliocene mollusks from the San Joaquin basin, mostly middle Miocene species from the Kern River area. Describes new formations from the southern Diablo Range and Temblor Range; includes several lists of mollusks from these formations. Also lists 15 species of middle(?) Miocene mollusks from Carisa Ranch, San Juan River, west of the San Andreas fault. Forty-six mollusks are listed from the Kern River area including 14 newly described species.

Anderson, F. M., 1908, A further stratigraphic study in the Mount Diablo Range of California: California Acad. Sci. Proc., ser. 4, v. 3, no. 3, p. 1–40.

Lists mollusks from the Temblor, Coalinga [Santa Margarita], and Etchegoin Formations of the Diablo and Temblor Ranges; there is a section on correlation of these strata with other areas in California.

Anderson, F. M., 1911, The Neocene deposits of Kern River, California, and the Temblor Basin: California Acad. Sci. Proc., ser. 4, v. 3, p. 73–148.

The definitive report on Miocene strata of the Kern River area. Includes faunal list of mollusks from his zones A, B, and C. A "Neocene" correlation chart for the Coalinga, San Luis Obispo, Salinas Valley, Santa Cruz, and Mount Diablo areas shows some characteristic mollusks. The Vaqueros Formation of the outer Coast Range is believed to be a facies of the Temblor Formation of interior areas. Anderson disagrees with J. C. Merriam's view that the Vaqueros and Temblor can be differentiated.

Anderson, F. M., 1929, Marine Miocene and related deposits of North Colombia: California Acad. Sci. Proc., ser. 4, v. 18, no. 4, p. 73–213, pls. 8–23.

A few Colombian Miocene species are compared with late Tertiary mollusks from California.

Anderson, F. M., 1932, Pioneers in the geology of California, *in* Shedd, Solon, Bibliography of the geology and mineral resources of California to December 31, 1930: California Div. Mines Bull. 104, p. 1–24.

Short bibliographic accounts of several early paleontologists who worked on California fossils.

ANDERSON, F. M., and MARTIN, BRUCE, 1914, Neocene record in the Temblor Basin, California, and Neocene deposits of the San Juan district, San Luis Obispo County: California Acad. Sci. Proc., ser. 4, v. 4, no. 3, p. 15–112, pls. 1–10.

A general review of Miocene stratigraphy of the central California Coast Ranges with description of Miocene strata of the San Juan district [northern part of the La Panza Range]. Include lists of Miocene mollusks from the San Juan area, Kern River area, and Los Vaqueros Valley. List a small assemblage from the Santa Margarita Formation of the San Juan district. New species of Miocene mollusks are described from the Kern River area and the San Juan district, California, and various localities in northwestern Oregon and western Washington.

Anderson, Robert, 1911, Preliminary report on the geology and oil prospects of the Cantua-Panoche region, California: U.S. Geol. Survey Bull. 431, p. 58–87.

Reports *Turritella ocoyana*, *Pecten propatulus*, and *Pecten andersoni* as characteristic of lower Miocene sandstone and shale. *Ostrea titan* occurs in "middle Miocene" deposits overlying the Big Blue Formation.

Anderson, Robert, 1912, Preliminary report on the geology and possible oil resources of the south end of the San Joaquin Valley, California: U.S. Geol. Survey Bull. 471, p. 106–136.

Lists six mollusks from exposures of white sand [Santa Margarita Formation] at the western edge of Tejon Hills. Included are *Ostrea titan* and *Pecten crassicardo*.

Anderson, Robert, and Pack, R. W., 1915, Geology and oil resources of the west border of the San Joaquin Valley north of Coalinga, California: U.S. Geol. Survey Bull. 603, 220 p., 14 pls., 5 figs.

Typical Vaqueros [Temblor of later usage] fossils occur in or above beds included in the Big Blue Serpintinous Member of the Vaqueros Formation. *Turritella ocoyana* and *Tivela inezana* are reported from a measured section of the Vaqueros [Temblor] Formation in the Vallecitos. *Ostrea titan* is reported from undifferentiated Miocene near Tesla [Cierbo Formation of later usage]. The Santa Margarita Formation contains abundant mollusks, including oysters, north of Coalinga. *Pecten peckhami*, *Nucula*, and *Dosinia* are recorded from undifferentiated Tertiary rocks underlying the San Pablo Formation in sec. 7, T. 7 S., R. 8 E.

Anderson, T. I., and Crawford, F. D., 1956, Road log, Huasna Basin, San Luis Obispo County, California: Soc. Econ. Paleontologists and Mineralogists Ann. Spring Field Trip, 1956, 8 p.

Localities containing Miocene and Pliocene mollusks are noted in the road log.

Anonymous, 1924, Informe sobre la exploracion geologica de Baja California, por la Marland Oil Company of Mexico: Boletin del Petroleo, v. 17, no. 6, p. 417–453; v. 18, no. 1, p. 14–53.

Includes a very brief resume of Tertiary stratigraphy (p. 43) in which marine rocks of Miocene and Pliocene age are described. These formations are reported to contain abundant, unstudied faunas.

Antisell, Thomas, 1856a, Geological report, *in* Parke, J. G., Report of explorations for railroad route from San Francisco Bay to Los Angeles, California, west of the Coast Range ***: 33d U.S. Cong., 2d Sess., House Ex. Doc. 91, pt. II, 196 p., 14 pls. [Pac. R.R. Repts.]

Lists 10 mollusks from Estrella Valley at Panza [San Luis Obispo County] identified by T. A. Conrad. Several collections of Miocene mollusks from the Santa Ynez Mountains are also listed. A few mollusks from the Santa Lucia Range are listed.

Antisell, Thomas, 1856b (1857), Geological report, *in* U.S. War Dept., 1855–1860, Reports of explorations and surveys to ascertain the most practical and economical route for a railroad from the Mississippi River to the Pacific Ocean ***: v. 7, pt. 2, 204 p., 14 pls.

Fossiliferous strata of the southern part of the California Coast Ranges can be correlated by similar species of mollusks. Miocene and Pliocene

mollusks occur in many areas along the route of the expedition: Pajaro Valley, Salinas Valley, San Antonio Hills, La Panza Range, Santa Margarita Valley, San Luis Obispo, Santa Ynez Mountains, and San Fernando Pass. Molluscan species or genera from each area are listed in the text. Paleontologic description of these mollusks by T. A. Conrad are included.

Arnold, Ralph, 1901, The geology in the vicinity of Stanford University: Stanford Sequoia, v. 10, no. 15, p. 301–304.

A preliminary account of the Mesozoic and Neogene stratigraphy of the foothill area near Stanford University. *Ostrea titan* is recorded from the ridge overlooking Stevens Creek and Portola Valley [Vaqueros Formation]. *Pecten peckhami* is recorded from Miocene shales. Fossiliferous sandstone of Pliocene age occurs in the vicinity of Felt Lake.

Arnold, Ralph, 1902, Bibliography of the literature referring to the geology of Washington: Washington Geol. Survey, v. 1, Ann. Rept. for 1901, pt. VI, p. 323–338.

The first bibliography of geological reports on Washington includes a few reports dealing with Neogene mollusks.

ARNOLD, RALPH, 1903*, The paleontology and stratigraphy of the marine Pliocene and Pleistocene of San Pedro, California: California Acad. Sci. Mem., v. 3, 419 p., 37 pls. (Reprint Stanford Univ., Contr. Biology, Hopkins Seaside Lab. No. 31, 1903).

This report deals with the systematic paleontology of the prolific Pleistocene molluscan faunas of the San Pedro area. It includes a correlation chart of Pliocene and Pleistocene formations of California. There is a brief discussion of the San Diego Pliocene. Late Pliocene climate [early Pleistocene, for the most part] was cooler than today. Faunal migration from Japan to Pacific Coast of North America occurred during the late Tertiary; many of the species common to these areas are cited.

Arnold, Ralph, 1904, Faunal relations of the Carrizo Creek beds of California: Science, n.s., v. 19, no. 482, p. 503.

The molluscan fauna indicates a Miocene age, shallow water conditions, and close relationship to modern fauna of the Gulf of California.

Arnold, Ralph, 1905, Coal in Clallam County, Washington: U.S. Geol. Survey Bull. 260, p. 413–421.

Pliocene rocks containing boulders of fossiliferous Miocene rock occur from Clallam Bay to the mouth of Hoko River.

Arnold, Ralph, 1906a, Geological reconnaissance of the coast of the Olympic Peninsula, Washington: Geol. Soc. America Bull., v. 17, p. 451–468, 1 map.

Lists five faunal assemblages from the Clallam Formation, one of which is from near Cape Flattery, west of its type section. Also lists 22 mollusks from the Quinaielt [Quinault] Formation from the mouth of Quinault River. These are correlated with the Purisima Formation of central California and are considered to be of early Pliocene age.

ARNOLD, RALPH, 1906b, The Tertiary and Quaternary pectens of California: U.S. Geol. Survey Prof. Paper 47, 264 p., 53 pls., 2 figs.

Sets up the first Tertiary chronology for California, recognizing Oligocene in California for the first time and establishing three divisions of the Miocene and two of the Pliocene. These divisions are typified by Forma-

tions with designated type localities, characteristic pectinids, complete faunal lists with other characteristic mollusks, and lists of known occurrences throughout the state. [Arnold's usage of formations was in the sense of our present stages.] Most descriptions of pectinids include listing of associated molluscan assemblages. The report includes an index map showing principal occurrences of fossiliferous localities and a range chart of the pectinids.

ARNOLD, RALPH, 1907a*, Fossils of the oil-bearing formations of southern California, *in* Eldridge, G. H., and Arnold, Ralph, The Santa Clara Valley, Puente Hills, and Los Angeles oil districts, southern California: U.S. Geol. Survey Bull. 309, p. 219–255, pls. 25–41.

Includes illustrations of characteristic Miocene and Pliocene mollusks from southern California; most, if not all, are from previous publications by Arnold.

ARNOLD, RALPH, 1907b*, Geology and oil resources of the Summerland district, Santa Barbara County, California: U.S. Geol. Survey Bull. 321, p. 1–93, figs. 1–3, pls. 1–17 (pls. 9–17 are of Tertiary fossils).

Lists three species from the Monterey Formation; includes an illustration of *Pecten peckhami*. Many early Pleistocene mollusks from the Santa Barbara Formation are illustrated.

Arnold, Ralph, 1907c, The Los Angeles oil district, southern California, in Eldridge, G. H., and Arnold, Ralph, The Santa Clara Valley, Puente Hills, and Los Angeles oil districts, southern California: U.S. Geol. Survey Bull. 309, p. 138–218.

Lists two assemblages from the Puente Sandstone, an assemblage from the type Topanga Formation of the Santa Monica Mountains, a small assemblage from the Fernando Formation of downtown Los Angeles and mollusks identified by J. G. Cooper (in Watts, 1897) from four localities in the Fernando Formation of downtown Los Angeles. Many of these Miocene and Pliocene mollusks are illustrated in an accompanying paper by Arnold.

ARNOLD, RALPH, 1907d, New and characteristic species of fossil mollusks from the oil-bearing Tertiary formations of Santa Barbara County, California: Smithsonian Inst. Misc. Colln., v. 50, pt. 4, no. 1781, p. 419–447, pls. 50–58.

Describes and illustrates three new species from the lower Miocene Vaqueros Formation and 10 new species from the Pliocene Fernando Formation. Illustrates many other characteristic mollusks from these formations and lists Vaqueros mollusks from the western part of the Santa Ynez Range (20 taxa) and Fernando mollusks from the Santa Maria basin (105 taxa).

ARNOLD, RALPH, 1907e, New and characteristic species of fossil mollusks from the oil-bearing Tertiary formations of Southern California: U.S. Natl. Mus. Proc., v. 32, no. 1545, p. 525–546, pls. 38–51.

Describes and illustrates nine new species from the type area of the Topanga Formation of the Santa Monica Mountains listing 25 other species that occur at the same locality; seven new mollusks from the Fernando Formation at Elsmere Canyon, Los Angeles County, are described and illustrated and 26 mollusks associated with them are listed; two new

species are described from Pliocene exposures in downtown Los Angeles and 15 mollusks associated with them are listed; five mollusks from Pliocene exposures at Temescal Canyon are also listed.

Arnold, Ralph, 1908a, Description of a new brittle star from the upper Miocene of the Santa Cruz Mountains, California: U.S. Natl. Mus. Proc., v. 34, no. 1620, p. 403–406, pl. 40.

Records *Pecten crassicardo* from the upper part of Santa Margarita Formation in the Santa Cruz Mountains.

ARNOLD, RALPH, 1908b, Descriptions of new Cretaceous and Tertiary fossils from the Santa Cruz Mountains, California: U.S. Natl. Mus. Proc., v. 34, no. 1617, p. 345–390, pls. 31–37.

Describes and illustrates five new species from the Miocene Vaqueros Formation and lists 32 additional mollusks [lumped early and middle Miocene of later usage]; two new species from the Monterey Formation and 12 associated species; lists one species from the Santa Margarita Formation; three new species and 20 associated species from the "Purisima Formation" [actually middle Miocene] near Stanford University; two new mollusks and 35 associated taxa from the lower part of the Purisima Formation; one new species and 54 associated species from the upper part of the Purisima; and one new species and 26 associated mollusks from the Merced Formation.

Arnold, Ralph, 1909a, Environment of the Tertiary faunas of the Pacific coast of United States: Jour. Geology, v. 17, p. 509–533.

A résumé of paleogeographic and tectonic history of Tertiary depositional basins from northwest Mexico to Canada with incidental commentary on climatic change. Includes a series of paleogeographic maps of the Oligocene, early Miocene, late Miocene and Pliocene; probably the first for the Pacific coast. Eocene climate was subtropical to tropical; Oligocene transitional. Miocene climate was warm temperate—warmer than today at the same latitude. Marine climate became sub-boreal during the later part of the Pliocene.

ARNOLD, RALPH, 1909b, Paleontology of the Coalinga district, Fresno and Kings Counties, California: U.S. Geol. Survey Bull. 396, 173 p., 30 pls. [1910].

Lists 45 mollusks from the Vaqueros [Temblor] Formation including 10 new taxa; 11 species of mollusks from the Santa Margarita Formation; 47 species from the Jacalitos Formation including eight new taxa; 89 mollusks from the Etchegoin Formation including 16 new taxa. Three faunal zones are recognized in the Vaqueros Formation; three in the Jacalitos Formation; and four in the Etchegoin Formation. The Vaqueros is assigned to the early Miocene because of faunal similarity to the early Miocene of the Atlantic Coast States and relative position in the geologic column of Pacific coast. The Etchegoin is assigned to the Miocene on basis of Lyellian correlation—65 percent of the species are extinct—and also because of relative position in an assumed 25,000-foot Tertiary section (7,000–10,000 ft below the top).

ARNOLD, RALPH, and ANDERSON, ROBERT, 1907a*, Geology and oil resources of the Santa Maria oil district, Santa Barbara County, California: U.S. Geol. Survey Bull. 322, 161 p., 26 pls.

List 21 mollusks from localities in the Vaqueros Formation and more than 100 from the Fernando Formation. Many of these are figured.

Arnold, Ralph, and Anderson, Robert, 1907b, Preliminary report on the Santa Maria oil district, Santa Barbara County, California: U.S. Geol. Survey Bull. 317, 69 p.

Fossils [mostly mollusks] occur in the Vaqueros Formation, sparingly in the Monterey Shale, and at four horizons in the Fernando Formation. The lowest horizon in the Fernando is considered to be late Miocene; the other three, Pliocene.

Arnold, Ralph, and Anderson, Robert, 1909, Preliminary report on the Coalinga Oil District, Fresno and Kings Counties, California: U.S. Geol. Survey Bull. 357, 142 p.

Assemblage zones in Miocene and Pliocene formations are described; characteristic mollusks are noted in the text and in descriptions of columnar sections.

ARNOLD, RALPH, and ANDERSON, ROBERT, 1910*, Geology and oil resources of the Coalinga District, California: U.S. Geol. Survey Bull. 398, 354 p., 52 pls.

The definitive description of the geology and paleontology of Neogene formations of the Coalinga district (Coalinga anticline, Kreyenhagen Hills, Reef Ridge, Kettleman Hills, and outlying areas). Biostratigraphic units, lists and illustrations of fossils, and locality descriptions were previously published by Arnold (1909, U.S. Geol. Survey Bull. 396).

Arnold, Ralph, and Arnold, Delos, 1902, The marine Pliocene and Pleistocene stratigraphy of the coast of southern California: Jour. Geology, v. 10, no. 2, p. 117–133.

An account of the Pleistocene stratigraphy of the San Pedro area. Molluscan faunas of a few Pliocene and upper Miocene formations are briefly reviewed: San Diego Formation, Merced Formation, Santa Barbara Formation, and San Pablo Group. A few mollusks are listed from the San Diego Formation.

Arnold, Ralph, and Clark, B. L., 1917, An Apalachicola fauna from Lower California [abs.]: Geol. Soc. America Bull., v. 28, p. 223–224.

Marine mollusks from near Magdalena Bay collected by Arnold Heim, and assigned by him to his Purissima Nueva Formation, are conspecific, in part, with mollusks from the Apalachicola fauna of the Caribbean. The strata are of Miocene age; five conspecific mollusks are listed.

Arnold, Ralph, and Hannibal, Harold, 1913, The marine Tertiary stratigraphy of the north Pacific Coast of America: Am. Philos. Soc. Proc., v. 52, no. 212, p. 559–605.

The first detailed Tertiary chronology for Pacific Northwest States. Describes a series of eight Oligocene to Pliocene formations from Oregon and Washington listing characteristic faunas from each based on extensive collections made by Hannibal. Usage of these is more nearly in a time-stratigraphic than a rock-stratigraphic sense. The sequence is comparable to that presently recognized with exception that their Sooke and Seattle Formations are placed too low in the column. Recognized faunas of Sooke and Twin River as being the coolest of the Eocene to Miocene succession.

Lists faunas from the type Monterey and type Merced Formations in California. Divides the type Astoria Formation into the Seattle and Monterey Formations.

Arnold, Ralph, and Johnson, H. R., 1910, Preliminary report on the McKittrick-Sunset oil region, Kern and San Luis Obispo Counties, California: U.S. Geol. Survey Bull. 406, 225 p.

List a few mollusks from exposures of the Vaqueros [Temblor] Formation and the Monterey Shale in the Temblor Range.

Ashley, G. H., 1895a, The Neocene stratigraphy of the Santa Cruz Mountains of California: California Acad. Sci., ser. 2, v. 5, p. 273–367 [1896]. Reviewed by F. L. Ransome, Am. Geologist, v. 17, p. 331–335 (1896). Reprinted in Stanford Univ. Pubs., Geology and Palaeontology, no. 1, p. 18–367, 1895.

Includes bibliography of earlier paleontologic work in the California Coast Ranges. Lists mollusks from his Pescadero sandstones and shales (in part early Miocene), Monterey Series, and Merced Series (including separate lists for Purisima Formation of later usage from Point Montara to Capitola—50 spp.; lower part of the type Merced—30 spp.; uppermost part of the type Merced—30 spp.; and a mixture of middle Miocene and early Pliocene mollusks from near Stanford University). Also lists Pliocene mollusks from the eastern part of the Ventura basin; early Pleistocene mollusks (105 spp.) from San Pedro. Recognizes the warm aspect of the lower part of type Merced and cooler aspect of the upper part.

Ashley, G. H., 1895b, Studies in the Neocene of California: Jour. Geology, v. 3, no. 4, p. 434–454.

Lists three spp. from his Pescadero Series (*Turritella hoffmanni*, *Ostrea titan*, and *Lyropecten estrellanus*) and four mollusks from his Monterey Series. Includes a broad discussion of Pliocene faunas of Santa Cruz Mountains, a list of species from the lower part of the Merced, and a discussion of percentages of extinct species.

Atwill, E. R., 1935, Oligocene Tumey formation of California: Am. Assoc. Petroleum Geologists Bull., v. 19, no. 8, p. 1192–1204.

Lists an assemblage of five mollusks of middle Miocene age from the Temblor Formation near Tumey Gulch on the west side of the San Joaquin Valley.

Atwill, E. R., 1943, McKittrick Front and Cymric areas of the McKittrick oil field [California]: California Div. Mines Bull. 118, p. 507–509.

Reports *Mulinia densata* from cores of the Etchegoin Formation in columnar section.

Atwood, W. W., 1911, Geology and mineral resources of parts of the Alaska Peninsula: U.S. Geol. Survey Bull. 467, 137 p.

Includes discussion of correlation and age determination of fossils from the Unga Formation (Unga Island and Popof Island) including *Mytilus middendorffi*. Dall's list of mollusks from the Stepovak Series of Palache (1904) [Dall, 1904] is listed, again as Eocene, and included in Atwood's Kenai Formation. MacNeil and others (1961) later assigned these strata to the Oligocene *Acila shumardi* zone.

Auger, Irving V., 1920, Resume of oil well operations in Imperial Valley [California] : California Oil Fields, v. 5, no. 10, p. 5–9.

Oysters flourished in the Imperial basin during the Miocene.

Avila, F. A., and Weaver, D. W., 1969, Mid-Tertiary stratigraphy, Santa Rosa Island [California], in Weaver, D. W., ed., Geology of the Northern Channel Islands: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., p. 48–67.

List 14 mollusks from the Vaqueros Formation, 35 from the Rincon Formation, and five from the Monterey Formation. The molluscan assemblages represent inner shelf environments and, in the case of the Vaqueros and Rincon Formations, subtropical or tropical marine climate. The relationship of the "Vaqueros" and "Transition Stages" to the Zemorrian and Saucesian Stages of the microfaunal chronology is treated in considerable detail.

Ayars, R. N., 1939, Williamson area of the Lost Hills oil field [California]: California Oil Fields, v. 24, no. 3, p. 78–90.

Pecten oweni occurs in a gray, fine-grained sand at the top of the Etchegoin Formation ("*Pecten Oweni* water sand"). *Mulinia* occurs in the Universal Consolidated Oil Co. well Helm no. 1, 4 miles southeast of the field.

Ayars, R. N., 1941, Webster area of Midway-Sunset oil field [California] : California Oil Fields, v. 26, p. 19–24.

A *Cryptomya* bed equivalent to the Fourth *Mya* zone of the San Joaquin Clay is the highest molluscan marker bed in wells. *Mulinia densata*, marker for the top of the Pliocene Etchegoin Formation, was cored in all wells. The Etchegoin includes a *Mulinia* green shale, *Bittium* blue shale, and a 4-foot-thick oil sand containing *Pecten oweni* and *Arca trilineata*. *Pecten peckhami* occurs in the upper Miocene Belridge Diatomite in the *Uvigerina* A zone.

Back, William, 1957, Geology and groundwater features of the Smith River Plain, Del Norte County, California: U.S. Geol. Survey Water-Supply Paper 1254, 76 p.

Lists 12 mollusks from localities in the Pliocene St. George Formation.

Bacskai, J. A., 1969, Miocene porcupine fishes in California [abs.] : Geol. Soc. America, Abstracts with Programs for 1969, pt. 3, p. 3.

Porcupine fish in the California middle Miocene indicate warm-water conditions comparable to those inferred from studies of marine invertebrates [mollusks].

Bailey, T. L., 1952a, Summerland area, *in* Redwine, L. E., Chairman, and others, Cenozoic correlation section paralleling north and south margins [of the] western Ventura basin from Point Conception to Ventura and Channel Islands, California : Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

Pecten sespecensis var. *hydei* is reported from the Vaqueros Formation.

Bailey, T. L., 1952b, Ventura River area, *in* Redwine, L. E., Chairman, and others, Cenozoic correlation section paralleling north and south margins [of the] western Ventura basin from Point Conception to Ventura and

Channel Islands, California: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

Lists a few mollusks from the *Pecten hemphilli* zone of the Pico Formation (late Pliocene). *Pecten crassicardo, P. andersoni, Arca* sp., and *Turritella ocoyana* are reported from the Monterey Shale. *Turritella inezana* and *Pecten magnolia* occur in the lower part of the Rincon Shale.

Baldwin, E. M., 1945, Some revisions of the late Cenozoic stratigraphy of the southern Oregon coast: Jour. Geology, v. 53, no. 1, p. 35–46.

Fossiliferous concretions occur in a blue-gray argillaceous sand at the top of the newly described Port Oxford Formation. A "loose gray sand" regarded as equivalent to the upper Pleistocene terrace deposits at Cape Blanco overlies this bed.

BALDWIN, E. M., 1959*, Geology of Oregon, 1st ed.: Eugene, Oregon, 136 p. 1964, 2d ed., 165 p. (Oregon Univ. Coop. Book Store).

Includes line drawings of molluscan genera from Miocene beds at Coos Bay, the Astoria Formation, the Empire Formation, and the Port Orford Formation. Some of the more common occurrences of megafossils in Miocene and Pliocene formations of coastal Oregon are noted.

Baldwin, E. M., 1961, Offshore Mio-Pliocene Formations along the southern Oregon Coast [abs.]: Northwest Sci., v. 35, no. 4, p. 154.

Fossils occurring as beach drift near the mouth of the Coquille River near Bandon, Oreg., are presumed to be of Pliocene age. Fossiliferous "late" [middle] Miocene strata occur between Floras Lake and Blacklock Point and south of Cape Blanco, Curry County, Oreg.

Baldwin, E. M., 1966, Some revisions of the geology of the Coos Bay area, Oregon: Ore Bin, v. 28, no. 11, p. 189–203.

Miocene mollusks including *Dosinia* have been dredged from the channel at Coos Bay. Limited exposures of these strata have been recently found at Coos Bay. Fossils similar to those from the Pliocene Empire Formation occur on the beach at the mouth of Coquille River; correlative strata are found at China Creek three miles south of Bandon.

Bandy, O. L., 1950, Some later Cenozoic Foraminifera from Cape Blanco, Oregon: Jour. Paleontology, v. 24, no. 3, p. 269–281.

Mytilus middendorffi Grewingk and *Venus securis* Shumard are reported from the Empire Formation about 1 mile southeast of Cape Blacno. *Clementia subdiaphana* Carpenter occurs in the overlying Port Orford Formation.

Bandy, O. L., Butler, E. A., and Wright, R. C., 1969, Alaskan upper Miocene marine glacial deposits and the *Turborotalia pachyderma* datum plane: Science, v. 166, p. 607–609.

The Poul Creek Formation of Oligocene and Miocene age contains faunas of temperate or subtropical aspect. The overlying Yakataga Formation of Miocene and Pliocene age contains mostly cool or cold water molluscan faunas. The appearance of a left-coiling planktonic foraminifer in the Yakataga Formation is taken as indicative of the initiation of glaciation during the late Miocene (about 13 million years ago).

Bandy, O. L., and Kolpack, R. L., 1963, Foraminiferal and sedimentological trends in the Tertiary section of Tecolote Tunnel, California: Micropaleontology, v. 9, no. 2, p. 117–170.

Mollusk fragments are common in the lower sandstone of the Vaqueros Formation.

Barbat, W. F., and von Estorff, F. E., 1933, Lower Miocene Foraminifera from the San Joaquin Valley, California: Jour. Paleontology, v. 7, no. 2, p. 164–174.

List four mollusks from the Vaqueros Formation of the San Emigdio foothills.

Barbat, W. F., and Galloway, John, 1934, San Joaquin Clay, California: Am. Assoc. Petroleum Geologists Bull., v. 18, no. 4, p. 476–499.

Describe four molluscan zones in the San Joaquin Clay: a lowermost *Mya* zone, a *"Natica"-Mya* zone, a *Pecten coalingaensis* zone, and an uppermost *Mya* zone. Characteristic mollusks are listed in a stratigraphic description of the type section of the San Joaquin Clay. The distribution of these zones in the southern San Joaquin Valley and marine paleotemperatures suggested by the fauna of the Etchegoin and the San Joaquin are discussed.

Barbat, W. F., and Johnson, F. L., 1934, Stratigraphy and foraminifera of the Reef Ridge shale, upper Miocene, California: Jour. Paleontology, v. 8, no. 1, p. 3–17.

List mollusk assemblages from the basal McLure Shale in Jacalitos Creek, Henny's "Santa Margarita" fauna from Waltham Creek, and early Pliocene assemblages (14 taxa) overlying the Reef Ridge Shale in Alcalde Canyon. Five mollusks are reported from cores of the Reef Ridge Shale.

Barbat, W. F., and Weymouth, A. Allen, 1931, Stratigraphy of the *Borophagus littoralis* locality, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 21, no. 3, p. 25–26.

Pecten estrellanus Conrad and *Ostrea titan* Conrad occur in the Santa Margarita formation near Crocker Springs in the southern part of the Temblor Range, Kern County, Calif.

Barnes, R. M., 1943, Wasco oil field [California]: California Div. Mines Bull. 118, p. 553–555.

The top of the first *Mya* zone occurs at the San Joaquin-Tulare Formation contact.

Barrett, E. C., 1967, Baja California II, 1535–1964, a bibliography of historical, geographical and scientific literature relating to the peninsula of Baja California and to the Adjacent Islands in the Gulf of California and the Pacific Ocean ***: Los Angeles, Calif., Westernlore Press, 250 p.

Includes a number of references to reports containing information on late Cenozoic mollusks. Some of these include brief annotations.

Barth, T. F. W., 1956, Geology and petrology of the Pribilof Islands, Alaska: U.S. Geol. Survey Bull. 1028–F, p. 101–160.

Records mollusks identified by F. S. MacNeil from St. Paul and St. George Islands. The largest assemblage includes nine mollusks. MacNeil regarded the collections, from four different localities, as of about the

same age and "probably of early Pleistocene or, at the earliest, late Pliocene age."

BARTSCH, PAUL, 1911, The Recent and fossil mollusks of the genus *Bittium* from the west coast of America: U.S. Natl. Mus. Proc., v. 40, no. 1826, p. 383–414, pls. 51–58.

Two new species of *Bittium* are described from the Pliocene of the Santa Maria basin, California.

BARTSCH, PAUL, 1917a, Descriptions of new west American marine mollusks and notes on previously described forms: U.S. Natl. Mus. Proc., v. 52, no. 2193, p. 637–681, pls. 42–47.

Previously described Miocene species of *Odostomia, Cerithiopsis, Pyramidella, Eulima,* and *Syrnola* are reviewed. Describes *Turbonilla hemphilli* from a Pliocene well at San Diego, Calif.

BARTSCH, PAUL, 1917*, A monograph of west American melanellid mollusks: U.S. Natl. Mus. Proc., v. 53, no. 2207, p. 295–356, pls. 34–49.

Illustrates one species each of *Melanella* and *Niso* from middle Miocene strata near Bakersfield, Calif.

Bartsch, Paul, Rehder, H. A., and Shields, B. E., 1946, A bibliography and short biographical sketch of William Healy Dall: Smithsonian Misc. Colln., v. 104, no. 15, 96 p.

Bibliographic listing of Dall's 1,607 published reports and articles includes many dealing with Neogene mollusks of the Pacific coast. A brief account of Dall's work on Tertiary fossils of the northwest coast of North America is included.

Beal, C. H., 1948, Reconnaissance of the geology and oil possibilities of Baja California, Mexico: Geol. Soc. America Mem. 31, 138 p.

Mollusks are listed from Arroyo San Angel, 4 kilometers south of San Ignacio, Arroyo Patrocinio, Arroyo Guajademi, Arroyo Purisima, Arroyo San Ramundo, Arroyo Tiebre, Elephant Mesa, and Bahia Tortuga. All localities are shown on the geologic map; several of the faunal lists are from Hertlein and Jordan (1927).

Beck, R. S., 1952, Correlation chart of Oligocene, Miocene, Pliocene, and Pleistocene in San Joaquin Valley and Cuyama Valley areas [California], *in* Field trip routes, geology, oil fields: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists-Soc. Explor. Geophysicists Guidebook, Joint Ann. Mtg., Los Angeles, California, 1952, p. 104.

Basic foraminiferal correlation chart for Miocene and Pliocene formations of the San Joaquin basin and central California Coast Ranges. Two mollusk "zones" in the Pliocene are shown.

Becker, G. F., 1888, Geology of the quicksilver deposits of the Pacific Slope * * *: U.S. Geol. Survey Mon. 13, 486 p.

Pecten and *Ostrea* occur in upper Tertiary strata in the New Almaden mining district, Santa Clara County, Calif.

Bennett, W. A. G., 1939, Bibliography and index of geology and mineral resources of Washington, 1814–1936: Washington Div. Mines and Geology Bull. 35, 140 p.

This is a useful, well-indexed reference to geologic and paleontologic reports up to 1936. A list of new species of mollusks described from Washington during this period (p. 129–136) is included.

BENTSON, HERDIS, 1940, A systematic study of the fossil gastropod *Exilia*: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 25, no. 2, p. 199–238, pls. 1–3.

Figures *Exilia* n. sp. D from near the mouth of Twin River, Wash., presumably from the upper part of the Twin River Formation and of early Miocene age [*Echinophoria apta* zone of Durham (1944)].

Bereskin, S. R., 1969, Miocene biostratigraphy of southwestern Santa Cruz Island, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 469.

Marine mollusks occur in a 2,265-foot sedimentary section of Miocene age.

BERESKIN, S. R., and EDWARDS, L. N., 1969*, Mid-Tertiary stratigraphy, southwestern Santa Cruz Island [California], *in* Weaver, D. W., ed., Geology of the Northern Channel Islands: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., p. 68–79.

List 17 mollusks from the Lower Conglomerate of the "Vaqueros Formation," 27 from the volcanic arenite of the "Vaqueros Sandstone," five from the San Onofre Breccia, and one from the Monterey Formation. Inner shelf bathymetric environments are postulated for the Vaqueros assemblages in addition to a slight warming trend during deposition of the Vaqueros based on foraminiferal and molluscan data. Cooler conditions are postulated during deposition of the Rincon Formation but warming to subtropical conditions is suggested by analysis of the fauna of the overlying San Onofre Breccia.

BERRY, S. S., 1922, Fossil chitons of western North America: California Acad. Sci. Proc., ser. 4, v. 11, no. 18, p. 399–526, pls. 1–16, figs. 1–11.

A résumé of Tertiary occurrences of chitons including two from the lower Miocene and five from the Pliocene. A new genus and new species, *Oligochiton lioplax*, from the Sooke Formation, British Columbia, is described and illustrated.

Bertholf, H. W., 1962, Northeast area of McKittrick oil field [California]: California Oil Fields, v. 48, no. 1, p. 63–68.

Turritella nova occurs in the lower part of the Etchegoin Formation. The uppermost occurrence of *Mulinia* [*Pseudocardium*] *densata* is used to determine the top of the Etchegoin Formation. Typical mollusks in the lower part of the formation are: *Nassarius californianus*, *Pecten oweni* [*Patinopecten lohri*], and *Turritella nova*. *Calyptraea filosa*, *Arca trilineata*, *Mya* [*Cryptomya*] *quadrata*, and *Mulinia densata* are common in the upper part. *Mya japonica* is reported from the San Joaquin Formation.

Blacut, Gustavo, and Kleinpell, R. M., 1969, A stratigraphic sequence of benthonic smaller Foraminifera from the La Boca Formation, Panama Canal Zone: Cushman Found. Foram. Research Contr., v. 20, pt. 1, p. 1–22.

A zoogeographic boundary between Miocene mollusks of the "Astoria Subprovince" and the "Temblor Subprovince" occurs in the southern part

of the Diablo Range south of the Vallecitos area. The "Astoria Subprovince" is typified by *"Pecten" propatulus*. During the Saucesian and the Relizian stages benthonic Foraminifera of this region fall into the same faunal subprovince though the equivalent inshore molluscan faunas differ at least subprovincially. *Turritella inezana* and *T. ocoyana* occur together in the lower part of the Saucesian microfaunal stage. *Turritella ocoyana* does not range downward into the Zemorrian Stage. Both of these turritellids are invaders from the Caribbean.

Blake, W. P., 1855, Preliminary geological report ***: U.S. 33d Cong., 1st Sess., House Ex. Doc. 129, 80 p.

Includes a brief commentary on the fossil mollusks identified by T. A. Conrad. Reviews some of the principal Miocene and Pliocene localities discovered during the railroad surveys: Ocoya Creek, Carrizo Creek, San Diego, San Fernando Pass, Monterey, and Benicia.

Blake, W. P., 1856, Observations on the physical geography and geology of the coast of California from Bodega Bay to San Diego: U.S. Coast Survey Rept. of 1855, U.S. 34th Cong., 1st Sess., Senate Ex. Doc. 22, p. 376–398.

According to Vogdes (1896) Tertiary fossils are recorded from the vicinity of Monterey and San Diego.

Blake, W. P., 1857, Geological report, pt. II *in* Williamson, R. S., Reports of explorations and surveys, to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. *** v. 5: U.S. 33d Cong., 2d Sess., Senate Ex. Doc. 78, p. 1–310. [Title page of v. 5 bears date 1856, Williamson's report (pt. I) 1855, and Blake's report (pt. II) 1857.]

Description of itinerary includes records of fossils, mostly by generic name or as "fossils," from many localities along the route. Some of these are Mount Diablo, Monterey, Ocoya (Poso) Creek, San Fernando Pass, Carrizo Creek (Imperial County), San Diego, and Santa Barbara. Many of the species named by Conrad are listed.

Blanchard, R. C., 1913, The geology of the western Buckskin Mountains, Yuma County, Arizona: Columbia Univ. Contr. Geology Dept., v. 26, no. 1–80.

Initial notice of fossiliferous beds along Osborne Wash, Ariz., that were later referred to the Bouse Formation by Metzger (1968). Mollusks include *Bittium* and a probable young *Corbicula*.

Bode, F. D., 1935, The fauna of the *Merychippus* zone, north Coalinga District, California: Carnegie Inst. Washington Pub. 453, (Contr. Paleontology, VI), p. 65–96.

New reocrds of *Turritella ocoyana* along the west side of the San Joaquin Valley are related to the middle Miocene-late Miocene boundary and vertebrate-bearing beds. A correlation chart shows the relationship of vertebrate faunas to the California Miocene sequence.

Borkovich, G. J., 1958, Buena Vista oil field [California]: California Oil Fields, v. 44, no. 2, p. 5–20.

Reports *Mya* from cores of the San Joaquin Clay, *Mulinia densata* from the top of the Etchegoin Formation (used to determine contact between these formations), and a *Pecten-Mytilus* fossil bed in the San Joaquin

Clay. Older mollusk-designated sand units are compared with modern stratigraphic names.

Boss, K. J., 1965, Catalogue of the family Pandoridae (Mollusca: Bivalvia): Harvard Univ. Mus. Comp. Zoology, Dept. Mollusks, Occasional Papers on Mollusks, v. 2, no. 33, 413–424.

Lists four Miocene species of *Pandora* from California and Alaska.

Boss, K. J., 1967, *Thyasira disjuncta* (Gabb, 1866) in the Caribbean Sea: Marine Sci. Bull., v. 17, no. 2, p. 386–388.

Thyasira disjuncta ranges from Pliocene to Holocene in the Eastern Pacific. It is a larger, more quadrate species than *T. biscecta* which occurs in strata of Oligocene and Miocene age.

Boss, K. J., and Merrill, A. S., 1965, The Family Pandoridae in the Western Atlantic: Johnsonia, v. 4, no. 44, p. 181–215, pls. 115–126.

Pandora glacialis Leach occurs in the Pliocene Pico Formation near Ventura, Calif.

Boss, K. J., Rosewater, Joseph, and Ruhoff, F. A., 1968, The zoological taxa of William Healey Dall: U.S. Natl. Mus. Bull. 287, 427 p.

An alphabetic arrangement of all generic, subgeneric, and specific names introduced by Dall with bibliographic citations. Included in the 5,302 molluscan names are many Miocene and Pliocene taxa from the Pacific Coast States and Alaska.

Bowen, O. E., 1966, Stratigraphy, structure, and oil possibilities in Monterey and Salinas quadrangles, California, *in* Symposium *** of Papers: Am. Assoc. Petroleum Geologists, Pacific Sec., 40th Ann. Mtg., Bakersfield, Calif., 1965, p. 48–67.

Lists two small molluscan assemblages of middle Miocene age and three of late Miocene age from stratigraphic units in the northernmost part of the Santa Lucia Mountains. Identifications are mostly by L. G. Hertlein.

Bowers, Stephen, 1888, Ventura County [California]: California Mining Bur., Eighth Ann. Rept. State Mineralogist, p. 679–690.

A few mollusks of Miocene and Pliocene age are listed.

Bowers, Stephen, 1890a, Orange County [California]: California Mining Bur., Tenth Ann. Rept. State Mineralogist, p. 399–409.

Lyropecten, and other Neogene fossils, occur near Alisos Creek in the Santa Ana Mountains.

Bowers, Stephen, 1890b, Ventura County [California]: California Mining Bur., Tenth Ann. Rept. State Mineralogist, p. 758–762.

An assemblage of about 20 mollusks from calcareous sandstone about 400 feet thick on Pine Mountain is listed. The assemblage appears to be of late Miocene age although species that are now regarded as of early Miocene and of Pliocene age are included in the list.

Bowers, Stephen, 1901, Reconnaissance of the Colorado Desert mining district [California]: California Mining Bur., 12 p.

According to Mendenhall (1910), Bowers secured fossil collections from Carizzo Creek and Black Mountains and submitted them to J. C. Merriam, Ralph Arnold, and T. W. Vaughan for identification.

Brabb, E. E., 1964, Subdivision of San Lorenzo Formation (Eocene-Oligocene) west-central California: Am. Assoc. Petroleum Geologists Bull., v. 48, no. 5, p. 670–679.

Records *Pecten sanctaecruzensis* from the lower part of the Vaqueros Formation in the Santa Cruz Mountains.

Brabb, E. E., and Rau, W. W., 1959, Road log, *in* Big Basin area, Santa Cruz Mountains, California: Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip Guidebook, 1959, p. 8–15.

Pecten andersoni occurs in the lower Miocene Vaqueros Sandstone.

Bramkamp, R. A., 1935, Molluscan fauna of the Imperial formation of San Gorgonio Pass [California] [abs.]: Geol. Soc. America Proc. 1934, p. 385.

Notes tropical aspect of molluscan assemblages from the Imperial Formation considered to be of middle Miocene age. Less than one-fourth of the species are still living. Many of the species occur in middle Miocene formations of tropical America.

Bramlette, M. N., 1934, Heavy mineral studies on correlation of sands at Kettleman Hills, California: Am. Assoc. Petroleum Geologists Bull., v. 18, no. 12, p. 1559–1576.

Clementia pertenuis and *Miltha sanctaecrusis* occur in the upper part of Miocene sands at Reef Ridge [basal conglomerate of the McLure Shale]. *Turritella ocoyana* occurs in reef beds on Reef Ridge.

Bramlette, M. N., 1946, The Monterey formation of California and the origin of its siliceous rocks: U.S. Geol. Survey Prof. Paper 212, 57 p. [1957].

Mollusks are of rare occurrence in the siliceous rocks of the Monterey Formation. Small species of *Arca* and of Pectinidae are the only common mollusks. The fauna suggests relatively deep and cool water.

Bramlette, M. N., and Daviess, S. N., 1944, Geology and oil possibilities of the Salinas Valley, California: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 24.

Fossils [in large part mollusks] occur abundantly in the Miocene Vaqueros Formation and in rocks of Pliocene age.

BRANNER, J. C., NEWSOM, J. F., and ARNOLD, RALPH, 1909*, Description of the Santa Cruz quadrangle, California: U.S. Geol. Survey Geol. Atlas, Folio 163, 11 p., 2 pages of ills., 3 maps.

Includes lists of mollusks from Miocene and Pliocene formations of Santa Cruz quadrangle, all from an earlier publication by Arnold in 1908. Several mollusks from the Vaqueros Formation, Monterey Shale, Purisima Formation(?) barnacle beds [middle Miocene east of San Andreas fault], and the Purisima and Merced Formations are illustrated; practically all of these were previously figured by Arnold in 1908.

BREMNER, C. ST. J., 1932*, Geology of Santa Cruz Island, Santa Barbara County, California: Santa Barbara Mus. Nat. History Occasional Paper 1, 33 p., 3 pls.

Lists 21 species of mollusks from his Temblor Formation (identifications by W. H. Corey). Corey suggests that *Pecten vanvlecki* may range above his Vaqueros Formation ["Stage"]. Four characteristic Vaqueros mollusks from exposures of the Vaqueros Formation on Santa Rosa Island are illustrated.

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BREMNER, C. ST. J., 1933*, Geology of San Miguel Island, Santa Barbara County, California: Santa Barbara Mus. Nat. History Occasional Paper 2, 23 p., 4 pls.

Lists 11 species from the Vaqueros Formation and eight from the Temblor Formation (identifications by W. H. Corey). *Pecten* cf. *peckhami* occurs in the Monterey Shale.

Briggs, L. I., Jr., 1953, Geology of the Ortigalita Peak quadrangle, California: California Div. Mines Bull. 167, 61 p., 4 pls., 33 figs.

Very poorly preserved casts of pelecypods from the San Pablo Formation resemble *Spisula* according to J. W. Durham.

Brooks, A. H., 1906, The geography and geology of Alaska, a summary of existing knowledge ***: U.S. Geol. Survey Prof. Paper 45, 327 p.

Includes a brief review of localities and areas from which Miocene and Pliocene marine fossils have been reported.

Brooks, A. H., 1921, Note on the Tertiary geology of Alaska: Pan-Pacific Scientific Conf., First, Bernice P. Bishop Mus. Spec. Pub. 7, pt. 3, p. 797–800.

A marine transgression occurred along the Pacific coast of Alaska during the Miocene but did not extend north of Bristol Bay. Pliocene marine invertebrates occur in ancient beach deposits of Pliocene or Pleistocene age near Nome.

Brooks, T. J., Steinmeyer, E. H., and Billman, H. G., 1955, Devil's Den-McLure Valley area [California], *in* Soc. Econ. Paleontologists and Mineralogists-Am. Assoc. Petroleum Geologists, Spring Field Trip Guidebook, 1955: 4 p.

Pecten andersoni and oysters have been recovered from cores of their Kettleman sand (Escudo Formation) in wells at Pyramid Hills oil field. These mollusks also occur in surface exposures of this formation at nearby Wagonwheel Mountain.

Brown, A. S., 1968, Geology of the Queen Charlotte Islands, British Columbia: British Columbia Dept. Mines and Petroleum Resources, Bull. 54, 226 p.

A few mollusk localities in Skonun Formation at Masset Sound, Watun Creek, and Skonun Point are listed. F. J. E. Wagner believes that the assemblage is Miocene. Pollen specialists compare it with the Sooke Formation but also indicate late Miocene or early Pliocene affinities.

Brown, J. S., 1923, The Salton Sea region, California; a geographic, geologic, and hydrologic reconnaissance, with a guide to desert watering places: U.S. Geol. Survey Water-Supply Paper 497, 292 p.

Small pelecypods in limestone exposed in the Palo Verde Mountains [later mapped as basal part of Bouse Formation by Metzger (1968)] may indicate an extension of the Gulf of California during the later Tertiary.

Brown, R. D., Jr., and Gower, H. D., 1958, Twin River formation (redefinition), northern Olympic Peninsula, Washington: Am. Assoc. Petroleum Geologists Bull., v. 42, no. 10, p. 2492–2512.

Fossils collected from the upper member of the Twin River Formation, chiefly mollusks, are considered to be of late Oligocene or early Miocene age. Mollusks are relatively abundant in this member.

Brown, R. D., Gower, H. D., and Snavely, P. D., Jr., 1960, Geology of the Port Angeles-Lake Crescent area, Clallam County, Washington: U.S. Geol. Survey Oil and Gas Inv. Map OM–203 [1961].

Marine mollusks from the upper part of the Twin River Formation are considered to be of late Oligocene or early Miocene age by Ellen J. Trumbull. Two assemblages of mollusks from localities included in the upper part of the Twin River Formation by these authors were correlated with the middle Miocene Temblor Formation of California by Durham (1944).

Burch, J. Q., ed., 1944–46, Distributional list of the west American marine mollusks from San Diego, California, to the Polar Sea: Concholog. Club. Southern California Minutes nos. 33–63.

A valuable source of geographic and bathymetric range data for modern mollusks of the eastern North Pacific for use in paleoecologic and zoogeographic studies.

Burchfiel, B. C., 1964, Stratigraphic reassignment of four species in the lower Miocene rocks of the Bear Creek area, Santa Cruz County, California: Jour. Paleontology, v. 38, no. 2, p. 401–405.

The teilzone of *Pecten sanctaecruzensis* in the Santa Cruz Mountains is restricted to the Vaqueros Formation. The type locality of *Fusus sanctaecrusis* Arnold also occurs in the Vaqueros Formation.

Burk, C. A., 1965, Geology of the Alaska Peninsula-island arc and continental margin (3 parts) : Geol. Soc. America Mem. 99, 250 p.

Includes lists of Miocene fossils from near Port Moller, a late Oligocene or early Miocene assemblage from the Fox Bay-Boulder Bay area, and a Pliocene or Pleistocene assemblage from Herendeen Bay. His newly named Bear Lake Formation of middle and late Miocene age includes "large fossiliferous banks in which the shell matter may constitute a third of the rock" (p. 91). The lower part of the formation is characterized by specimens of *Mytilus middendorffi;* it is mapped as the Unga Conglomerate Member. *M. middendorffi* also occurs at Cape Aliaskin and on the eastern shore of Kodiak Island. List of Tertiary mollusks identified by F. S. MacNeil are included in Appendix C (p. 221–228). Sixty-eight species ranging from Eocene to Pliocene are recorded; most of the collections are of Oligocene age.

Bush, J. B., 1931, A preliminary study of the Foraminifera of some Monterey Shale beds, Santa Clara County, California: Micropaleontology Bull., v. 2, no. 5, p. 99–101.

Sandstone overlying Monterey Shale beds in the New Almaden quadrangle northeast of the San Andreas fault contains fragments of *Ostrea titan* and other fossils that suggest a late Miocene age.

Buwalda, J. P., 1913, Faunal zones of the San Pablo formation east of Walnut Creek, near Mount Diablo, California [abs.]: Geol. Soc. America Bull., v. 24, p. 130.

The abstract is: "Discussion of a measured section of the San Pablo formation on the western side of the Mount Diablo anticline, with the results of a study of the [molluscan] faunal zones."

Buwalda, J. P., and Stanton, W. L., 1930, Geological events in the history of the Indio Hills and the Salton basin, southern California: Science, v. 71, no. 1830, p. 104–106.

A marine formation of late Miocene or early Pliocene age crops out in the Indio Hills, Riverside County. The fauna is similar to the living fauna of the Gulf of California.

Canfield, C. R., 1939, Subsurface stratigraphy of Santa Maria Valley oil-field and adjacent parts of Santa Maria Valley, California: Am. Assoc. Petroleum Geologists Bull., v. 23, no. 1, p. 43–81.

Pecten healeyi occurs at the top of the Foxen Formation. *Pecten andersoni* has been recovered from cores of the "oil sand zone" of the Monterey Formation (middle Miocene).

Capps, S. R., 1937, Kodiak and adjacent islands, Alaska: U.S. Geol. Survey Bull. 880–C, p. 111–184.

Mollusks from Narrow Point, Kodiak Island, identified by W. P. Woodring (USGS loc. 13372) are considered to be of Miocene or Pliocene age. Ten taxa including *Mytilus middendorffi* are listed.

Cardwell, G. T., 1958, Geology and ground water in the Santa Rosa and Petaluma Valley areas, Sonoma County, California: U.S. Geol. Survey Water-Supply Paper 1427, 273 p.

Lists nine mollusks of late Pliocene age from a new locality in the Merced Formation about 7 miles west-northwest of Santa Rosa. Identifications are by L. G. Hertlein who correlates the assemblage with the lower part of the type Merced Formation. Most of the fossil localities in the Merced Formation of this area are near the base of the formation. The fossils are also found in well cores.

Carlson, Stanley, Dibblee, T. W., Jr., Ryan, Ben, Jr., and Schwade, I. T., 1951, Cuyama Valley [California], *in* Soc. Econ. Paleontologists and Mineralogists, Annual Field Trip, 1951: 6 p.

Characteristic mollusks from the upper Miocene Santa Margarita Formation and sandy beds in the underlying middle Miocene Monterey Shale are listed by Dibblee.

Carson, C. M., 1925a, Pliocene faunal zones in southern California: Pan-Am. Geologist, v. 43, no. 4, p. 265–270.

Lists characteristic mollusks from five "formations" of Pliocene age that are thought to represent successive faunal zones: Etchegoin sandstones, Fernando shaly sandstones, San Diego clays, Ventura sands, and Santa Barbara marls. The faunas are regarded as showing a more or less progressive cooling during the Pliocene, the Santa Barbara faunal assemblages being the coolest.

CARSON, C. M., 1925b, Some new species from the Pliocene of southern California, with a few changes in nomenclature: Southern California Acad. Sci. Bull., v. 24, pt. 2, p. 31–35, 1 pl.

Describes and illustrates three new Pliocene gastropods.

CARSON, C. M., 1926, New molluscan species from the California Pliocene: Southern California Acad. Sci. Bull., v. 25, pt. 2, p. 49–62, 4 pls.

Describes and illustrates 14 new species of mollusks from the Pliocene of California. Included are lists of mollusks associated with the new species at their type localities. Most of the new species are from the Santa Maria basin.

Carson, C. M., 1965, The Rincon Formation, *in* Western Santa Ynez Mountains, Santa Barbara County, California, Guidebook, 1965: Coast Geol. Soc., Pacific Sec. Soc. Econ. Paleontologists and Mineralogists, p. 38–40.

Reports *Ostrea howelli* from near the top of the lower Miocene Vaqueros Formation at Casitas Lake, Santa Barbara County, Calif.

Cartwright, L. D., Jr., 1928, Sedimentation of the Pico Formation in the Ventura quadrangle, California: Am. Assoc. Petroleum Geologists Bull., v. 12, no. 3, p. 235–269.

Molluscan fossils occur in Miocene and Pliocene formations (Vaqueros and Pico Formations) near Ventura, Calif. *Turritella ocoyana* is reported from the upper part of the Vaqueros Formation.

Chamberlin, J. L., and Stearns, Franklin, 1963, A geographic study of the clam *Spisula polynyma* (Stimpson), *in* Serial Atlas of the Marine Environment, Folio 3: Am. Geog. Soc. New York, 12 p., pls. 1–6.

Spisula voyi (Gabb) from Pliocene strata near Bear River, Humboldt County, Calif., is included as synonym of *S. polynyma.*

Chambers, L. S., 1943, Buttonwillow gas field [California]: California Div. Mines Bull. 118, p. 543–545.

The first occurrence of "true marine fossils" (including the *Mulinia* bed) is at the San Joaquin Clay-Etchegoin contact.

Church, C. C., 1958, Macropaleontology, *in* San Joaquin Geol. Soc. Guidebook, 1958 Spring Field Trip, Round Mountain area [California]: p. 12–13, 18–19.

Lists two middle Miocene mollusks from Blake's Ocoya Creek locality (Conrad, 1855), four early Miocene mollusks from Pyramid Hill, five from the Barker's Ranch (middle Miocene) area, and three from Sharktooth Hill (middle Miocene).

Church, C. C., 1968, The McKittrick tar seeps, *in* Guidebook, Geology and oil fields of west side southern San Joaquin Valley [California], Am. Assoc. Petroleum Geologists, Soc. Explor. Geophysicists, and Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Field trip, 1968: p. 86–92.

A 2- to 3-foot bed lying unconformably above Miocene diatomaceous siltstone contains abundant specimens of a small *Pecten* and a few small *Ostrea.* It is referred to the basal San Joaquin *Pecten eldridgei* zone (Pliocene).

Clapp, C. H., 1912, Southern Vancouver Island: Canada Geol. Survey Mem. 13, 202 p., 18 pls., 3 figs., reconn. geol. map.

Contains a map of exposures of Sooke and Carmanah Formations along southwest coast of Vancouver Island. There is a section on age of formations but with no fossil names.

Clapp, C. H., 1917, Sooke and Duncan map-areas, Vancouver Island: Canada Dept. Mines Mem. 96, Geol. ser. 80, p. 1–445.

Lists mollusks from the Sooke and Carmanah Formations from near Sooke northwest to the vicinity of Clo-oose (identifications by C. E. Weaver). Weaver correlated the Sooke with the Clallam Formation of the northern Olympic Peninsula.

Clark, Alex, 1937, Notes on Conrad's Miocene species from "Ocoya" Creek, Kern County [California] [abs.]: Geol. Soc. America Proc. 1936, p. 386–387.

Discovered Conrad's original Poso Creek [Ocoya Creek] locality from which *Turritella ocoyana* and other middle Miocene mollusks were described. Indicates some taxonomic revisions based upon restudy of material from this locality.

Clark, B. L., 1912, The Neocene section at Kirker Pass on the north side of Mount Diablo [California]: California Univ. Pubs., Dept. Geology Bull., v. 7, p. 47–60.

Lists 18 mollusks from his Upper Monterey Series, 44 species from the lower division of his San Pablo Series, and 21 species from the upper division of his San Pablo Series.

Clark, B. L., 1913, San Pablo formation on the north side of Mount Diablo, California [abs.]: Geol. Soc. America Bull., v. 24, p. 130.

A fauna of 60 species of marine invertebrates [mostly mollusks] occurs in this formation. Twenty species have been collected from the underlying Monterey Series.

Clark, B. L., 1914a, Fauna of the San Pablo Series [California] [abs.]: Geol. Soc. America Bull., v. 25, p. 152–153.

The fauna of the San Pablo is of Miocene age; it consists of about 150 species [mostly mollusks] that are divided into two faunal zones bearing the names of echinoids.

Clark, B. L., 1914b, Fauna of the *Scutella breweriana* zone of the upper Monterey Series [California] [abs.]: Geol. Soc. America Bull., v. 25, p. 151.

About 60 species of invertebrates [mostly mollusks] occur in this zone. The fauna is distinct from that of the *Agasoma gravida* zone below and the fauna of the San Pablo Series above.

CLARK, B. L., 1915a, Fauna of the San Pablo Group of middle California: California Univ. Pubs., Dept. Geology Bull., v. 8, no. 22, p. 385–572, pls. 42–71.

Describes and illustrates about 70 new molluscan taxa from the San Pablo Group (Cierbo and Neroly Formations of later usage). Regarded faunas as indicative of warm temperate conditions similar to those in the northernmost part of the present-day Californian molluscan province. Includes a faunal list, locality descriptions, stratigraphic descriptions of important sections, and descriptions of two faunal zones, both bearing the names of echinoids. Lists species limited to each of the two zones.

Clark, B. L., 1915b, The occurrence of Oligocene in the Contra Costa Hills of Middle California: California Univ. Pubs., Dept. Geology Bull., v. 9, no. 2, p. 9–21.

Defines the *Anadara montereyana* zone which is as old as the *Turritella ocoyana* zone of southern California. Lists nine mollusks from this zone and 86 molluscan taxa from the underlying *Agasoma gravida* zone which is regarded as older than the *T. inezana* zone of southern California.

Clark, B. L., 1916, Note on the marine Tertiary faunas of the Tejon Hills section, *in* Merriam, J. C., Mammalian remains from the Chanac formation of the Tejon Hills, California: California Univ. Pubs., Dept. Geology Bull., v. 10, no. 8, p. 115.

Lists characteristic mollusks from upper Miocene exposures at Comanche Point.

Clark, B. L., 1917, Astoria series (Oligocene) in the region of Mount Diablo, Middle California: Geol. Soc. America Bull., v. 28, p. 227–229.

The Astoria Formation of Oregon is considered equivalent to the Clallam Formation of northwestern Washington and is considered by Clark to be coeval with his *Agasoma gravidum* zone of the Mount Diablo area, the San Lorenzo Formation of the Santa Cruz Mountains, and the Kreyenhagen Shale, all in California.

CLARK, B. L., 1918, The San Lorenzo series of middle California: California Univ. Pubs., Dept. Geology Bull., v. 11, no. 2, p. 45–234, pls. 3–24.

Definitive report on the San Ramon Sandstone of the Mount Diablo area. This formation, characterized by mollusks referred to as the *Agasoma gravidum* fauna, is separated from the overlying Sobrante Sandstone of Lawson (1914) on the basis of an unconformity in the upper part of the formation. The San Ramon fauna is described and illustrated. It is correlated with other late Oligocene and (or) early Miocene faunas along the Pacific coast.

Clark, B. L., 1921a, Correlation of Tertiary marine formations of the west Coast of North America: Bernice P. Bishop Mus. Spec. Pub. 7, pt. 3, p. 801–818.

A correlation chart of the Pacific coast contains nine columns for California and one for Oregon and Washington. A few characteristic or stratigraphically restricted mollusks are shown for some of the marine formations. Latitudinal temperature gradients that were developed by the late Tertiary, and the isolated nature of depositional basins, complicate Neogene correlations along the Pacific coast.

Clark, B. L., 1921b, The marine Tertiary of the west coast of the United States—its sequence, paleogeography, and the problems of correlation: Jour. Geology, v. 29, no. 7, p. 583–614, 12 figs.

Seven subdivisions [time-stratigraphic] of the California Neogene are recognized and used on a chart showing formations and principal faunal elements for nine areas in California. The correlation of these units, their paleogeography, and their inferred climatic significance are discussed; paleogeographic maps showing the distribution of each of these are included. Progress in molluscan correlation has been hampered by poor preservation of material, geographic isolation of faunas, and latitudinal temperature differentiation that became very pronounced following the middle Miocene.

CLARK, B. L., 1922, A new family and new genus from the Tertiary of the Pacific coast: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 14, no. 4, p. 115–122, pls. 13–14.

Mesodesma pacifica Hall and Ambrose from the Monterey Group near Sunol, Calif., is included with the newly described *Myadesma dalli* from the Sooke Formation of British Columbia in this new genus. Both species are illustrated.

Clark, B. L., 1924, A summary of work in progress on the Tertiary and Quaternary of western North America: Pan-Pacific Sci. Cong., Second, Proc., v. 1, p. 874–879.

Principally a summary of work on molluscan faunas of the Paleogene in California, Oregon, and Washington. There was very little research in

progress on Miocene and Pliocene faunas; the only work noted being that of W. S. W. Kew on the Miocene and Pliocene of southern California.

CLARK, B. L., 1925, Pelecypoda from the marine Oligocene of western North America: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 15, no. 4, p. 69–136, pls. 8–22.

A review and systematic description of Oligocene and some early Miocene pelecypods, principally from Oregon and Washington. A few new species are described from the uppermost part of the Twin River Formation of northwestern Washington, the Scappoose Formation of northwestern Oregon, lower or middle Miocene beds of coastal Oregon, and the San Ramon Formation of central California. Lists of mollusks at the type localities of each of these new species are included.

CLARK, B. L., 1929*, Stratigraphy and faunal horizons of the Coast Ranges of California: Privately published, 132 p., 50 pls. [Ann Arbor, Mich., University Microfilms, Inc., 30 p., 50 pls.]

A review of Tertiary faunas listing characteristic species from several Miocene and Pliocene "horizons" or "formations." Illustrates previously described Miocene and Pliocene mollusks.

CLARK, B. L., 1932, Fauna of the Poul and Yakataga Formations (upper Oligocene) of southern Alaska: Geol. Soc. America Bull., v. 43, p. 797–846, pls. 14–21.

Recognizes 42 molluscan taxa, including 24 newly described species or subspecies, from rock units of late Oligocene to middle Miocene age. The combined fauna is correlated with the Blakeley "horizon" ["Stage"] of western Washington and the fauna of the Sooke Formation of Vancouver Island. Water temperatures are inferred to have been cool temperate and similar to modern conditions in this area. Evidence for late Oligocene age of the San Ramon Formation of California is discussed.

Clark, B. L., 1933, Fauna of the Yakataga Formation of southern Alaska [abs.]: Geol. Soc. America Bull., v. 44, pt. 1, p. 168.

The molluscan fauna of the Yakataga Formation is considered to be of late Oligocene age and is correlated with the faunas of the Blakeley Formation and San Ramon Formation of the Pacific Coast States. Some paleontologists consider these faunas to be of early Miocene age.

Clark, B. L., 1940, Two new Pliocene formations in California [abs.]: Geol. Soc. America Bull., v. 51, pt. 2, p. 1956–1957.

Proposes the name King City Formation for marine strata exposed southeast of King City, Monterey County, Calif., that overlie basement rocks and underlie the Pancho Rico Formation. This unit is characterized by a mollusk-echinoid faunal assemblage referred to as the *Astrodapsis antiselli* zone.

Clark, B. L., 1941, Notes on California Tertiary correlation: California Div. Mines Bull. 118, p. 187–191.

A discussion of Tertiary correlation with reference to a few mollusk and echinoid zones. A correlation chart of Coast Range Tertiary formations is included.

Clark, B. L., and Arnold, Ralph, 1918a, Marine Oligocene of the west coast of North America [abs.]: Geol. Soc. America Bull., v. 29, p. 153–154.

The younger of two Oligocene faunal units, that of the Seattle Group, is more closely related to the older Oligocene faunal unit (the San Lorenzo Group) than to early Miocene faunas.

Clark, B. L., and Arnold, Ralph, 1918b, Marine Oligocene of the west coast of North America : Geol. Soc. America Bull., v. 29, p. 297–308.

The youngest of three faunal zones included in the Oligocene of Washington, the *Acila gettysburgensis* zone, represents temperate marine climate, as does the oldest zone, the *Agasoma acuminata* zone of the Sooke Formation. The latter zone is now considered to be of probable early Miocene age; the former at least in part of early Miocene age (Weaver and others, 1944). Differentiation of climatic zones along the Pacific coast began during the Oligocene. A paleogeographic map of the early and middle Miocene of California ("Monterey") is included.

CLARK, B. L., and ARNOLD, RALPH, 1923, Fauna of the Sooke Formation, Vancouver Island, with description of a new coral by T. Wayland Vaughan: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 14, no. 5, p. 123–234, pls. 15–42.

The definitive study of the molluscan fauna of the Sooke Formation based upon all significant collections made as of that date. Sixty-six mollusks are recognized of which 45 are newly described. The fauna represents temperate climatic conditions along a strand line with the influence of brackish water in at least a few of the fossiliferous localities. The formation is considered to be of late Oligocene or early Miocene age, coeval with the *Acila gettysburgensis* zone of Oregon and Washington.

Clark, B. L., and Durham, J. W., 1942, Molluscan evidence for the Miocene age of the Vaqueros Formation, *in* Schenck, H. G., and Childs, T. S., Jr., Significance of *Lepidocyclina* (*Lepidocyclina*) *californica*, new species, in the Vaqueros formation (Tertiary), California: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 37–39.

The Vaqueros should be correlated with the European Burdigalian Stage because specific and generic composition are similar (list Aquitanian to Helvetian analogs of four Vaqueros species). *Turritella ocoyana* is represented by analogous species in South America which are of Miocene age. Faunal migrations occurred from Europe to the Americas, American occurrences are, therefore, at least as young if not younger than European occurrences.

Clark, J. C., 1968a, Miocene-Pliocene boundary in the central Santa Cruz Mountains, California [abs.]: Geol. Soc. America Spec. Paper 115, p. 316–317.

The Santa Margarita Formation of the Scotts Valley area includes mollusk assemblages that, together with foraminiferal and land-mammal control, suggest that the Miocene-Pliocene boundary occurs within this formation.

Clark, J. C., 1968b, Correlation of the Santa Cruz Mountains Tertiary—implications for San Andreas History, *in* Proceedings of Conference on Geologic Problems of San Andreas Fault System: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 11, p. 166–180.

Paleontologic evidence indicates that the Mindego volcanics west of the San Andreas fault and the Page Mill Basalt east of the fault are not, as

previously held, contemporaneous. An early Miocene assemblage, including four listed species, directly overlies the Mindego volcanics; a middle Miocene assemblage includes *Turritella ocoyana* and a "typical Temblor ['Temblor Stage'] fauna" overlies and is interbedded with the Page Mill Basalt.

Clark, L. M., and Clark, Alex, 1935, The Vaqueros in the Temblor Range [California] [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 19, no. 1, p. 137.

Ostrea vaquerosensis and *Pecten magnolia* are reported from localities in their "Aqua Sandstone", a sandstone within the upper part of their Santos Shale, documenting the occurrence of lower Miocene ["Vaqueros Stage"] strata along the west side of the San Joaquin basin.

Clark, S. G., 1940, Geology of the Covelo district, Mendocino County, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 25, no. 2, p. 119–142, 7 figs.

Ostrea, *Corbicula*?, *Natica*, and *Pecten* (determined by F. E. Turner) occur in strata assigned to the Miocene by Clark. *Desmostylus* also occurs in this unit and is believed to be of middle Miocene age according to VanderHoof (1937). Oysters are reported by Diller (1902) from strata that overly serpentine in this area.

Clements, Thomas, 1941, Review of ideas of today regarding a water connection at Panama, *in* Hill, H. W., ed., Proceedings of the dedicatory exercises, Hancock Hall, the Allan Hancock Foundation for Scientific Research at the University of Southern California: Southern California Univ., Univ. Chron. Ser., no. 7, p. 12–16.

A discussion of the paleogeography of the Panama-Costa Rica area including his Bolivar seaway and Tehuantepec Portal (open until the Pliocene). Caribbean affinities of Pacific coast faunas appear in the early Miocene and persist until middle Pliocene according to Clark.

Coan, E. V., 1968, The biogeography of certain west American tellinaceans[abs.]: The Echo, Western Soc. Malacologists, First Ann. Mtg., p. 11–12.

Two species of *Macoma* migrated through the Bering Straits during the late Tertiary and Quaternary (*M. obliqua* and *M. praetenuis*).

Coan, E. V., 1969, Recognition of an eastern Pacific *Macoma* in the Coralline Crag of England and its biogeographic significance: Veliger, v. 11, no. 3, p. 277–279.

Macoma incongrua von Martens (1865) of the eastern North Pacific is conspecific with *M. obliqua* (Sowerby, 1817), reported from the Coralline Crag of England. Eastern Pacific specimens previously identified as *M. incongrua* differ significantly from modern specimens of this species from Japan, the type locality. There are a few comments on Neogene migrations of *Macoma* from the Pacific to the Atlantic.

Coan, E. V., and Roth, Barry, 1966, The West American Marginellidae: Veliger, v. 8, no. 4, p. 276–299, pls. 48–51.

Two genera of Marginellinae are recorded from formations of Pliocene age in the low latitudes of the eastern Pacific.

Coats, R. R., 1947a, Geology of northern Adak Island, Alaska: U.S. Geol. Survey Alaskan Volcano Inv., pt. 5 of rept. no. 2, Progress of investigations in 1946, p. 73–85.

Includes the initial report of marine fossils of presumed late Tertiary age from the northern part of Adak Island.

Coats, R. R., 1947b, Reconnaissance geology of some western Aleutian Islands, Alaska: U.S. Geol. Survey Alaskan Volcano Inv., pt. 7 of rept. no. 2, Progress of investigations in 1946, p. 97–105.

The oldest fossiliferous sedimentary rocks of Tertiary age in this region occur on Adak Island on the east side of "Mount Adagdak" and on Amchitka Island about 2½ miles west of East Cape.

Coats, R. R., 1956, Geology of northern Adak Island, Alaska: U.S. Geol. Survey Bull. 1028–C, p. 47–67.

Sandstone containing abundant fragments of marine fossils is considered to be of late Tertiary age because of the similarity of the fossil fragments to modern beach drift.

Cohen, Gaston, 1968, L'isthme de Béring et ses vicissitudes-paléogéographie et migrations: Sci. Progres-La Nature, No. 3399, p. 241–248.

The Bering Straits opened briefly during the late Miocene and again near the end of the Pliocene according to evidence of migrations of marine invertebrates (reference not seen).

Collom, R. E., 1918, Santa Barbara, San Luis Obispo, Monterey, and Santa Clara Counties [California]: California Mining Bur. Bull. 82 (Second Rept. State Oil and Gas Supervisor), p. 198–230.

Lists Pliocene mollusks from localities in basal conglomerate of the Fernando Formation in Cat Canyon area and 21 mollusks from a railroad cut half a mile north of Schuman (identifications by H. H. Dievendorff).

CONRAD, T. A., 1848, Fossil shells from Tertiary deposits on Columbia River, near Astoria [Oregon]: Am. Jour. Sci., ser. 2, v. 5, p. 432–433, 14 figs. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 150–151.]

Fourteen species of mollusks from the Astoria Formation are described and illustrated by line drawings. The fossils are considered to be of Miocene age.

CONRAD, T. A., 1849, Fossils from northwestern America, *in* Dana, J. D., U.S. Explor. Exped. ***, 1838–1842, under the command of Charles Wilkes: v. 10, app. p. 722–728; atlas, pls. 17–21. [Text reprinted in Dall. 1909, U.S. Geol. Survey Prof. Paper 59, p. 152–156.]

A brief description and illustration, by line drawings, of 33 new species of mollusks from the Astoria Formation near Astoria, Oreg. Notations on measurements and morphology of these specimens are added in brackets by Dana.

CONRAD, T. A., 1853a, Descriptions of new fossil shells of the United States: Acad. Nat. Sci. Philadelphia Jour., new ser., v. 2, pt. 3, p. 273–276, pl. 24. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 159–161.]

Describes *Gnathodon lecontei* presumably from the Imperial Formation of Carrizo Creek, southeastern California.

CONRAD, T. A., 1853b, Notes on shells, with descriptions of new species: Acad. Nat. Sci. Philadelphia Proc. for 1852, v. 6, no. 6 (Jan. 31, 1853), p. 199–200. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 158.]

Describes *Ostrea titan* from near San Luis Obispo, Calif. Proposed the new genus *Schizothaerus* based upon *Lutraria nuttalii*.

CONRAD, T. A., 1854, Descriptions of new fossil shells of the United States: Acad. Nat. Sci. Philadelphia Jour., ser. 2, v. 2, no. 4, p. 299–300.

Describes *Ostrea vespertina* from Pliocene strata in Imperial Valley.

Conrad, T. A., 1855a, Notes on the Miocene and post-Pliocene deposits of California with descriptions of two new fossil corals: Acad. Nat. Sci. Philadelphia Proc., v. 7, p. 441.

Lists four species of mollusks from "Miocene" deposits at Santa Barbara [Santa Barbara Formation of late Pliocene to early Pleistocene age].

CONRAD, T. A., 1855b, Report of Mr. T. A. Conrad on the fossil shells collected in California by W. P. Blake, geologist of the expedition, under the command of Lieutenant R. S. Williamson, U.S. Topographical Engineers, 1853, in app. to Preliminary Geological Report of W. P. Blake: U.S. 33d Cong., 1st Sess., House Ex. Doc. 129, p. 5–20. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 163–171.]

Describes 12 new mollusks from Miocene strata northeast of Bakersfield, Calif., four from Pliocene strata at Carrizo Creek in southeast California, four from Miocene rocks in Monterey County, Calif., and one from an unspecified locality [Miocene?] presumably in the San Joaquin Valley. Several Eocene species from the San Diego area were believed by Conrad to be of Miocene age.

CONRAD, T. A., 1857a, Descriptions of the fossil shells, *in* Williamson, R. S., Report of explorations in California for railroad routes ***: U.S. 33d Cong., 2d Sess., Senate Ex. Doc. 78 and House Ex. Doc. 91, v. 5, pt. 2, app. art. 2, p. 317–329, pls. 2–9. [Pac. R. R. Repts.]

First illustration of species described by Conrad in 1855. Includes 12 new species and five genera from the Ocoya Creek locality in Kern County, four from the Pliocene strata of Carrizo Creek in Imperial County, four from Miocene rocks of Monterey County, and one species from Tulare Valley. Includes catalog of 59 marine mollusks named by Conrad from California Cenozoic deposits; a few are from Eocene strata in the San Diego area, others are from Pleistocene strata at San Pedro and Santa Barbara.

CONRAD, T. A., 1857b, Description of the Tertiary fossils collected on the survey [Williamson's survey], *in* Reports of explorations and surveys *** railroad *** from the Mississippi River to the Pacific Ocean: U.S. 33d Cong., 2d Sess., Senate Ex. Doc. 78 and House Ex. Doc. 91, v. 6, pt. 2, p. 69–73, pls. 2–5. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 176–179.] [Pac. R. R. Repts.]

Describes new species of Miocene mollusks and figures 16 mollusks described, but not illustrated, in earlier publications.

CONRAD, T. A., 1857c, Description of three new genera; twenty-three new species middle Tertiary fossils from California, and one from Texas: Acad. Nat. Sci. Philadelphia Proc. for 1856, v. 8, p. 312–316. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 173–175.]

Describes 22 new species of late Cenozoic mollusks from California, two of which may have been collected from Pleistocene strata at Santa Barbara, Calif.

CONRAD, T. A., 1857d, Report on the paleontology of the survey [Parke's survey], *in* Reports of explorations and surveys *** railroad *** from the Mississippi River to the Pacific Ocean: U.S. 33d Cong., 2d Sess., Senate Ex. Doc. 78 and House Ex. Doc. 91, v. 7, pt. 2, p. 189–196, pls. 1–10. [Reprinted in Dall, 1909, U.S. Geol. Survey Prof. Paper 59, p. 180–185.] [Pac. R. R. Repts.]

Describes and illustrates new species from the Miocene and Pliocene of California; illustrates several previously described, but unillustrated, species.

CONRAD, T. A., 1862, Descriptions of new genera, subgenera, and species of Tertiary and Recent shells: Acad. Nat. Sci. Philadelphia Proc., v. 14, no. 6, p. 284–291.

The genus *Lyropecten* is represented by three species on the Pacific coast: *L. estrellanus*, *L. crassicardo*, described in this report, and *L. volaeformis*, a new name for *Pallium estrellanum* Conrad (Pacific Railroad Reports, v. 7, p. 191).

CONRAD, T. A., 1865a, Catalogue of the older Eocene shells of Oregon: Am. Jour. Conchology, v. 1, p. 150–154.

Proposes the new genus *Priscofusus* for six Neogene species from the Pacific coast. Assigns specific names to mollusks figured, but not named, in his 1849 report. Assigns mollusks from the Astoria Formation to the Eocene.

Conrad, T. A., 1865b, Observations on the Eocene Lignite formation of the United States: Acad. Nat. Sci. Philadelphia Proc., v. 9, 2d ser., p. 70–73.

Assigns the Asotria Formation of Oregon to the Eocene on the basis of his identification of an *Aturia* from the formation as the European Eocene species *A. ziczac.*

Conrad, T. A., 1866, Check list of the invertebrate fossils of North America: Smithsonian Misc. Colln., v. 7, no. 200, 41 p.

Assigns mollusks from the Astoria Formation of Oregon (Conrad, 1848, 1849) to the Eocene.

Cooper, J. G., 1874, California in the Miocene epoch: California Acad. Sci. Proc., ser. 1, v. 5, p. 401–405.

A generalized account of Miocene paleogeography of California in which it is maintained that most of the Coast Ranges south of San Francisco were under water during this epoch. *Ostrea titan* found in the Colorado River basin at an elevation of 1,000 feet is believed to indicate marine conditions during the Miocene at that time. Most of northern California was emergent during the Miocene.

Cooper, J. G., 1888, Catalogue of California fossils: California Mining Bur. Seventh Ann. Rept., p. 221–308.

Lists Cenozoic fossils from California with geologic range and geographical distribution. Many of the fossils are recorded for the first time from certain areas.

COOPER, J. G., 1894, Catalogue of Californian fossils, parts 2–5: California Mining Bur. Bull. 4, 65 p., 6 pls. [Plates reprinted by Yates, 1903, Southern California Acad. Sci. Bull., v. 2, no. 4, (pls. 1–4); no. 6 (pl. 5); no. 7 (pl. 6).

Includes a 17-page bibliography of "fossil mollusca" [actually a list composed almost exclusively of reports on living mollusks]. Report includes supplementary list to his earlier catalog (1888). Describes and illustrates two new Miocene gastropods from Kern County, Calif., and illustrates four previously unfigured Miocene pelecypods from California.

Cope, E. D., 1880, Corrections of the geological maps of Oregon: Am. Naturalist, v. 14, p. 457–458.

In discussing unpublished notes of Prof. Thomas Condon, indicates argillaceous shales that contain invertebrate fossils (Astoria Formation) make up much of the Coast Range. Above it are extensive beds rich in mollusks that he named "*Solen* beds."

Corey, W. H., 1929, Fauna and stratigraphy of the Vaqueros formation in Ventura and Santa Barbara counties, California [abs.]: Geol. Soc. America Bull. v. 40, p. 261.

"The Vaqueros has a large fauna containing many new species, several of which are quite common. Some forms are apparently directly ancestral to Temblor species."

"Field work has also brought out some interesting facts concerning stratigraphic relationships of the Vaqueros formation in this region."

Corey, W. H., 1935, Age of schist clastics, Venice district [California] [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 19, no. 12, p. 1842.

Fossil mollusks of late Miocene age have been recovered from cores in the Venice and Del Rey oil fields.

Corey, W. H., 1936, Age and correlation of schist-bearing clastics, Venice and del Rey fields, California: Am. Assoc. Petroleum Geologists Bull., v. 20, no. 2, p. 150–154.

Lists *Mytilus* cf. *M. mathewsoni* Gabb, *Ostrea* sp., *Pecten raymondi brionianus* Trask, *Pecten crassicardo* var., and *Calyptraea inornata* (Gabb) from the schist-bearing sand and conglomerate of late Miocene age that unconformably overlie schist basement in three wells.

Corey, W. H., 1954, Tertiary basins of southern California, [pt.] 8 *in* chap. 3 *of* Jahns, R. H., ed., Geology of southern California: California Div. Mines Bull. 170, p. 73–83, 9 figs.

Includes a series of five paleogeographic maps of the Neogene based upon informal megafaunal time-stratigraphic units named "Vaquerosian," "Temblorian," "Montereyian," "Margaritian," and "Pliocene" that show shorelines, land areas, and areas of coarse clastic deposition. The stratigraphic range of formations is depicted on a stratigraphic chart which also shows the relative distribution of sea and land areas in southern California during the Neogene.

Cornwall, I. E., 19222, Some notes on the Sooke Formation, Vancouver Island, British Columbia: Canadian Field-Naturalist, v. 36, no. 7, p. 121–123.

A few previously described mollusks from the Sooke Formation, including fresh or brackish water taxa and fully marine taxa, are listed. Two of Clark and Arnold's (1923) new species are listed: *Cerithidea newcombei* and *Goniobasis sookensis*.

Cornwall, I. E., 1927, Fossil Cirripedia from the upper Oligocene Sooke Formation of Vancouver Island, B.C. [Canada]: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 16, no. 9, p. 399–408, pls. 58, 59.

Barnacles in the Sooke Formation occur with *Cyrena* and *Ostrea* suggesting brackish water conditions.

Corwin, C. H., 1950, Kern Bluff oil field [California]: California Oil Fields, v. 36, no. 1, p. 15–17.

Shell fragments [presumably mollusks] are common in the Santa Margarita Formation at Kern Bluff field.

COSSMANN, A. E. M., 1895–1925*, Essais de paleoconchologie comparee, ***: Paris, Chez l'auteur, [etc.], v. 1–13.

Includes several records of Pacific coast Miocene and Pliocene gastropods and initial designation of type species for certain Pacific coast genera.

Cox, A. V., Hopkins, D. M., and Dalrymple, G. B., 1966, Geomagnetic polarity epochs, Pribilof Islands, Alaska: Geol. Soc. America Bull., v. 77, no. 9, p. 883–909.

Twenty-five mollusks from the basal sedimentary strata on St. George Island are indicative of assignment to the Beringian marine transgression which is of late Pliocene or early Pleistocene age. The mollusks were identified by F. S. MacNeil; a few are mentioned in MacNeil's discussion. The Bergingian strata are covered by volcanic flow rock dated at about 2.1 m.y.

Cox, K. W., 1962, California abalones, family Haliotidae: California Dept. Fish and Game Bull. 118, 133 p., illus.

Lists four Miocene species of *Haliotis* from California.

Cox, L. R., 1942, Neogene aspect of Vaqueros mollusks, *in* Schenck, H. G., and Childs, T. S., Jr., Significance of *Lepidocyclina* (*Lepidocyclina*) *californica*, new species, in the Vaqueros formation (Tertiary), California: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 34–35.

It is not until the Burdigalian Stage in Europe that pectinids reach the size of Vaqueros species such as *Pecten magnolia*, *P. miguelensis*, *P. bowersi*, and *P. perrini*. *Pecten vanvlecki* seems to be an *Amussiopecten*; the earliest occurrence of the genus is in the upper Aquitanian of Europe. *Ostrea vespertina loeli* is very similar to the Burdigalian *O. verleti* from the Mediterranean. The *Turritella* fauna of the Vaqueros does not support an Oligocene age. The general aspect of the fauna is Neogene, although the evidence is not very strong.

Crickmay, C. H., 1929, The anomalous stratigraphy of Deadman's Island, California: Jour. Geology, v. 37, p. 617–638.

Pseudamussium pedroanum (Trask) occours in Miocene? shale that is unconformably overlain by Pleistocene strata.

Crittenden, M. D., Jr., 1951, Geology of the San Jose-Mount Hamilton area, California: California Div. Mines Bull. 157, 74 p., 11 pls., 14 figs.

Lists five mollusks from the Temblor Formation including *Bruclarkia oregonensis* and *Patinopecten propatulus*. Three species are listed from the Briones Formation: *P. propatulus*, *Spisula solbyenis*?, and *Tivela merriami*?.

Cross, Rodman K., 1943, East Cat Canyon area of the Cat Canyon Oil Field [California]: California Div. Mines Bull. 118, p. 435–439.

A doubtfully identified fragment of *Pecten andersoni* is reported from a core recovered from the Monterey Shale.

Crowell, J. C., 1952a, Geology of the Lebec quadrangle, California: California Div. Mines Spec. Rept. 24, 23 p., 2 pls., 10 figs.

Eleven mollusks from the Santa Margarita Formation northeast of the San Andreas fault identified by W. H. Corey are very similar to assemblages from the northern Tejon Hills in the southeastern part of the San Joaquin Valley.

Crowell, J. C., 1952b, Geology of the Ridge Basin area, Los Angeles and Ventura Counties [California]: California Div. Mines Bull. 170, Map Sheet 7, scales 1 in. = 2½ miles approx.

The lowermost 2,000 ft of his Ridge Basin Group are marine and contain mollusks [not listed] of late Miocene age.

Crowell, J. C., 1960, Notes on the geology of the Whitaker Peak quadrangle, southern California, *in* San Gabriel Fault, Am. Assoc. Petroleum Geologists, Pacific Section, Spring Field Trip, 1960: p. 1–4.

Turritella inezana is reported from the Vaqueros Formation.

Crowell, J. C., Hope, R. A., Kahle, J. E., Ovenshine, A. T., and Sams, R. H., 1966, Deep-water sedimentary structures, Pliocene Pico Formation, Santa Paula Creek, Ventura basin, California: California Div. Mines Spec. Rept. 89, 40 p.

Disarticulated valves of *Macoma*? sp. and *Semele*? sp., about 2 cm in diameter, occur with two preferred orientations: (1) imbricated with concave sides upward in a massive sandstone and (2) with concave sides downward in laminated sandstone.

Cruess, W. V., 1914, Comparison of the oysters of the lower and upper horizons of the Miocene of the Muir syncline [California] [abs.]: Geol. Soc. America Bull., v. 25, p. 154.

Large oysters indiscriminately identified as *Ostrea titan* represent two or three different species based upon details of internal morphology.

CUMMINGS, J. C., TOURING, R. M., and BRABB, E. E., 1962*, Geology of the northern Santa Cruz Mountains, California, *in* Bowen, O. E., Jr., ed., Geologic guide to the gas and oil fields of northern California: California Div. Mines Bull. 181, p. 179–220.

The definitive stratigraphic study of the marine Tertiary of the northern Santa Cruz Mountains. List four species characteristic of the lower Miocene Vaqueros Formation, six species from the lower Miocene Mindego Formation, one from the Monterey Formation, and 65 from the Pliocene Purisima Formation. The Purisima Formation is subdivided into five members; many mollusks from it are illustrated. The Pliocene mollusks suggest deposition in relatively shallow water: 10–50 fathoms.

Cunningham, G. M., and Barbat, W. F., 1932, Age of producing horizon at Kettleman Hills, California: Am. Assoc. Petroleum Geologists Bull., v. 16, no. 4, p. 417–421.

Include a stratigraphic column of Miocene formations of type Temblor Formation, type Monterey Formation, North Beldridge area, Lost Hills

area and Kettleman Hills area; the three latter being well sections. *Pecten andersoni, Turritella ocoyana, Turritella* sp., and *Ostrea* sp. occur in subsurface units of middle Miocene age.

Curran, J. F., 1943, Eocene stratigraphy of Chico Martinez Creek area, Kern County, California: Am. Assoc. Petroleum Geologists Bull., v. 27, no. 10, p. 1361–1386.

Lists six mollusks from his Phacoides sandstone, three from his Carneros Sandstone, and two from his upper Temblor Sandstone ("Button beds") on Chico Martinez Creek.

Cushman, J. A., and Laiming, Boris, 1931, Miocene foraminifera from Los Sauces Creek, Ventura County, California: Jour. Paleontology, v. 5, no. 2, p. 79–120.

Turritella inezana Conrad was recovered from a core taken at 5,543 ft in the General Petroleum Corp. well Kerwin no. 1 (sec. 5, T. 30 S., R. 29 E.) in the Edison oil field. The identification was by W. H. Corey. *Turritella ocoyana* is reported from a 4,000-foot sequence of Miocene strata at Goat Spring (secs. 32 and 33, T. 12 N., R. 27 W., San Luis Obispo County.

Cushman, J. A., and LeRoy, L. W., 1938, A microfauna from the Vaqueros Formation, lower Miocene, Simi Valley, Ventura County, California: Jour. Paleontology, v. 12, no. 2, p. 117–126.

List 35 species of mollusks from Vaqueros Formation localities of the South Oak Ridge area identified by W. H. Corey. A map and columnar section show the occurrence of six molluscan zones (named by Corey) in 1,470-foot section of Vaqueros Formation. A foraminiferal assemblage in middle of section seems to be of late Zemorrian age, comparable to the lower part of the Rincon Shale.

DALL, W. H., 1874, Notes on some Tertiary fossils from the California coast, with a list of the species obtained from a well at San Diego, Calif., with descriptions of two new species: California Acad. Sci. Proc., v. 5, p. 296–299.

Lists an assemblage of 69 megafossils from a well drilled in Balboa Park, "the San Diego well," considered to be of Pliocene age. Describes *Chrysodomus diegoensis.*

DALL, W. H., 1879a, Fossil mollusks from later Tertiaries of California: U.S. Natl. Mus. Proc., v. 1, p. 10–16.

Lists 114 Pliocene and Pleistocene mollusks from localities at San Diego and at Santa Barbara, the latter being of probable early Pleistocene age. Species from the San Diego well are indicated separately. Six new species of Pliocene age are described from exposures at Pacific Beach, San Diego.

Dall, W. H., 1879b, Distribution of Californian Tertiary fossils: U.S. Natl. Mus. Proc., v. 1, p. 26–30.

Pliocene and Pleistocene fossil assemblages from the San Diego peninsula and from the mainland are listed separately, supplementing the earlier list in which the assemblages were lumped (Dall, 1879a). Thirteen species of Pliocene age are recorded from Pacific Beach.

Dall, W. H., 1882, Note on Alaska Tertiary deposits: Am. Jour. Sci., ser. 3, v. 24, no. 139, p. 67–68.

Brown sandstone along the coast of Alaska contains extinct fossils (*Crepidula*, *Mytilus*, and *Ostrea*) which are comparable to Miocene mollusks from California. One deposits on St. Paul Island may be younger than these.

DALL, W. H., 1890, Conchological notes from Oregon: Nautilus, v. 4, no. 8, p. 87–89.

Marine fossils in Pliocene beds at Shoalwater Bay, Wash., conformably underlying Quaternary strata include *Buccinum cyaneum* and other northern forms indicating cooler climate than at present. *Mytilus condoni* is described as a new species characterized by a few, strong, divaricating ridges extending from about the middle of the valve toward the posterior extremity.

Dall, W. H., 1896, Report on coal and lignite of Alaska: U.S. Geol. Survey 17th Ann. Rept., pt. 1, p. 763–875.

An assemblage of 46 mollusks from the "Astoria group" of Alaska is correlated with sandstones and shales at Astoria, Oreg. Alaskan Miocene water temperatures were warmer than at present. The fossils are from Lituya Bay, the Alaska Peninsula, and the Aleutian chain. A cool water Pliocene fauna occurs at Shoalwater Bay, Wash.; Pliocene fossils are recorded from the St. Elias Alps, southeast Alaska.

Dall, W. H., 1898, A table of North American Tertiary horizons, correlated with one another and with those of Western Europe, with annotations: U.S. Geol. Survey 18th Ann. Rept., pt. 2, p. 327–348. [First published as House Doc. 5, U.S. 55th Cong., 2d Sess., 1897.]

The initial recognition of Oligocene strata on the Pacific coast. Most of the Astoria Formation and the Tunnel Point Sandstone of Oregon coast were included in the Oligocene.

Dall, W. H., 1899, The mollusk fauna of the Pribilof Islands: The Fur Seals and Fur Seal Islands of the North Pacific Ocean, pt. III, p. 539–546.

Lists 35 mollusks collected by Stanley-Brown from "horizontal layers of a hard claystone" on St. Paul Island. The list is derived mainly from Dall (1896). Fragments of bivalves (*Saxicava*?) are reported to have been collected on Bering Island of the Commander Islands by Stejneger.

DALL, W. H., 1890–1903, Contributions to the Tertiary fauna of Florida, with especial reference to the Miocene silex beds of Tampa and the Pliocene beds of the Caloosahatchie River: Wagner Free Inst. Sci. Trans., v. 3, pts. 1–6, 1654 p., 60 pls. 1890, pt. 1, p. 1–200, pls. 1–12. 1892, pt. 2, p. 201–473, pls. 13-22. 1895, pt. 3, p. 474–570. 1898, pt. 4, p. 571–947, pls. 23–35 1900, pt. 5, p. 948–1218, pls. 37–47 1903, pt. 6, p. 1219–1654, pls. 48–60.

Contains descriptions of a few new species from California and Washington. Illustrations and incidental taxonomic observations on other Pacific coast species are also included. Includes a review of Pacific coast pectinids.

DALL, W. H., 1900, A new species of *Lima*: Nautilus, v. 14, no. 2, p. 15–16.

Describes *Lima hamlini* from Pliocene rocks exposed in the Third Street Tunnel, Los Angeles [Calif.].

Dall, W. H., 1901, Synopsis of the Lucinacea and of the American species: U.S. Natl. Mus. Proc., v. 23, p. 779–833, pls. 39–42'

Discusses Miocene and Pliocene records of two species of *Thyasira* from California.

DALL, W. H., 1904, Neozoic invertebrate fossils, a report on collections made by the expedition, *in* Harriman Alaska Expedition, v. IV (Geology and Paleontology) : New York, Doubleday, Page and Co., p. 99–122, pls. 9, 10. [Reprinted by Smithsonian Inst., 1910.]

Six new species of Miocene mollusks from Unga Island are described and illustrated. Thirty-one Miocene mollusks are recorded from Unga Island and Popof Island. These assemblages are correlated with the Miocene fauna from Astoria, Oreg. Mollusks from the Stepovak Series of Palache (1904) considered to be of Eocene age are now considered to belong to the Oligocene *Acila shumardi* zone (MacNeil and others, 1961). Thirty-two taxa, including 10 newly described mollusks from the Upper Beds, are recorded.

DALL, W. H., 1907a, Notes on some upper Cretaceous Volutidae with descriptions of new species and a revision of the groups to which they belong: Smithsonian Misc. Colln., v. 50, pt. 1, no. 1704, 23 p.

Contains a discussion of *Volutoderma indurata* (Conrad) from the Astoria Formation and intial description of the Pliocene species *Miopleiona oregonensis* Dall, both from coastal Oregon.

DALL, W. H., 1907b, On climatic condtions at Nome, Alaska, during the Pliocene, and on a new species of *Pecten* from the Nome gold-bearing gravels: Am. Jour. Sci., ser. 4, v. 23, no. 138, p. 457–458, 1 fig.

Pecten liocius is described from marine gravel believed to be of Pliocene age from near Nome. A few associated molluks suggest water temperatures warmer than occur at this latitude today.

DALL, W. H., 1908, Another large Miocene *Scala*: Nautilus, v. 22, no. 7, p. 80–81.

Four species of *Epitonium*, including *E. atwoodi* n. sp., are recorded from upper Tertiary strata of the Alaska Peninsula and Shumagin Islands, Alaska.

Dall, W. H., 1909a, Biographical memoir of William More Gabb, 1839–1878: Natl. Acad. Sci., Biog. Mem., v. 6, p. 347–361.

Gabb's paleontologic studies and fieldwork in California are described.

DALL, W. H., 1909b, Contributions to the Tertiary paleontology of the Pacific Coast, I. The Miocene of Astoria and Coos Bay, Oregon: U.S. Geol. Survey Prof. Paper 59, 278 p., 23 pls.

An important reference on systematic paleontology of the middle Miocene Astoria Formation and the Pliocene Empire Formation. There are many descriptions of new Pliocene species from the collection of B. H. Camman. Two cancellariids of Pliocene age from California are described. There is a useful bibliography of reports on post-Eocene mollusks of the Pacific coast (25 p.) and reprinted descriptions of new species from several earlier reports on Pacific coast mollusks, mostly by T. A. Conrad.

Dall, W. H., 1909c, Material toward a bibliography of publications on the post-Eocene marine mollusks of the northwest coast of America, 1865–1908, Appendix 13, *in* Dall, W. H., Contributions to the Tertiary

paleontology of the Pacific coast ***: U.S. Geol. Survey Prof. Paper 59, p. 192–216.

Includes bibliographic citations to reports dealing with Miocene and Pliocene Mollusks.

Dall, W. H., 1915, A review of some bivalve shells of the group Anatinacea from the west coast of America: U.S. Natl. Mus. Proc., v. 49, no. 2116, p. 441–456.

Four Miocene and Pliocene species of *Thracia* have been described from the Pacific coast.

DALL, W. H., 1917, Summary of the mollusks of the family Alectrionidae of the west coast of America: U.S. Natl. Mus. Proc., v. 51, no. 2166, p. 575–579.

Alectrion grammatus is described from Pleistocene exposures [Pliocene] at Santa Barbara, Calif.

Dall, W. H., 1918, Notes on *Chrysodomus* and other mollusks from the North Pacific Ocean: U.S. Natl. Mus. Bull., v. 54, no. 2234, p. 207–234.

Exilia is represented in the Pliocene of California.

Dall, W. H., 1919, On some Tertiary fossils from the Pribiloff Islands [Alaska]: Washington Acad. Sci. Jour., v. 9, no. 1, p. 1–3.

Forty-four mollusks of Pliocene age are identified from localities at Tolstoi Point, St. Paul Island, and Tolstoi Point, St. George Island.

DALL, W. H., 1920, Pliocene and Pleistocene fossils from the Arctic coast of Canada and the auriferous beaches of Nome, Norton Sound, Alaska: U.S. Geol. Survey Prof. Paper 125–C, p. 23–37, 2 pls.

Includes lists of Pliocene and Pleistocene mollusks from 22 localities mostly from near Nome but with a few from the Arctic coast. Fifteen new species of mollusks are described and illustrated. A few previously described mollusks are also illustrated. A "more free connection probably existed in Pliocene time between the North Atlantic and the Bering Sea regions" (p. 25). Miocene climate was much cooler than during the Eocene. During the Pliocene the climate seems to have become more moderate judging by the marine fauna.

Dall, W. H., 1921a, Summary of the marine shell-bearing mollusks of the northwest coast of America ***: U.S. Natl. Mus. Bull. 112, 217 p., 22 pls.

A very useful résumé of original bibliographic citations and geographic range data for the modern molluscan fauna of the Pacific coast. There are excellent line drawings of many species that have pre-Quaternary records. Trans-Arctic migration of Pacific and Atlantic mollusks occurred during late Tertiary periods of warmer marine climate than today. Several mollusks from the Bering Sea are found as fossils in the Pliocene of Nantucket and Iceland.

DALL, W. H., 1921b, Two new Pliocene pectens from Nome, Alaska: Nautilus, v. 34, no. 3, p. 76–77.

Pecten hallae and *P. ryhtidus* are described from a buried Pliocene beach deposit near Nome. These and five other mollusks suggest a warmer marine climate than occurs in this area today.

Dall, W. H., 1922, Fossils of the Olympic Peninsula [Washington]: Am. Jour. Sci., ser. 5, v. 4, p. 305–314.

A critical commentary upon report by Reagan (1909) on mollusks of the Clallam and Quillayute Formations of the Olympic Peninsula. Many of Reagan's specific determinations and generic assignments were changed or corrected.

DALL, W. H., 1925*, Illustrations of unfigured types of shells in the collections of the United States National Museum: U.S. Natl. Mus. Proc., v. 66, art. 17, p. 1–41, pls. 1–36.

Lima hamlini from "Pliocene clays of Los Angeles' [Calif.] is figured.

Dall, W. H., and Harris, G. D., 1892, Correlation papers: Neocene: U.S. Geol. Survey Bull. 84, 349 p.

Includes a review of paleontologic studies on the Tertiary of the Pacific coast with stratigraphic data. There are a few lists of fossils including a list of 46 mollusks from the "Astoria group" of Alaska (based on 12 localities). An index map shows the known distribution of Neogene formations in Alaska.

Dana, J. D., 1849, On Oregon and Northern California, *in* U.S. Explor. Exped. ***, 1838–1842, under the command of Charles Wilkes: v. 10, chap. 17, p. 611–675.

Shale near Astoria, Oreg., contains many kinds of mollusks that are regarded by T. A. Conrad as of Miocene age. Three species, *Nucula divaricata*, *Lucina acutilineata*, and *Natica saxea*, closely resemble Miocene species from the Northern Atlantic.

Darton, N. H., 1921, Geologic reconnaissance in Baja California: Jour. Geology, v. 29, p. 720–748.

Lists fossils characteristic of the California Miocene from localities in the vicinity of San Ignacio and La Purisima, Baja California. Included are *Pecten crassicardo* and *Turritella ocoyana*. Monterey beds 500 ft thick contain the above species; overlying yellow beds of the same thickness contain fossils that suggest a late Miocene age.

Davies, A. M., 1929, Faunal migrations since the Cretaceous period: Geol. Assoc. London Proc., v. 40, pt. 4, p. 307–327.

Postulates migration of marine invertebrates from the North Pacific through the Arctic into the North Atlantic during the late Miocene or early Pliocene based on *Acila*, *Searlesia*, *Cochlodesma*, *Pholadidea*, *Mya*, and other mollusks. These genera appear in the Pliocene or Quaternary of the British Isles but have pre-Pliocene records in the North Pacific.

Davies, A. M., 1934, Tertiary faunas; a text-book for oilfield paleontologists and students of geology, v. II The sequence of Tertiary faunas: London, Thomas Murby and Co., 252 p., illus.

A few molluscan genera of modern aspect in Oligocene faunas of the North Pacific suggest that certain formations such as the San Ramon might be better dated as Miocene. Climatic zones were well established along the Pacific coast by the early Miocene. Many new warm-water species, probably of Caribbean-Mediterranean derivation, appear in the fauna of the Vaqueros Formation. There is an increase in taxonomic diversity of mollusks during the middle Miocene. Late Miocene and early Pliocene

faunal migration from the North Pacific into the Atlantic probably followed a route along the Arctic coast of North America; at least one species of mollusk may have migrated in the opposite direction—from Western Euorpe to Japan. Temperature contrasts between molluscan faunas along the Pacific coast are much greater during the Pliocene than during earlier periods.

DAVIES, A. M., 1935* Tertiary faunas; a text-book for oilfield paleontologists and students of geology, v. 1. The composition of Tertiary faunas: London, Thomas Murby and Co., 406 p., illus.

Reference is made to some Neogene species from the Pacific Coast of North America. Two Miocene gastropods from the Pacific coast, *Molopophorus* and *Bruclarkia*, are figured. Volume II was issued prior to volume I.

Daviess, S. N., and Woodford, A. O., 1949, Geology of the northwestern Puente Hills, Los Angeles, California: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 83.

About 60 species of mollusks of late Pliocene age occur in collections from the Pico Formation at the north edge of the Whittier Hills.

DAVIS, C. H., 1913, New species from the Santa Lucia Mountains, California, with a discussion of the Jurassic age of the Slate's Springs: Jour. Geology, v. 21, no. 5, p. 453–458, figs. 1–7.

Tellina tenuistriata is described as a new species from the "Lower Temblor" near the headwaters of the San Antonio River, Monterey County, Calif.

Dawson, G. M., 1880, Report on the Queen Charlotte Islands [Canada]: Canada Geol. Survey Rept. Prog. for 1878–79, p. 1–239.

Lists Miocene mollusks from near Skon-un Point identified by J. F. Whiteaves.

Dawson, G. M., 1894, Geological notes on some of the coasts and islands of Bering Sea and vicinity [Alaska]: Geol. Soc. America Bull., v. 5, p. 117–146.

"Marine Miocene fossils" occur on Atka Island. "Upper Miocene (Astoria Group of Dall)" and "post-Pliocene" fossils occur on St. Paul Island.

Dehlinger, Peter, 1952, Geology of the southern Ridge basin, Los Angeles County, California: California Div. Mines Spec. Rept. 26, 11 p.

The mollusks from the upper Miocene Modelo Formation identified by J. W. Durham are recorded.

DeLise, K. C., 1967, Biostratigraphy of the San Emigdio Formation, Kern County, California: California Univ. Pubs. Geol. Sci., v. 68, 67 p.

Fragments of *Ostrea* sp. occur near the base of the Vaqueros Formation.

Denton, G. H., and Armstrong, R. L., 1969, Miocene-Pliocene glaciations in southern Alaska: Am. Jour. Sci., v. 267, p. 1121–1142.

The Yakataga Formation contains mollusks suggesting deposition under cool conditions; marine tillities occur well below mollusks of late Miocene age in this formation. Marine tillities on Middleton Island are of late Pliocene and early to middle Pleistocene age based on their molluscan faunas. Molluscan assemblages underlying the Miocene marine tillities suggest subtropical and temperate climates.

Dibblee, T. W., Jr., 1950, Geology of southwestern Santa Barbara County, California; Point Arguello, Lompoc, Point Conception, Los Olivos, and Gaviota quadrangles: California Div. Mines Bull. 150, 95 p.

Lists nine mollusks from the Vaqueros Formation, five from the Tranquillon Formation, and 12 from the Careaga Sand. Includes a correlation chart of molluscan zones and stages and foraminiferal stages.

Dibblee, T. W., Jr., 1952, Point Conception northeastward, *in* Redwine, L. E., chm., and others, Cenozoic correlation section paralleling north and south margins [of the] western Ventura basin from Point Conception to Ventura and Channel Islands, California: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

Pecten magnolia occurs in the Vaqueros Formation.

Dibblee, T. W., Jr., 1961, Geologic features of the San Emigdio Mountains, Kern County, California: Soc. Econ. Paleontologists and Mineralogists-Soc. Econ. Geologists-Am. Assoc. Petroleum Geologists, Pacific Sec. and San Joaquin Geol. Soc., Guidebook, Spring field trip, 1961, p. 2–25.

Pecten andersoni? occurs in the middle Miocene, *Pecten estrellanus* and *Ostrea titan* occur in the upper Miocene "Santa Margarita" [Formation].

Dibblee, T. W., Jr., 1966a, Geology of the Central Santa Ynez Mountains, Santa Barbara County, California: California Div. Mines and Geology Bull. 186, 99 p.

Lists assemblages of five mollusks each from the Miocene Vaqueros and Temblor Formations. Other mollusks are recorded from the Pliocene Careaga Sandstone and "Pico" Formation, as well as from the Pliocene and Pleistocene Santa Barbara Formation.

Dibblee, T. W., Jr., 1966b, Geology of the Palo Alto quadrangle, Santa Clara and San Mateo Counties, California: California Div. Mines Map Sheet 8.

An unnamed sandstone overlying the Page Mill Basalt contains molluscan assemblages indicative of middle Miocene age near Stanford University and late(?) Miocene age near Stevens Creek. The Merced(?) Formation contains abundant shallow water molluscan fossils near Felt Lake.

Dibblee, T. W., Jr., 1967, Areal geology of the western Mojave Desert, California: U.S. Geol. Survey Prof. Paper 522, 153 p.

Early Miocene mollusks occur in the Cajon Pass area at the eastern edge of the San Gabriel Mountains. Late Miocene mollusks occur in the Quail Lake Formation at the western edge of Antelope Valley.

Dibblee, T. W., Jr., and Chesterman, C. W., 1953, Geology of the Breckenridge Mountain quadrangle, California: California Div. Mines Bull. 168, 56 p.

The Bena Formation, a dominantly terrestrial unit, contains a few indeterminate marine pelecypods. The formation grades laterally into the Olcese Sand and is, therefore, considered to be of middle Miocene age.

Dickerson, R. E., 1914, The Martinez and Tejon Eocene and associated formations of the Santa Ana Mountains [California]: California Univ. Pubs., Dept. Geology Bull., v. 8, no. 11, p. 257–274.

Lists eight mollusks from the *Turritella inezana* zone and 24 species from the *Turritella ocoyana* zone

Dickerson, R. E., 1917a, Ancient Panama Canals: California Acad. Sci. Proc., ser. 4, v. 7, no. 8, p. 197–205.

The Pliocene fauna of Carrizo Creek, Imperial County, Calif., is related to molluscan faunas of the Atlantic Ocean. A late Tertiary assemblage (four species of probable Miocene age) from Magdalena Bay, Baja California, suggests a seaway across Panama because all of the taxa are conspecific with Atlantic mollusks.

Dickerson, R. E., 1917b, Climate and its influence upon the Oligocene faunas of the Pacific Coast, with descriptions of some new species from the *Molopophorus lincolnesis* zone: California Acad. Sci. Proc., ser. 4, v. 7, no. 6, p. 157–192, pls. 27–31.

Lists characteristic species from the *Acila gettysburgensis* zone (from Weaver, 1916). This zone represents a cooling of marine climate perhaps related to opening of the Bering Straits.

Dickerson, R. E., 1918, Mollusca of the Carrizo Creek beds and their Caribbean affinities [abs.]: Geol. Soc. America Bull., v. 29, p. 148.

Mollusks collected by Kew, Buwalda, and English confirm earlier conclusions by T. W. Vaughan, based upon corals, that the fauna has strong Caribbean affinities. Many species are identical to species characteristic of the Miocene Gatun Formation of Panama.

Dickerson, R. E., 1922, Tertiary and Quaternary history of the Petaluma, Point Reyes and Santa Rosa quadrangles [California]: California Acad. Sci. Proc., ser. 4, v. 11, no. 19, p. 527–601.

Two brackish water mollusks occur in his Petaluma Formation. Lists 38 mollusks from localities in the Merced Formation, most of them from the Freestone and Wilson Ranch localities.

Dickert, P. F., 1966, Tertiary phosphatic facies of the Coast Ranges [California]: California Div. Mines Bull. 180, p. 289–304.

A review of Tertiary occurrences of phosphatic pebbles and nodules, most of which are of middle Miocene age. All occurrences are correlated with the provincial benthonic foraminiferal chronology; a few with the molluscan sequence. Some of the Pliocene occurrences are phosphatized internal molds of marine mollusks.

Dickinson, W. R., 1963, Tertiary stratigraphic sequence of the Hancock Ranch area, Monterey and Kings Counties, California, *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip, 1963, p. 47–53.

Lists 24 mollusks from a lower sandstone member of the Temblor Formation; identifications are by A. M. Keen.

Dickinson, W. R., 1966a, Structural relationships of San Andreas fault system, Cholame Valley and Castle Mountain Range, California: Geol. Soc. America Bull., v. 77, no. 7, p. 707–726.

Pecten andersoni occurs in Miocene sandstone near Parkfield.

Dickinson, W. R., 1966b, Table Mountain serpentinite extrusion in California Coast Ranges: Geol. Soc. America Bull., v. 77, no. 5, p. 451–472.

Four middle Miocene mollusks and one Pliocene mollusk are recorded in a stratigraphic column for the Table Mountain-Turkey Flat area.

Dickinson, W. R., 1969, Miocene stratigraphic sequence on upper Sespe Creek and Pine Mountain [California], *in* Dickinson, W. R., chm., Soc. Econ. Mineralogists and Paleontologists, Pacific Coast Section, 1969 Field Trip [Guidebook], Upper Sespe Creek: p. 49–55, illus.

Seven mollusks are recorded from the Vaqueros Formation, four from the Monterey Formation, and seven from the Santa Margarita Formation.

Dickinson, W. R., and Lowe, D. R., 1966, Stratigraphic relations of phosphate- and gypsum-bearing upper Miocene strata, upper Sespe Creek, Ventura County, California: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 11, p. 2464–2470.

A few mollusks are reported from Miocene Formations exposed in the upper Sespe Creek area: Vaqueros Formation, Monterey Formation, Santa Margarita Formation.

Diller, J. S., 1896, A geological reconnaissance in northwestern Oregon: U.S. Geol. Survey 17th Ann. Rept., pt. 1, p. 441–520.

Miocene and Pliocene fossil localities along the Oregon coast are shown on an index map. Molluscan assemblages are recorded from many areas: Oligocene [Miocene, Astoria Formation] from Short Beach, Clatsop County and near the mouth of Tillamook River, Miocene [Astoria and Scappoose Formations] from northwestern Oregon, and Miocene [Pliocene, Empire Beds] from Coos Bay.

Diller, J. S., 1901, Description of the Coos Bay quadrangle, Oregon: U.S. Geol. Survey Geol. Atlas, Folio 73, 5 p.

The Empire Formation contains numerous marine fossils characteristic of the Miocene. It extends from Coos Bay southward to beyond Seven Devils in a narrow coastal strip. The overlying fossiliferous strata exposed at Fossil Rock are considered to be Pleistocene by W. H. Dall.

Diller, J. S., 1902, Topographic development of the Klamath Mountains [California and Oregon]: U.S. Geol. Survey Bull. 196, p. 1–69, pls. 1–13.

Miocene and Pliocene fossiliferous strata occur at Cape Blanco, Oreg. Pliocene mollusks, identified by W. H. Dall, are recorded from Crescent City, 13 miles east of Crescent City [Wymer Beds], Mad River, and Eel River. Miocene oysters are reported from Salt Creek near Round Valley, Calif. (T. 21 N., R. 13 W.). Shows a "Neocene" shoreline in northwest California and southwest Oregon.

Diller, J. S., 1903, Description of the Port Orford Quadrangle, Oregon: U.S. Geol. Survey Geol. Atlas, Folio 89, 6 p.

Fossils are very abundant in the Empire Formation which is considered by W. H. Dall to be of Miocene age.

Dodds, B. R., 1963, The relocation of geologic locales in Astoria, Oregon: Ore Bin, v. 25, no. 7, p. 113–128.

A review of geological studies in and near Astoria, Oreg., including a list of fossil localities keyed to an index map showing present and past street names in Astoria. Thirty-four localities are listed together with comments on their present condition.

Doell, E. C., 1943, Trico gas field [California]: California Div. Mines Bull. 118, p. 551–552.

A series of three *Mya* zones occurs in the "San Joaquin clays."

Doerner, D. P., 1969, Lower Tertiary biostratigraphy of southwestern Santa Cruz Island [California], *in* Weaver, D. W., ed., Geology of the Northern Channel Islands: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., p. 17–29.

Lyropecten, Rapana vaquerosensis, and *Turritella inezana* occur in cobble conglomerate unconformably overlying lower Tertiary strata in the southwestern part of Santa Cruz Island.

Dolman, S. G., 1938, Capitan oil field [California]: California Oil Fields, v. 24, no. 2, p. 15–26.

Fragments of *Pecten magnolia* and *Turritella inezana* have been recovered from cores of the Vaqueros Formation.

Dosch, M. W., 1967, Sespe oil field [California]: California Oil Fields, v. 53, no. 1, p. 39–53.

Sandy limestone beds in the lower Miocene Vaqueros Formation contain numerous oyster shells.

Dott, R. H., Jr., 1962, Geology of the Cape Blanco area, southwest Oregon: Ore Bin, v. 24, no. 8, p. 121–133.

Three mollusks of probable Miocene age [Pliocene] occur in poorly consolidated sandstone exposed along the coast 1½ miles southeast of Port Orford.

Dougherty, J. F., 1940, A new Miocene mammalian fauna from Caliente Mountain, Calif.: Carnegie Inst. Washington Pub. 514 (Contr. Paleontology, VIII), p. 109–143.

Middle Miocene mollusks occur in a 1,500-foot section of unnamed sandstone below the upper Triple Basalt. The mollusks are correlated with nonmarine vertebrates occurring in this section.

Drewes, Harald, Fraser, G. D., Snyder, G. L., and Barnett, H. F., Jr., 1961, Geology of Unalaska Island and adjacent insular shelf, Aleutian Islands, Alaska: U.S. Geol. Survey Bull. 1028–G, p. 583–676.

The upper part of the Unalaska Formation is believed to be of early Miocene age based upon the remains of a desmostylid and specimens of *Mya* cf. *M. truncata.*

Dunnill, R. M., and Coan, E. V., 1968, A new species of the genus *Macoma* (Pelecypoda) from west American coastal waters, with comments on *Macoma calcarea* (Gmelin, 1791): Canada Natl. Mus., Nat. History Paper 43, 19 p., 10 figs.

The Pliocene origin of *Macoma elimata* n. sp. and isolation, at that time, from *M. calcarea* are discussed. The genus *Macoma* probably originated in the North Pacific basin; *M. calcarea* has a longer geologic record in the Pacific than in the Atlantic.

Durham, D. L., 1963, Geology of the Reliz Canyon, Thompson Canyon, and San Lucas quadrangles, Monterey County, California: U.S. Geol. Survey Bull. 1141–Q, p. Q1–Q41.

Nine mollusks are recorded from an unnamed Pliocene formation [later included in Pancho Rico Formation]; identifications are by E. J. Moore.

Durham, D. L., 1964, Geology of the Cosio Knob and Espinosa Canyon quadrangles, Monterey County, California: U.S. Geol. Survey Bull. 1161–H, p. H1–H29.

Six mollusks are recorded from an unnamed Pliocene formation [later included in Pancho Rico Formation]; identifications are by E. J. Moore.

Durham, D. L., 1965a, Evidence of large strike-slip displacement along a fault in the southern Salinas Valley, California: U.S. Geol. Survey Prof. Paper 525–D, p. D106–D111.

Late Miocene and early Pliocene megafossil localities are shown on a geologic map of part of the Bradley and Adelaida quadrangles, San Luis Obispo County.

Durham, D. L., 1965b, Geology of the Jolon and Williams Hill quadrangles, Monterey County, California: U.S. Geol. Survey Bull. 1181–Q, p. Q1–Q27.

Lyropecten magnolia occurs in the Vaqueros Formation. Twenty-three mollusks are listed from an unnamed Pliocene formation [Pancho Rico Formation].

Durham, D. L., 1966, Geology of the Hames Valley, Wunpost, and Valleton quadrangles, Monterey County, California: U.S. Geol. Survey Bull. 1221–B, 53 p.

Lists two mollusks from the Monterey Shale and 66 mollusks from the lower Pliocene Pancho Rico Formation.

Durham, D. L., 1968a, Geologic map of the Adelaida quadrangle, San Luis Obispo County, California: U.S. Geol. Survey Geol. Quad. Map GQ–768.

Late Miocene marine mollusks occur in the Santa Margarita Formation; early Pliocene marine mollusks occur in the Pancho Rico Formation.

Durham, D. L., 1968b, Geology of the Tierra Redonda Mountain and Bradley quadrangles, Monterey and San Luis Obispo Counties, California: U.S. Geol. Survey Bull. 1255, 60 p.

Seven molluscan taxa are recorded from the Vaqueros Formation, five from the Santa Margarita Formation, and 28 from the Pancho Rico Formation; identifications are by W. O. Addicott.

Durham, D. L., and Addicott, W. O., 1964, Upper Miocene and Pliocene marine stratigraphy in southern Salinas Valley, California: U.S. Geol. Survey Bull. 1194–E, p. E1–E7.

The upper Miocene Santa Margarita Formation in the southern Salinas Valley area is characterized by the giant oyster *Crassostrea titan*. The overlying Pancho Rico Formation contains a large molluscan fauna of early Pliocene age. Ten mollusks that are characteristic of the California Pliocene are listed from the Pancho Rico.

DURHAM, D. L., and ADDICOTT, W. O., 1965*, Pancho Rico Formation, Salinas Valley, California: U.S. Geol. Survey Prof. Paper 524–A, p. A1–A22, 5 pls.

An early Pliocene molluscan fauna of about 120 taxa consists largely of species not previously reported from the Salinas Valley area. Many of the mollusks are illustrated; a few are undescribed. Shallow-water assemblages indicate marine climate warmer than occurs at this latitude today. Fossil localities are listed and are shown on a generalized geologic map. Eight mollusks are listed from exposures of the underlying upper Miocene Santa Margarita Formation in Vineyard Canyon.

Durham, D. L., and Yerkes, R. F., 1964, Geology and oil resources of the eastern Puente Hills area, southern California: U.S. Geol. Survey Prof. Paper 420–B, p. B1–B62.

Molluscan assemblages are recorded from the Topanga Formation, the lower member of the Fernando Formation, and the upper member of the Fernando Formation.

DURHAM, J. W., 1937, Gastropods of the family Epitoniidae from Mesozoic and Cenozoic rocks of the West Coast of North America, including one new species by F. E. Turner and one by R. A. Bramkamp: Jour. Paleontology, v. 11, no. 6, p. 479–512, pls. 56–57.

Description and classification of about 30 epitoniids of Miocene and Pliocene age from Mexico to Alaska. Included are eight newly described taxa. A chart shows the stratigraphic occurrence of species; a key to epitoniid genera and subgenera is included.

Durham, J. W., 1942a, Eocene and Oligocene coral faunas of Washington: Jour. Paleontology, v. 16, no. 1, p. 84–104.

Restudy of molluscan species in the fauna of the Sooke Formation, Vancouver Island, British Columbia (lat 48.5° N.), considered by Clark and Arnold (1923) to be analogous to living species, suggests latitudinal equivalence to molluscan assemblages now living in the latitude of San Francisco, California (lat 38° N.). The analysis was based on the median-of-midpoints method of Keen (1937).

DURHAM, J. W., 1942b*, Notes on Pacific coast Galeodeas: Jour. Paleontology, v. 16, no. 2, p. 183–191, pls. 29–30.

Echinophoria apta occurs consistently above *E. rex* in the upper part of the Twin River Formation. The uppermost part of the Twin River Formation containing *E. apta* is younger than the fauna of the type Blakeley Formation near Seattle. "*Galeodea*" *petrosa* is not related to *E. apta* and *E. rex*.

Durham, J. W., 1943, Pacific Coast Cretaceous and Tertiary corals: Jour. Paleontology, v. 17, no. 2, p. 196–202.

Arca sisquocensis Reinhart, var. occurs in an unnamed formation of "late Pliocene or Pleistocene" age at Little River Beach State Park (Moonstone Beach), Humboldt County, Calif.

DURHAM, J. W., 1944, Megafaunal zones of the Oligocene of northwestern Washington: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 27, no. 5, p. 101–211, pls. 13–18.

The definitive report on Oligocene and lower Miocene biostratigraphy of western Washington. Lists 19 "Miocene" fossils from the Clallam Formation and about 40 species each from his *Echinophoria apta* zone in the upper part of the Twin River Formation and from rocks near Seattle correlated with the Sooke Formation. Describes four new molluscan taxa from lower Miocene formations. Included are a stratigraphic column, geologic sketch maps, and a chart showing generalized phylogenies of stratigraphically important molluscan genera.

Durham, J. W., 1948a, Age of post Mint Canyon beds [California] [abs.]: Geol. Soc. America Bull., v. 59, no. 12, pt. 2, p. 1386.

The Modelo(?) Formation of Kew in the eastern Ventura basin, California, includes many mollusks indicative of late Miocene age and of correl

tion with the Cierbo and Neroly Formations of the Mount Diablo area of central California. Eleven mollusks are recorded from this formation.

Durham, J. W., 1948b, Relationship of California Upper Miocene-Lower Pliocene vertebrate and invertebrate faunas [abs.]: Geol. Soc. America Bull., v. 59, no. 12, pt. 2, p. 1386.

The Mint Canyon vertebrate fauna is pre-upper Neroly in terms of the Pacific coast molluscan chronology. The Clarendonian Age of the vertebrate scale includes the Briones, Cierbo, and Neroly ["Stages"] of the molluscan chronology.

Durham, J. W., 1950a, Cenozoic marine climates of the Pacific Coast: Geol. Soc. America Bull., v. 61, no. 11, p. 1243–1264.

The definitive analysis of Cenozoic marine climate of the Pacific coast. During the Miocene and the Pliocene the marine climate was significantly warmer than today according to analysis of shallow water mollusks and corals. Marine climate cooled gradually during the Neogene, possibly with minor oscillations.

DURHAM, J. W., 1950b, Megascopic paleontology and marine stratigraphy, pt. II, p. 1–216 *in* 1940 E. W. Scripps Cruise to the Gulf of California: Geol. Soc. America Mem. 43, 48 pls.

Catalog of Pliocene and Pleistocene mollusks collected during the E. W. Scripps 1940 Cruise in the Gulf of California. Many new species are described and illustrated. There is an extensive discussion of the origin and modern affinities of the Gulf of California molluscan province. The age of the Imperial Formation (and San Marcos Formation) is revised from early Miocene to early Pliocene. Faunal units in the Gulf are correlated with fossiliferous sections from Southern California, the outer coast of Baja California, Colorado Desert, Panama, and Ecuador.

Durham, J. W., 1953, Miocene at Cape Blanco, Oregon [abs.]: Geol. Soc. America Bull., v. 64, no. 12, pt. 2, p. 1504–1505.

An unconformity within the Empire Formation of Diller (1903) separates a fauna containing *Mytilus middendorffi* and other mollusks of middle Miocene age from an overlying fauna containing mollusks characteristic of the type Empire Formation of early Pliocene age. Five middle Miocene mollusks are listed.

Durham, J. W., 1954, The marine Cenozoic of southern California, [pt.] 4 *in* chap. 3 *of* Jahns, R. H., ed., Geology of southern California: California Div. Mines Bull. 170, p. 23–31.

Includes a correlation chart of nine important sequences in southern California based upon the marine megafaunal chronology, and a chart showing correlation of the mammalian, megafaunal, and microfaunal sequences of the Pacific coast by J. W. Durham, R. M. Kleinpell, and D. E. Savage. A paleobathymetric curve for the Los Angeles basin depicts a middle Miocene-early Pleistocene cycle with depths of about 4,000 feet attained during the early part of the Pliocene. A paleotemperature curve shows progressive climatic cooling during the Cenozoic interrupted by a late Pliocene warm pulse and several oscillations during the Pleistocene.

Durham, J. W., 1957a, Notes on echinoids: Jour. Paleontology, v. 31, no. 3, p. 625–631, pl. 72.

Vaquerosella coreyi Durham, a newly described echinoid from the Te
blor Formation at Reef Ridge, Calif., occurs with mollusks of middle M
cene age including *Turritella ocoyana* and *Aequipecten andersoni*. Accor
ing to L. G. Hertlein the fauna [mollusks] of Tertiary mudstone a
sandstone exposed at Lituya Bay, southeastern Alaska, is correlative wi
the Empire Formation of southwestern Oregon. The fauna lived in a sh
low water environment, mostly less than 50 fathoms deep under climat
conditions similar to those now prevailing along the Oregon and Washin
ton coast.

Durham, J. W., 1957b, Pelecypod *Dosinia* in lower Oligocene of central Califo
nia [abs.] : Geol. Soc. America Bull., v. 68, no. 12, pt. 2, p. 1823–1824.

Dosinia first appears on the Pacific coast in rocks of Oligocene a
[*Acila shumardi* zone]. The initial occurrence of this pelecypod is n
therefore, indicative of Miocene age as held by some paleontologists.

Durham, J. W., 1958, Climatic significance of marine invertebrates during lat
geologic time [abs.] : Science, v. 128, no. 3332, p. 1143.

During the Tertiary the limits of the marine tropical zone, as defined
warm-water marine faunas, were much closer to the poles than today. T
tropical zone extended above the middle latitudes during the early Cen
zoic but retreated toward its present limits during the later part of t
Cenozoic.

Durham, J. W., 1959a, Paleoclimates, *in* Physical chemistry of the earth : Lo
don, Pergamon Press, v. 3, p. 1–16.

A review of Paleogene and Neogene marine climate of the northeaste
Pacific Ocean based, in large part, on inferences from marine mollus
(Durham, 1950).

DURHAM, J. W., 1959,* The pelecypod *Dosinia* in the lower Oligocene of Cal
fornia : Veliger, v. 2, no. 2, p. 21–24, pl. 4.

The interior of *Dosinia mathewsoni*, an early Miocene species from t
San Ramon Formation, is figured and compared with a new species
early Oligocene age from the Kirker Formation.

Durham, J. W., 1960, Tertiary : Chicago, London, Toronto, Geneva, Sydney, E
cyclopaedia Britannica, Inc., v. 21, p. 877–880.

West American megafaunal "stages" are correlated with the provinci
microfaunal sequence and with European stages.

Durham, J. W., 1963, Paleogeographic conclusions in light of biological data,
Gressit, J. L., ed., Pacific Basin Biogeography : Honolulu, Bernice Bisho
Mus. Press, p. 353–365.

The provincial aspect of California Cenozoic molluscan faunas is tab
lated, epoch by epoch, showing that very few, if any, Miocene and Pliocen
species have been recorded from other provinces (11 out of 300 for t
Pliocene; none out of 370 for the Miocene). The Bering Strait opened du
ing the Pliocene; the Panama-Costa Rican portal was open until the mi
dle Miocene.

Durham, J. W., and Allison, E. C., 1960, The geologic history of Baja Califo
nia [Mexico] and its marine faunas, *in* Symposium—The biogeography
Baja California and adjacent seas—Pt. 1, Geologic history : Systematic Z
ology, v. 9, no. 2, p. 47–91.

The oldest Miocene deposits, from near La Purísima, contain a *Turritella* allied to *T. hamiltonensis* suggesting correlation with the *Echinophoria apta* zone of Washington. Rocks correlated with the lower Miocene Vaqueros and middle Miocene Temblor Formations of Southern California occur in the southern part of the peninsula, as do rocks of late Miocene age. Pliocene rocks occur at many places along both coasts. Provincialism in molluscan faunas accelerated during the Neogene owing to closing of Pacific-Caribbean connections. Paleogeographic maps showing the maximum extent of Miocene and Pliocene seas are included, as is a useful bibliography.

Durham, J. W., Arellano, A. R. V., and Peck, J. H., Jr., 1955, Evidence for no Cenozoic Isthmus of Tehuantepec seaways: Geol. Soc. America Bull., v. 66, no. 8, p. 977–992.

Molluscan faunas of Miocene age from near Santa Lucrecia are of Caribbean affinities and not at all similar to Pacific faunas of Miocene age suggesting that no isthmus existed in this area during the Miocene as had been postulated by others.

Durham, J. W., Harper, Herbert, and Wilder, Beverly, Jr., 1942, Lower Miocene in the Willamette Valley, Oregon [abs.]: Geol. Soc. America Bull., v. 53, no. 12, p. 1817.

A molluscan assemblage with *Spisula* cf. *S. catilliformis*, *S. albaria*, *Tellina oregonensis*, and *Pecten sespeensis* occurs near Butte and Abiqua creeks about 30 miles south of Portland. The fauna is considered to be equivalent to the Vaqueros Formation of California.

Durham, J. W., Jahns, R. H., and Savage, D. E., 1964, Marine-nonmarine relationships in the Cenozoic section of California, [Pt.] 7 *in* chap. 3 *of* Jahns, R. H., ed., Geology of Southern California: California Div. Mines Bull. 170, p. 59–71.

Continental vertebrate occurrences in California are correlated with the marine megafaunal sequence. There is a chart showing the relationship of key vertebrate-bearing sequences to marine strata. Terrestrial vertebrate, marine megafaunal, and marine microfaunal sequences for the Pacific coast are also correlated with European stages.

urham, J. W., and MacNeil, F. S., 1965, Cenozoic marine faunal migrations through the Bering Strait region [abs.]: Internat. Assoc. Quaternary Res., VIIth Gen. Sess., p. 16.

The earliest migrations through the Bering Straits may have taken place during the late Miocene or earliest Pliocene. Many more invertebrates of Pacific origin have reached the Atlantic by this route than have entered the Pacific from the Atlantic.

urham, J. W., and MacNeil, F. S., 1967, Cenozoic migrations of marine invertebrates through the Bering Strait Region, *in* Hopkins, D. M., ed., The Bering Land Bridge: Stanford, Calif., Stanford Univ. Press, p. 326–349.

List 69 mollusks of Pacific origin that have entered the Arctic-Atlantic area perhaps owing to the prevailing eastward currents in the Arctic Ocean. Fourteen mollusks are considered to have entered the Pacific from the Atlantic Ocean. The earliest migration is thought to have taken place in the late Miocene or earliest Pliocene based upon five molluscan genera. Many Pacific species had reached the Atlantic by the late Pliocene. More

migrations occurred during the Pleistocene. The seaways may have opened and closed during the late Miocene to Holocene but molluscan data do not permit dating of such events.

Durham, J. W., and Primmer, S. R., 1962, Displaced Miocene molluscan provinces along the San Andreas Fault, California, by C. A. Hall, Jr.: Am. Assoc. Petroleum Geologists Bull., v. 46, no. 10, p. 1952–1953.

A critique of Hall's (1960) late Miocene paleotemperature report in which it is contended that certain data were overlooked or incorrectly interpreted.

Durham, J. W., and Sasa, Yasuo, 1961, A comparison of the fauna of the Poronai Formation of Japan with west American middle Tertiary faunas [abs.]: Ninth Pacific Sci. Cong. Proc., v. 12, p. 276.

Twenty-three mollusks from the Poronai Formation of Hokkaido are very similar to species from the "Blakeley Stage" of Oregon, Washington, and Alaska, suggesting age equivalence. Ten pairs of most similar Japanese and west American species are listed. The Poronai Formation is shown to be equivalent to Poul Creek Formation, Blakeley Formation, and Yaquina Formation in a correlation chart.

Durham, J. W., and Savage, D. E., 1964, New land mammal and marine megafossil associations in the Neogene of California [abs.]: Geol. Soc. America Bull., v. 65, no. 12, pt. 2, p. 1338.

The Clarendonian Age of the vertebrate sequence is equivalent to the "Santa Margarita 'stage'" based on the close association of late Miocene marine mollusks with continental vertebrates at Comanche Point in the San Joaquin basin and at Cammatta Ranch near Paso Robles. A few mollusks are listed from each locality.

Durham, J. W., and Wolfe, J. A., 1958, Joint occurrence of *Dendraster* and *Scutellaster* [*Anorthoscutum*] [abs.]: Geol. Soc. American Bull., v. 69, no. 12, pt. 2, p. 1682–1683.

Specimens of *Pationopecten lohri* and *Opalia varicostata*, and other unlisted mollusks, occur about 100 ft above a locality in the type section of the Jacalitos Formation in which the two echinoids indicated in the title were found.

Durham, J. W., and Zullo, V. A., 1961, The genus *Bankia* Gray (Pelecypoda) in the Oligocene of Washington: Veliger, v. 4, no. 1, p. 1–4, 3 text figs.

Occurrences of "*Teredo* sp." from Miocene formations on the Pacific coast are reviewed.

Eames, F. E., Banner, F. T., Blow, W. H., and Clarke, W. J., 1962, Fundamentals of mid-Tertiary stratigraphical correlation; with a contribution by L. R. Cox: New York, Cambridge Univ. Press, 163 p.

A brief discussion of Foraminifera and a few mollusks from formations in Panama that are considered, by the authors, to be correlative with the Aquitanian Stage of Europe and of Miocene age.

Eaton, J. E., 1926, A contribution to the geology of Los Angeles Basin, California: Am. Assoc. Petroleum Geologists Bull., v. 10, no. 8, p. 753–767.

Includes a list of six mollusks from the Vaqueros Formation of the San Joaquin Hills identified by Ralph Arnold and 13 mollusks from the lower part of the Fernando Group identified by P. P. Goudkoff.

Eaton, J. E., 1928, Divisions and duration of the Pleistocene in southern California: Am. Assoc. Petroleum Geologists Bull., v. 12, no. 2, p. 111–141.

A faunal assemblage of 27 molluscan taxa occurs in "Pliocene horizon MF7" of the Fernando Group of the western Ventura basin (identified by A. J. Tieje). Thirty-six percent of the species are considered to be extinct whereas less than 12 percent of the species in a "Pliocene-Pleistocene transition zone" of the Saugus Formation are extinct. This change takes place within 40 ft of strata in a conformable sequence.

Eaton, J. E., 1932, Decline of Great Basin, southwestern United States: Am. Assoc. Petroleum Geologists Bull., v. 16, no. 1, p. 1–49.

A series of eight paleographic maps of California Neogene and Quaternary is presented.

Eaton, J. E., 1939a, Tie-ins between the marine and continental records in California: Am. Jour Sci., v. 237, no. 12, p. 899-919.

Three Miocene and two Pliocene mega-invertebrate stages, and several index species of mollusks, are correlated with some of the principal continental vertebrate faunas from California. The California Miocene is characterized by the abundance and taxonomic diversity of species of *Lyropecten*; the European analog *Gigantopecten* marks the base of the Miocene in Europe. Pliocene mollusks record a transition from warm temperate climate at the outset of the epoch to cool temperate at the close.

Eaton, J. E., 1939b, Geology and oil possibilities of Caliente Range, Cuyama Valley, and Carrizo Plain, California: California Jour. Mines and Geology, v. 35, p. 255–274.

Stratigraphic descriptions of Miocene formations include mention of a few characteristic mollusks.

Eaton, J. E., 1943, Caliente Range, Cuyama Valley, and Carrizo Plain [California]: California Div. Mines Bull. 118, p. 453-455.

Columnar sections of the Cuyama Valley and the Caliente Range show occurrence of characteristic mollusks in the Vaqueros, Temblor, and Monterey "stages."

EATON, J. E., GRANT, U.S., and ALLEN, H. B., 1941, Miocene of Caliente Range and environs, California: Am. Assoc. Petroleum Geologists Bull., v. 25, no. 2, p. 193–262, 9 pls.

Initial biostratigraphic study of Caliente Range and Cuyama Valley areas with lists of Miocene faunas (Vaqueros, Temblor, and Santa Margarita Formations). Several mollusks are illustrated; 10 new mollusks are described and illustrated. Several Vaqueros and Temblor zones are indicated on stratigraphic columns for the Caliente Range; other zones are shown for the Santa Margarita [Briones, Cierbo, Neroly] on the south side of Cuyama Valley. Paleogeographic maps, both detailed and regional, are also included. Successive cooling of marine climate from tropical conditions during the Vaqueros to subtropical conditions during the Temblor and even cooler climate during the Monterey is postulated.

Edwards, E. C., 1934, Pliocene conglomerates of Los Angeles basin and their paleogeographic significance [California]: Am. Assoc. Petroleum Geologists Bull., v. 18, no. 6, p. 786–812.

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Pholad borings occur in upper Miocene or lower Pliocene breccia in the San Joaquin Hills and in lower Pliocene strata in the Santa Monica Mountains.

Edwards, E. C., 1943, Kern Front area of the Kern River Oil field [California]: California Div. Mines Bull. 118, p. 571–574.

Casts of *Macoma kerica* and *Cryptomya* are recorded from his Etchegoin Claystone Member.

Edwards, E. C., 1951, Los Angeles region [California] in possible future petroleum provinces of North America: Am. Assoc. Petroleum Geologists Bull., v. 35, no. 2, p. 241–248.

Some Miocene "fossil markers" [mollusks] are indicated in a correlation chart of Los Angeles basin oil fields.

Edwards, K. L., 1940, Stratigraphic occurrence of *Pecten sanctaecruzensis* in California [abs.]: Geol. Soc. America Bull., v. 51, no. 12, pt. 2, p. 1983.

Pecten sanctaecruzensis occurs with *Chlamys perrini* and *Dosinia margaritana* at a locality near The Indians, Monterey County, Calif.

Egenhoff, E. L., 1943, List of publications cited throughout Bulletin 118: California Div. Mines Bull. 118, p. 689–720.

Reports cited in this publication are arranged alphabetically by author. This is a comprehensive bibliography covering publications issued prior to 1942.

Ehlen, Judi, 1967, Geology of State Parks near Arago, Coos County, Oregon: Ore Bin, v. 29, no. 4, p. 61–82.

An unnamed concretionary, fossiliferous sandstone of Miocene age has been found by John Armentrout near Sitka Dock in Coos Bay. It contains the same middle Miocene molluscan fauna initially recorded by James (1950) from nearby dredgings. Four mollusks characteristic of the Pliocene Empire Formation are listed.

Eichwald, Eduard von, 1871, Die Miocän- und Kreideformation von Alaska und den aleutischen Inseln, *in* Eichwald, Eduard von, Geognostisch-paleontologische Bemerkungen über die Halbinsel Mangischalk und die aleutischen Inseln: St. Petersburg, p. 88–200, illus.

According to Dall and Harris (1892), Eichwald referred all of Grewingk's (1850) Tertiary species to the Cretaceous. Many of these species are of Miocene age.

Ekman, Sven, 1953, Zoogeography of the sea: London, Sidgwick and Jackson Ltd., 417 p.

A late Tertiary connection between the Atlantic and North Pacific Oceans had a profound influence on the invertebrate fauna of the North Atlantic. Six mollusks that were restricted to either the North Atlantic or North Pacific during the late Tertiary but which are now found living only in the opposite ocean basin are listed.

Eldridge, G. H., 1907a, The Puente Hills oil district, southern California, *in* Eldridge, G. H., and Arnold, Ralph, The Santa Clara Valley, Puente Hills, and Los Angeles oil districts, southern California: U.S. Geol. Survey Bull. 309, p. 102–137.

Reports one pectinid from the Miocene Puente Formation and 38 species from the Pliocene Fernando Formatic.

Eldridge, G. H., 1907b, The Santa Clara Valley oil district, southern California, *in* Eldridge, G. H., and Arnold, Ralph, The Santa Clara Valley, Puente Hills, and Los Angeles oil districts, southern California: U.S. Geol. Survey Bull. 309, p. 1–101.

Lists molluscan assemblages from the Miocene Vaqueros and Pliocene Fernando Formations in the Santa Clara Valley.

ELDRIDGE, G. H., and ARNOLD, RALPH, 1907*, The Santa Clara Valley, Puente Hills, and Los Angeles oil districts, southern California: U.S. Geol. Survey Bull. 309, 266 p., pls. 25–41.

Includes four papers, two by Eldridge—on the Santa Clara Valley and Puente Hills—and two by Arnold—on the Los Angeles oil district and on characteristics fossils of the southern California area; Miocene and Pliocene mollusks are figured or listed in each report.

Elliott, H. S., 1875, A report on the condition of affairs in the Territory of Alaska: U.S. Treasury Dept.

According to Dall (1899) the occurrence of fossil mollusks in limestone and argillite at Black Bluff,, St. Paul Island, is noted. According to Barth (1956, p. 155) the fossil shells collected by Elliott during the period 1872–74 were also referred to in later general accounts of Alaska published by Elliott in 1887 and in 1895.

Elliott, W. J., Tripp, Eugene, and Karp, S. E., 1968, Road Guides, west side oil fields and Temblor Range outcrop area [California]: Am. Assoc. Petroleum Geologists, Geology and oilfields, west side southern San Joaquin Valley, p. 104–130.

Lucina (*Phacoides*) *acutilineatus* occurs in the Phacoides Sandstone. A few Miocene mollusks are listed on a generalized stratigraphic column for the Carneros Creek-Chico Martinez Creek area.

Ellis, A. J., and Lee, C. H., 1919, Geology and ground waters of the western part of San Diego County, California: U.S. Geol. Survey Water-Supply Paper 446, 321 p.

Pliocene mollusks identified by W. H. Dall (1874) from the San Diego well are re-listed. Mollusks recovered from several other wells at San Diego are also listed.

EMERSON, W. K., 1957, Three new Tertiary scaphopods, with a review of the extinct western North American Siphonodentaliidae: Jour. Paleontology, v. 31, no. 5, p. 985–991.

Cadulus (*Platyschides*?) *addicotti* n. sp. is described from the middle Miocene of the Kern River area, California. *Siphonodentalium arcticus* (Dall) from the Pliocene Carter Creek Beds near Camden Bay, Arctic Alaska, is reviewed.

Emerson, W. K., 1958, Notes on the scaphopod mollusks: rectifications of nomenclature II: Biol. Soc. Washington Proc., v. 71, p. 91–94.

Miocene species of *Dentalium* from the Astoria Formation, their systematic position and stratigraphic occurrences, are discussed.

EMERSON, W. K., 1964, Results of the Puritan-American Museum of Natural History expedition to westen Mexico: 20. The Recent mollusks: Gastropoda: Harpidae, Vasidae, and Volutidae: Am. Mus. Novitates, no. 2202, 23 p.

Vasum pufferi n. sp. occurs in the Pliocene Imperial Formation, Carrizo Mountain, Imperial County, Calif. It was originally identified as *V. caestum* Broderip by Hanna (1926). The Cenozoic history of *Vasum* is reviewed.

Emerson, W. K., 1965, The eastern Pacific species of *Niso* (Mollusca: Gastropoda): Am. Mus. Novitates, no. 2218, 12 p.

Niso? *antiselli*, a Miocene species from central California, is excluded from *Niso* (*Niso*) because of the lack of a nisoid umbilicus.

Emerson, W. K., and Addicott, W. O., 1953, A Pleistocene invertebrate fauna from the southwest corner of San Diego County, California: San Diego Soc. Nat. History Trans., v. 11, no. 17, p. 429–444.

Pliocene fossils including *Patinopecten healeyi* occur near the mouth of a ravine half a mile inland from the United States-Mexican border. This is the San Diego Formation "border locality" of later workers.

Emerson, W. K., and Hertlein, L. G., 1960, Pliocene and Pleistocene invertebrates from Punta Rosalia, Baja California, Mexico: Am. Mus. Novitates, no. 2004, p. 1–38, 3 figs.

Ten mollusks of Pliocene age are recorded from exposures 20 to 30 ft thick underlying a Pleistocene marine terrace. The assemblage is compared with Pliocene mollusks from Turtle Bay and elsewhere along the coast of northwestern Baja California (Hertlein and Allison, 1959).

EMERSON, W. K., and HERTLEIN, L. G., 1964, Invertebrate megafossils of the Belvedere Expedition to the Gulf of California: San Diego Soc. Nat. History Trans., v. 13, no. 17, p. 333–368, figs. 1–6.

Mollusks from about 20 localities of Pliocene age on islands in the Gulf of California are recorded. Several Pliocene mollusks are illustrated and treated systematically. *Gyrineum* (*Bechtelia*) n. subgen. is proposed for a group of west American bursids ranging in age from Eocene to Pleistocene. All of the Pliocene and Pleistocene mollusks are combined into a systematic list in which geologic and geographic occurrences are indicated.

Emmons, S. F., and Merrill, G. P., 1894, Geological sketch of Lower California: Geol. Soc. America Bull., v. 5, p. 489–514.

Mytilus californianus and a *Pecten* similar to *P. cerrosensis* occur in the "mesa sandstones" near San Quintin; these may be of Miocene age.

ENGLISH, W. A., 1914a, The *Agasoma*-like gastropods of the California Tertiary: California Univ. Pubs., Dept. Geology Bull., v. 8, no. 10, p. 243–256, pls. 24–25.

A review of *Ficus*, *Trophosycon*, and *Agasoma* [including *Bruclarkia* of later usage]. Fourteen taxa, two of which are newly described, are treated systematically; most of these are illustrated.

ENGLISH, W. A., 1914b, The Fernando Group near Newhall, California: California Univ. Pubs., Dept. Geology Bull., v. 8, p. 203–218, pl. 23.

Seven new species of Pliocene mollusks, mostly from the Elsmere Canyon locality, are described. Lists 72 molluscan taxa from localities of early Pliocene age in Elsmere Canyon, Pico Canyon, and Holser Canyon. Faunas from the Ventura area, to the west, are of late Pliocene age.

English, W. A., 1916, Geology and oil prospects of Cuyama Valley, California: U.S. Geol. Survey Bull. 621–M, p. 191–215.

Lists four mollusks from the Vaqueros Formation near Santa Barbara Canyon, nine from the Vaqueros Formation southeast of Caliente Mountain, six from the Monterey Group (middle Miocene) from south of Cuyama Valley, and seven from the Whiterock Bluff Shale Member of Santa Margarita Formation.

English, W. A., 1918, Geology and oil prospects of the Salinas Valley-Parkfield area, California: U.S. Geol. Survey Bull. 691–H, p. 219–250.

The Santa Margarita Formation has a small fauna in which *Ostrea titan* and *Pecten estrellanus* are characteristic species.

English, W. A., 1921, Geology and petroleum resources of northwestern Kern County, California: U.S. Geol. Survey Bull. 721, 48 p., 2 pls., 2 figs.

The basal part of the Vaqueros Formation (Temblor Formation of Anderson, 1905) contains abundant, well-preserved megafossils, particularly near Carneros Springs and Media Agua Creek. The basal beds contain oysters north of Bitterwater Creek. A fossiliferous reef occurs at the base of the Miocene on the east side of Cedar Canyon near its mouth [Agua Sandstone of later usage]. *Turritella ocoyana* occurs 300 ft above the base of the Vaqueros Sandstone near the head of Antelope Valley.

English, W. A., 1926, Geology and oil resources of the Puente Hills region, southern California, with a section on the chemical character of the oil by P. W. Prutzman [p. 101–108]: U.S. Geol. Survey Bull. 768, 110 p.

Miocene mollusks from the Vaqueros Formation (four) and the Topanga Formation (14) are listed. The best Topanga locality is on the west side of the small anticline south of El Modena. Marine fossils occur at several localities in a zone about 3,000 ft above the base of the Pliocene Fernando Formation; 38 species of mollusks are recorded from localities near Brea and Olinda canyons.

ERMAN, A., 1843, Archiv für wissenschaftliche kunde von Russland, v. 3: Berlin, G. Reimer, 725 p., illus.

Two new species, *Nucula ermani* Girard and *Cardium aleuticum* Girard, are described from tuffaceous strata cropping out on Atka Island in the Aleutian chain.

Eschner, Standord, 1969, Geology of the central part of the Fillmore quadrangle, Ventura County, California: Am. Assoc. Petroleum Geologists, Pacific Coast Sec., Field Trip, June 6, 1969, 47 p.

A few mollusks are recorded from the Vaqueros Formation (presumably from Loel and Corey, 1932), the lower sandstone member of the Monterey Formation (presumably from Hudson and Craig, 1929), the Pico Formation, and the Santa Barbara Formation.

ETHERINGTON, T. J., 1931, Stratigraphy and fauna of the Astoria Miocene of southwest Washington: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 20, no. 5, p. 31–142, 14 pls.

The definitive report on the molluscan paleontology and stratigraphy of the Astoria Formation of the Grays Harbor area, Washington. Seventy-seven species of mollusks are listed, including 14 newly described taxa. Two new species are described from the upper Miocene Montesano Formation. The Astoria fauna is considered to be of middle Miocene age because 17 percent of the species are still living and because of faunal similarity to the Temblor Formation of California.

Evans, J. W., 1967, A re-interpretation of the sand-pipes described by Adegoke: Veliger, v. 10, no. 2, p. 174–175, pl. 17.

Late Miocene silicified burrows from San Luis Obispo County, Calif., believed to have been made by *Chaceia* by Adegoke (1966b) more likely were constructed by *Nettastomella rostrata*.

Evans, J. W., 1968, The effect of rock hardness and other factors on the shape of the burrow of the rock-boring clam, *Penitella penita*: Palaeogeography, Palaeoclimatology Palaeoecology, v. 4, no. 4, p. 271–278.

Burrow shape may be used in estimating rock hardness at the time of boring. Miocene burrows in siliceous and cherty mudstone (Adegoke, 1966) were formed when the rock was relatively soft.

Fairbanks, H. W., 1893a, Geology of San Diego; also portions of Orange and San Bernardino Counties [California]: California Mining Bur., 11th Rept. State Mineralogist, p. 76–120.

Four miles below Carrizo Station strata of shells including pectens and oysters of Miocene age cap the soft clay hills.

Fairbanks, H. W., 1893b, The validity of the so-called Wallala beds as a division of the California Cretaceous: Am. Jour. Sci., ser. 3, v. 45, p. 473–478.

"The mesas along the eastern side side of the [San Diego] bay on which the city is situated are filled with Pliocene fossils; the strata being separated from the Chico-Tejon by a small nonconformity" (p. 477).

Fairbanks, H. W., 1894a, Geology of northern Ventura, Santa Barbara, San Luis Obispo, Monterey, and San Benito Counties [California]: California Mining Bur., 12th Rept. State Mineralogist, p. 493–526.

Ostrea titan is abundant in sandstones south of Santa Margarita; it also occurs near La Panza.

Fairbanks, H. W., 1894b, Review of our knowledge on the geology of the California coast ranges: Geol. Soc. America Bull., v. 6, p. 71–102.

Miocene strata are the most extensive of all formations of the southern Coast Ranges; they are characterized by the giant oyster, *Ostrea titan*.

Fairbanks, H. W., 1895, The stratigraphy of the California Coast Ranges: Jour. Geology, v. 3, no. 4, p. 415–433.

Sandstones on the south side of Pine Mountain, Ventura County, Calif., have yielded [late] Miocene fossils including *Pecten discus* and *Ostrea titan*; 4 miles down the same canyon Bowers (1890) listed 25 species from the same stratum. A Miocene pectinid and ostreid occur on the south side of the "Cuyamas Range." Other mollusks of Miocene age occur near the old mission on Santa Ynez River, Santa Barbara County, in the north fork of Arroyo Atascadero near Templeton (*Pecten peckhami*) and near Arroyo Grande (three species of mollusks including *Arca microdonta*).

Fairbanks, H. W., 1896, The geology of Point Sal [California]: California Univ. Pubs., Dept. Geology Bull., v. 2, p. 1–92, pls. 1–2, 7 figs., map.

Pecten peckhami occurs in Miocene bituminous shales.

Fairbanks, H. W., 1898, Geology of a portion of the southern Coast Ranges [California]: Jour. Geology, v. 6, no. 6, p. 551–576.

Mollusk borings occur in boulders of "Monterey series" in the basal part of the San Pablo Formation. A fauna from this formation is briefly noted but no fossils are listed.

Fairbanks, H. W., 1904, San Luis folio [California]: U.S. Geol. Survey Geol. Atlas, Folio 101, 14 p., 4 maps.

Ostrea titan is an abundant and characteristic mollusk in the Santa Margarita Formation of the Salinas Valley. Exposures of the Vaqueros Formation are usually fossiliferous.

Fairchild, W. W., Wesendunk, P. R., and Weaver, D. W., 1969, Eocene and Oligocene Foraminifera from the Santa Cruz Mountains, California: California Univ. Pubs. Geol. Sci., v. 81, 93 p.

Sandstone beds in the Lambert Shale in the upper San Lorenzo River drainage contain a *Turritella inezana* and *Pecten magnolia* faunal assemblage. Neritic mollusks occur in the Vaqueros Formation in the Bear Creek-Brown School area.

FAUSTMAN, W. F., 1964, Paleontology of the Wildcat Group at Scotia and Centerville Beach, California: California Univ. Pubs. Geol. Sci., v. 41, no. 2, p. 97–160, 3 pls., 7 figs.

The Pliocene Rio Dell and Scotia Bluffs Formations of the Wildcat Group near Scotia contain a large molluscan fauna indicative of a fairly cold water environment. Sixty-seven mollusks are listed from these formations. The molluscan fauna of the Rio Dell Formation at Centerville Beach consists of 35 species, two of which are new. Many of the mollusks are illustrated. The report includes two measured sections and a correlation chart of Pliocene and Pleistocene formations of northern California and southern Oregon.

FENTON, C. L., and FENTON, M. A., 1958*, The fossil book, the exciting story of plants, animals, and lesser creatures during the past two billion years: Garden City, N.Y., Doubleday and Co., 482 p.

Illustrate *Lunatia lewisi* (Gould) "Miocene to Recent, Pacific coast of North America", *Ostrea titan* Conrad from the Miocene of California "length to 50 inches," and *Cardium coosense* Dall "Miocene to Recent, Pacific coast" (p. 169).

Ferguson, G. C., 1941, Correlation of oil field formations on east side San Joaquin Valley [California]: California Div. Mines Bull. 118, p. 239–246. [Report reprinted in Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, Calif., 1947, p. 117–124.]

The Etchegoin Formation is defined as "that portion of the Pliocene below the top of the *Mulinia densata* zone and above the originally defined Jacalitos formation."

Fiedler, W. M., 1944, Geology of the Jamesburg quadrangle, Monterey County, California: California Jour. Mines and Geology, v. 40, no. 2, p. 177–250.

Turritella ocoyana and *Anadara* n. sp. (identified by B. L. Clark) are among 19 larger invertebrates previously identified from the Vaqueros-Temblor Sandstone of this area in an unpublished M.A. thesis by C. L. Herold, Univ. of California, Berkeley. Several other new species may be present. Several other mollusks are listed from the Monterey Formation and from the upper Miocene San Pablo Formation.

Fitch, J. E., and Reimer, R. D., 1967, Otoliths and other fish remains from a Long Beach, California, Pliocene deposit: Southern California Acad. Sci. Bul., v. 66, no. 2, p. 77–91.

Tresus pajaroanus (Conrad) was recovered from an excavation for U.S. Interstate Route 405 (San Diego Freeway) in Long Beach, Calif. Identification of this species, and other unspecified mollusks, by G. P. Kanakoff indicates a Pliocene age.

Flynn, D. B., 1963, The San Benito-Waltham Canyon Trough—possible oil province? [California], *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip, 1963, p. 27–33.

Turritella ocoyana (identified by H. G. Schenck) is reported from the southwest part of the San Benito-Waltham Canyon trough on the east side of Priest Valley suggesting a "Temblor" age.

Forrest, L. C., and Gribi, E. A., Jr., 1963, Salinas Valley oilfields and San Andreas fault field trip, *in* Guidebook to the geology of Salinas Valley and the San Andreas fault [California]: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip, 1963, Road log, p. 120–160.

Nine mollusks of early Pliocene age are recorded from a locality in the Pancho Rico Formation about 1 mile east of San Lucas (identifications by W. O. Addicott).

Foss, C. D., and Blaisdell, R., 1968, Stratigraphy of the west side southern San Joaquin Valley [California]: Am. Assoc. Petroleum Geologists Guidebook, Geology and oilfields, west side southern San Joaquin Valley, p. 33–43.

A few mollusks from Miocene and Pliocene formations of the southwest part of the San Joaquin Valley (Temblor Range) are listed.

Fowler, G. A., 1966, Notes on late Tertiary Foraminifera from off the central coast of Oregon: Ore Bin. v. 28, no. 3, p. 53–60.

Mollusca and Foraminifera have been used in making age determinations from rock samples obtained from the continental shelf and slope off Oregon. The rocks recovered range from late Miocene to perhaps Pleistocene in age.

Fraser, G. D., and Barnett, H. F., 1959, Geology of the Delarof and westernmost Andreanof Islands, Aleutian Islands, Alaska: U.S. Geol. Survey Bull. 1028–I, p. 211–248.

Late Tertiary (possibly Miocene and Pliocene) mollusks from Kanaga and Tanaga Islands identified by F. S. MacNeil are recorded.

FRAZIER, KENNETH, 1968*, Marine fossils in Southern California: Earth Sci., v. 21, no. 1, p. 13–16, illus.

Five pelecypods from the Pliocene San Diego Formation are illustrated.

Fritsche, A. E., 1967, Taxonomy and distribution of some southern California Miocene mollusks: Geol. Soc. America, Program, 63d Ann. Mtg. Cordilleran Sec., p. 35–36.

Taxonomic, distributional, and stratigraphic notes on seven species of Miocene mollusks based on records from the Sierra Madre Mountains, Santa Barbara County, Calif., are presented.

GABB, W. M., 1861*, Descriptions of new species of American Tertiary fossils and a new Carboniferous cephalopod from Texas: Acad. Nat. Sci. Philadelphia Proc. for 1861, p. 367–372.

Six species from Miocene [?early Pleistocene] strata at Santa Barbara, Calif., are described.

GABB, W. M., 1866, Tertiary invertebrate fossils: California Geol. Survey, Paleontology, v. 2, sec. 1, pt. 1, p. 1–38, pls. 1–13.

An important systematic report in which about 40 new species of Miocene and Pliocene mollusks from various localities in California and Baja California are described. A few new genera and subgenera are proposed. Some of the new species from the Miocene south of Martinez and near Walnut Creek may be of late Oligocene age. A few previously described species are also illustrated.

GABB, W. M., 1869a, Tertiary invertebrate fossils: California Geol. Survey, Paleontology, v. 2, Cretaceous and Tertiary fossils, sec. 1, pt. 2, p. 39–63, pls. 14–18.

This is a continuation of descriptions in Gabb (1866).

Gabb, W. M., 1869b, Synopsis of the Tertiary invertebrate fossils of California: California Geol. Survey, Paleontology, v. 2, sec. 1, pt. 3, p. 65–124.

A systematic list of the known Tertiary and Quaternary species from California and Baja California together with geologic range and taxonomic notes for a few of the species is presented.

GALE, H. R., 1928, West coast species of *Hinnites* [California]: San Diego Soc. Nat. History Trans., v. 5, no. 9, p. 91–94.

Pecten (*Chlamys*) *multirugosus* var. *crassiplicatus* is described from the California Miocene.

Gale, H. R., 1929, Summary of West Coast subgenus *Trophosycon* [abs.]: Geol. Soc. America Bull., v. 40, p. 257–258.

Different species are recognized from middle Miocene strata of California and Washington. Undescribed species occur in the upper Miocene and the lower Pliocene strata of California.

Gale, H. R., 1931, Correlation between later Cenozoic deposits of California and of Europe [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 15, no. 5, p. 555–556.

A marked break in the molluscan faunal record defines the boundary between the Tertiary and the Quaternary. The break is the result of climatic cooling associated with the onset of glaciation. Alternating cool-water and warm-water faunas in the California Pleistocene permit recognition of the major glacial epochs in the marine sequence.

Galvez, V., 1927, Algunas exploraciones en el distrito sur de la peninsula de Baja California: Inst. Geol. Mexico, Anal., v. 2, no. 6, p. 157–194.

Marine mollusks collected by Dr. Ernesto Angermann from indurated sandstone about 600 meters above sea level are considered to be old beach deposits. These are from near Cacachilas. Two small areas of Tertiary sedimentary rocks are mapped on Ceralbo Island and on the east coast between Point Arena and Point Pescaderos.

Gealey, W. K., 1951, Geology of the Healdsburg quadrangle, California: California Div. Mines Bull. 161, p. 7–50.

The Merced Formation contains abundant molds of marine mollusks.

Gentry, A. W., 1943, Ten Section oil field [California]: California Div. Mines Bull. 118, p. 549–550.

An upper *Mulinia* zone occurs at a depth of about 4,000 ft in wells.

Gester, G. C., 1917, Geology of a portion of the McKittrick district, a typical example of the west side, San Joaquin Valley oil fields, and a correlation of the oil sands of the west side fields: California Acad. Sci. Proc., ser. 4, v. 4, no. 7, p. 207–227, pls. 32–33.

Several small assemblages of marine mollusks from the Etchegoin Formation along the southwest side of the San Joaquin Valley, mainly from well cores, are recorded. The northermost assemblage is from Lost Hills. Fossiliferous surface exposures occur along the West Side Highway near McKittrick oil field, on Muddy or Los Lobos Creek, and in the McKittrick oil field. Pliocene fossils occur in strata overlying Santa Margarita Formation west of Fellows.

Gester, G. C., and Galloway, John, 1933, Geology of Kettleman Hills oil field, California: Am. Assoc. Petroleum Geologists Bull., v. 17, no. 10, p 1161–1193.

A stratigraphic column for the Coalinga-Kettleman Hills and McKittrick-Midway-San Emigdio areas indicates the position of molluscan zones in the Etchegoin and San Joaquin Formations. The uppermost of three zones (lithologic zones) in the Temlor Formation at Reef Ridge is characterized by *Pecten andersoni.*

GLEN, WILLIAM, 1959, Pliocene and Lower Pleistocene of the western part of the San Francisco Peninsula: California Univ. Pubs. Geol. Sci., v. 36, no. 2, p. 147–198, pls. 15–17, 5 text figures.

Lists 49 mollusks from the type Merced Formation—middle Pliocene to lower Pleistocene. The Purisima Formation at Pillar Point, to the south, is of middle Pliocene age; 31 species of mollusks are listed from it. Includes a systematic section in which one new pelecypod is described, a columnar section, and geologic maps with fossil localities.

Glover, S. L., 1940, Browns Point Formation, Olympic Peninsula, Washington [abs.]: Geol. Soc. American Bull., v. 51, no. 12, p. 2022–2023.

A small fossil assemblage in this newly described formation suggests a "Miocene (Astoria?) age."

Goudkoff, P. P., 1934, Subsurface stratigraphy of Kettleman Hills oil field, California: Am. Assoc. Petroleum Geologists Bull., v. 18, no. 4, p. 435–475.

Includes subsurface records of mollusks from wells in the Kettleman Hills area (lower Pliocene and middle Miocene). Two faunas are recognized in the Jacalitos Formation. An informal sandstone unit in the lower part of the Monterey Formation is referred to as the *Pecten andersoni* sand. In addition to abundant specimens of the pectinid there are fragmentary oysters and a few *Turritella ocoyana.* This sand occurs within the *Valvulineria californica* zone.

Goudkoff, P. P., 1941, Correlation of oil field formations on west side of San Joaquin Valley [California]: California Div. Mines Bull. 118, p. 247–252.

Pecten andersoni is recorded from the Main sand (Miocene) of the Kettleman Hills oil field.

Goudkoff, P. P., 1947, Correlation of oil field formations on west side of San Joaquin Valley [California], *in* Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, California, 1947: p., 90–99.

Pecten andersoni is reported from the Main sand [Temblor Formation] in Kettleman Hills. The Pacific coast correlation chart of Weaver and others (1944) is reprinted in part [standard sections and four San Joaquin Valley columns].

Gower, H. D., 1960, Geologic map of the Pysht quadrangle, Washington: U.S. Geol. Survey Geol. Quad. Map GQ–129, scale 1:62,500.

Marine molluscan evidence suggests that the upper part of the Twin River Formation is of early Miocene age. Mollusks from the overlying Clallam Formation are correlated with the middle Miocene Astoria Formation.

GRABAU, AMADEUS, and SHIMER, H.W., 1909*, North American index fossils: Invertebrates: New York, v. I ,853 p., 1,210 figs.

A few Miocene and Pliocene mollusks from California and Washington are figured. Included is a short bibliographic list of reports dealing with Tertiary larger invertebrates from California and Alaska, as well as one for Mexico and central Amerca.

GRANT, U. S., 4th, 1930, *Mytilus loeli*, a new name for *Mytilus kewi* Wiedey (not *Mytilus kewi* Nomland) : Jour. Paleontology, v. 4, no. 4, p. 419–420.

Taxonomic revision of a Miocene mytilid from California.

Grant, U. S., 4th, 1933, Notes on *Searlesia* [abs.]: Geol. Soc. America Bull:. v. 44, pt. 1, p. 220.

Searlesia first appeared during the Oligocene in the Northern Pacific; it reached the Atlantic during the Pliocene by way of the Arctic Ocean.

GRANT, U. S., 4th, and GALE, H. R., 1931, Catalogue of the marine Pliocene and Pleistocene Mollusca of California: San Diego Soc. Nat. History Mem., v. 1, 1,036 p., 32 pls., 15 figs., 3 tables.

The single most important systematic report pertaining to the Pliocene molluscan faunas of the Pacific coast. Includes a comprehensive systematic catalog of California Pliocene and Pleistocene mollusks and a thorough review of stratigraphic and geographic distribution of species. Many species are illustrated. Twenty-six new species, mostly from the Neogene, are described. There are many notes pertaining to Miocene mollusks; a few species are illustrated. Include a correlation chart and an extended discussion of molluscan biostratigraphy of California Pliocene basins.

Grant, U. S., 4th, and Hertlein, L. G., 1938, The West American Cenozoic Echinoidea: California Univ., Los Angeles, Pub. Math. Phys. Sci., v. 2, 225 p., 30 pls., 17 figs.

Several records of important Miocene and Pliocene mollusks occurring with echinoids are scattered throughout the systematic section.

Grant, U. S., 4th, and Hertlein, L. G., 1941, Pliocene correlation chart: California Div. Mines Bull. 118, p. 201–202.

Pecten bellus and *Chlamys opuntia* occur in the Santa Barbara Formation; both are extinct and are considered to be indicative of Pliocene age.

GRANT, U. S., 4th, and QUAYLE, E. H., 1934, A new middle Miocene *Neptunea* from California: Nautilus, v. 47, no. 3, p. 91–93, 2 figs.

Neptunea (*Sulcosipho*) *catoni* n. sp. is described from middle Miocene rocks in the Caliente Range, San Luis Obispo County, Calif.

GRANT, U. S., 4th, and STEVENSON, R. E., 1948, A new *Pecten* from the upper Miocene of California: Jour. Paleontology, v. 22, no. 6, p. 804–805, 1 pl.

Pecten (*Pecten*) *juanensis* is described from the Neroly Formation (upper Miocene).

GRATACAP, L. P., 1912*, An unusual specimen of *Mytilus middendorffii* Grewingk, from Alaska: Am. Mus. Nat. History Bull. 31, p. 69–70, illus.

One specimen from Cape Seniavin, Alaska Peninsula, is described and illustrated. Grewingk's original illustrations of this species are refigured.

Grau, G., 1959, Pectinidae of the Eastern Pacific: Allan Hancock Pacific Exped., v. 23, p. 1–308, pls. 1–57.

An important report on living pectinids of the eastern Pacific. Geologic ranges for those species that also occur as fossils are listed.

Gray, C. H., Jr., 1961, Geology of the Corona South quadrangle and the Santa Ana Narrows area, Riverside, Orange, and San Bernardino Counties, California: California Div. Mines Bull. 178, p. 1–58.

"Fragmentary and poorly preserved megafossils were collected [from the Topanga Formation] from a number of places southwest of State Highway 71 along the Metropolitan Water District pipe line, but they could be dated only as Miocene" (p. 31).

Grayson, A. J., 1872, On the physical geography and natural history of the islands of the Tres Marias and Socorro, off the western coast of Mexico: Boston Soc. Nat. History Proc., v. 14, p. 261–303.

Contains the first notice of marine fossils on Maria Madre Island.

Grewingk, Constantin, 1848, Beitrag zur Kenntniss der geognostichen Beschaffenheit Californiens: Verhandlungen der Russisch-Kaiserlichen Mineralogischen Geellschaft zu St. Petersburg, 1847, p. 143–162.

Contains the first record of fossil invertebrates from the Gulf of California region.

GREWINGK, CONSTANTIN, 1850, Beitrag zur Kenntniss der orographischen und geognostischen Beschaffenheit der Nord-West Küste Amerikas mit den anliegenden Inseln: Verhandlungen der Russisch-Kaiserlichen Mineralogischen Gesellshaft zu St. Petersburg, 1848–1849, p. 76–324, pls. 1–7 [pls. 4–7 are of fossils].

Some new species of Tertiary mollusks from Alaska are described.

HAAS, OTTO, 1942, Miocene molluscs from Costa Rica: Jour. Paleontology, v. 16, no. 3, p. 307–316, 7 text figs.

Seventeen species of mollusks are recorded from localities near Carballo on the Pacific coast. One of these, *Mactra macescens* var. *elongata* is figured and described as new. The faunal assemblage is correlated with the fauna of the Gatun Formation of Panama; this is a northwest extension of that fauna along the Pacific coast. Two Pacific pectinids identified from highland areas of Costa Rica indicate that there was a connection between the Atlantic and Pacific during the Miocene.

Hackel, Otto, Edmonson, W. F., Pierce, R. L. Cross, R. K., Fletcher, G. L., and Groom, J. E., 1962, Road log of geologic field trip, *in* Geology of Carrizo Plains and San Andreas Fault [California]: San Joaquin Geol. Soc. and Pacific Sec. Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Guidebook, 1962, p. 37–50.

Three mollusks from an exposure of the upper Miocene Santa Margarita Formation near the junction of State Route 178 and San Juan River are listed.

Hackel, Otto, and Krammes, Kenneth, 1958, Road log: San Joaquin Geol. Soc. Guidebook, 1958 Spring Field Trip, Round Mountain area, p. 3–9.

The "*Turritella ocoyana* fauna" occurs in exposures of middle Miocene strata on Poso Creek and near mouth of Cottonwood Creek.

Haehl, H. L., and Arnold, Ralph, 1904, The Miocene diabase of the Santa Cruz Mountains in San Mateo County, California: Am. Philos. Soc. Proc., v. 43, no. 175, p. 16–53.

List 37 species from the Vaqueros Formation, 13 species from the Monterey Shale, and 52 species from the Purisima Formation.

Hagg, R., 1924, Stangenaskraniets skalbank: Geol. Föreningens Förh., v. 46, no. 5. Stockholm [reference from Soot-Ryen (1932)].

According to Soot-Ryen (1932) a few mollusks that are first recorded from upper Miocene or lower Pliocene deposits in the North Pacific-Bering Straits region and subsequently appear in upper Pliocene or Quaternary deposits in the North Atlantic are listed.

Hake, B. F., 1926, Occurrence of *Pholadomya* in the Miocene of California [abs.]: Geol. Soc. America Bull., v. 37, p. 214.

A specimen of *Pholadomya* occurs with a Temblor [middle Miocene] fauna near Bakersfield, Calif.

Hall, C. A., Jr., 1958a, Gastropod genus *Ceratostoma* [abs.]: Geol. Soc. America Bull. 69, no. 12, pt. 2, p. 1687.

The distribution and faunal associations of Miocene and Pliocene species of *Ceratostoma* indicate that the genus has gradually adapted from a warm or warm-temperate environment to its modern distribution in much cooler water environments. The described species of *Ceratostoma* fall into two groups, one living in warmer waters (12°–19°C), the other in cooler water (2°–15°C).

HALL, C. A., JR., 1958b, Geology and paleontology of the Pleasanton area, Alameda and Costra Costa County, California: California Univ. Pubs. Geol. Sci., v. 34, no. 1, p. 1–90, 2 figs., 5 maps, 12 pls., 69 refs.

Illustrates about 35 species of Miocene mollusks including four newly described taxa. Includes faunal lists of Miocene mollusks from the Sobrante Sandstone, Oursan Sandstone, Hambre Sandstone, Briones Formation, Cierbo Sandstone, and Neroly Sandstone.

Hall, C. A., Jr., 1959a, Displaced Miocene molluscan provinces along the San Andreas fault, California [abs.]: Geol. Soc. America Bull., v. 70, no. 12, pt. 2, p. 1723.

The distribution of late Miocene molluscan provinces and minimum shallow-water isotherms inferred from these associations suggest post-late Miocene lateral slip of from 50 to 150 miles along the San Andreas fault.

HALL, C. A., JR., 1959b*, The gastropod genus *Ceratostoma*: Jour. Paleontology, v. 33, no. 3, p. 428–434, pls. 61–63.

The genus *Ceratostoma* ranges from middle Miocene to Holocene. Five species have been described from the California Neogene; one of these, *C. delorae*, is figured.

Hall, C. A., Jr., 1960, Displaced Miocene molluscan provinces along the San Andreas fault, California: California Univ. Pubs. Geol. Sci., v. 34, no. 6, p. 281–308.

This analysis is based upon extensive faunal lists of late Miocene mollusks from seven areas in central California; an accompanying chart shows bathymetric and temperature ranges. These faunas are converted into inferred February minimum isotherms and into inferred late Miocene molluscan provinces. The inferences are utilized to reconstruct lateral slip along the San Andreas fault. Post-late Miocene movement of 120 miles is inferred, although movement may have varied between 50 and 150 miles. Includes a late Miocene paleogeographic map.

Hall, C. A., Jr., 1962a, Displaced Miocene molluscan provinces along the San Andreas fault [California], *in* Geology of Carrizo Plains and San Andreas Fault: San Joaquin Geol. Soc. and Pacific Sec. Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Guidebook, 1962, p. 24.

Infers marine surface water temperatures from late Miocene molluscan faunas in California and, from these, infers post-late Miocene right-lateral slip of from 50 to 150 miles along the San Andreas fault. A warm water *Arca-Turritella* faunal element in San Luis Obispo County west of fault is not developed in the San Joaquin Valley east of fault.

Hall, C. A., Jr., 1962b, Evolution of the echinoid genus *Astrodapsis*: California Univ. Pubs. Geol. Sci., v. 40, no. 2, p. 47–180.

Lists small assemblages of mollusks and echinoids from six members of the upper Miocene Santa Margarita Formation in the Phoenix-Saucelito Creeks area, San Luis Obispo County, Calif. These assemblages indicate deposition in shallow water—intertidal to 75 ft.

Hall, C. A., Jr., 1962c, Reply [to critical review by J. W. Durham and S. R. Primmer of "Displaced Miocene molluscan provinces along the San Andreas fault, California" (1960)]: Am. Assoc. Petroleum Geologists Bull., v. 46, no. 10, p. 1953–1960.

A rebuttal of Durham and Primmer's (1962) critique. Includes a revised late Miocene paleogeographic map showing inferred molluscan provinces and isotherms and a list of mollusks from the San Pablo Group.

HALL, C. A., JR., 1964, *Area* (Arca) *leptogrammica*, a new Tertiary pelecypod from the San Luis Obispo region, California: Jour. Paleontology, v. 38, no. 1, p. 87–88, pl. 22.

The new species is from the upper Miocene Santa Margarita Formation. Lists 12 mollusks that occur with the new *Arca*.

Hall, C. A., Jr., 1966, *Archaeopneustes moorefieldi*, a new Pliocene spatangoid echinoid from the San Luis Obispo area, California: Jour. Paleontology, v. 40, no. 5, p. 1123–1126, figs. 1–3.

Several mollusks from the Pismo Formation are listed. Related mollusks and some echinoids suggest a bathymetric range of 150–300 ft for the fossil occurrence.

Hall, C. A., and Corbató, C. E., 1967, Stratigraphy and structure of Mesozoic and Cenozoic rocks, Nipomo quadrangle, southern Coast Ranges, California: Geol. Soc. America Bull., v. 78, no. 5, p. 559–582.

Includes a check list of mollusks from localities in the Vaqueros Formation, Obispo Formation, Monterey Formation, Santa Margarita Formation, all of Miocene age, and the Pliocene Careaga Formation. The uppermost part of the Santa Margarita Formation is of Pliocene age.

Hall, C. A., and Surdam, R. C., 1967, Geology of the San Luis Obispo-Nipomo area, San Luis Obispo County, California: Geol. Soc. America Cordilleran Sec. Mtg., Guidebook, 1967, 25 p.

List common mollusks from the Vaqueros Formation, Obispo Tuff, and Pismo Formation. Specific molluscan occurrences in roadcuts along the field trip route are noted in the road log.

Hall, C. A., Turner, D. L., and Surdam, R. C., 1966, Potassium-argon age of the Obispo Formation with *Pecten lompocensis* Arnold, Southern Coast Ranges, California: Geol. Soc. America Bull., v. 77, no. 4, p. 443–446.

A rhyolitic tuff from the Obispo Formation yielded a plagioclase age of 20.9±1.5 m.y. [subsequently revised to 16.5±1.2 m.y. by Turner]. A few mollusks of middle Miocene age are reported for this formation.

Hall, E. A., and Redin, T., 1967, Big Mountain Oil Field, Ventura County, California, Stratigraphic section, *in* Geology of the Big Mountain Oil Field and the nearby area, including notes on the trip from Piru to Big Mountain, Ventura County, California: Am. Assoc. Petroleum Geologists, Pacific Sec., Spring Field Trip, morning section, 6 p.

Anomia vaquerosensis and *Rapana vaquerosensis* occur in the Vaqueros [Formation] at Big Mountain oil field. *Pecten healeyi* occurs in the basal part of the Las Posas [Formation].

HALL, E. B., and AMBROSE, A. W., 1917, Descriptions of new species from the Cretaceous and Tertiary of the Tesla, Pleasanton, San Jose, and Hamilton quadrangles, California: Nautilus, v. 30, no. 6, p. 68–71; no. 7, p. 77–82.

Five new species of pelecypods from rocks of Miocene age in the northern part of the Diablo Range are described. These were subsequently illustrated by Wiedey (1929c.)

Hall, N. Timothy, 1965, Late Cenozoic stratigraphy between Mussel Rock and Fleishhacker Zoo, San Francisco Peninsula [California], *in* International Association for Quaternary Research, VII Congress, Denver, Colorado: Guidebook for Field Conference I: Northern Great Basin and California, p. 151–158.

Nine mollusks from the lower part of the type Merced Formation are recorded.

Ham, C. K., 1952, Geology of Las Trampas Ridge, Berkeley Hills, California: California Div. Mines Spec. Rept. 22, 26 p.

Lists four species, including *Echinophoria apta*, from the San Ramon Formation; 14 species from the Monterey Formation; 10 species from the Briones Formation; four species from the Cierbo Formation; and three species from the Neroly Formation.

Hamilton, Warren, 1960, Pliocene(?) sediments of salt water origin near Blythe, southeastern California, *in* Short papers in the geological sciences: U.S. Geol. Survey Prof. Paper 400–B, p. B276–B277.

"Lime caps" similar to beach rock of tropical shores found at altitudes of at least 800 ft contain scattered pelecypods of late Cenozoic age.

Hamlin, Homer, 1904, Water resources of the Salinas Valley, California: U.S. Geol. Survey Water-Supply Paper 89, 91 p.

Eleven species are recorded from his "Vaquero Sandstone." Beds underlying the Monterey Shale near Stone Canyon in the Diablo Range are also referred to his Vaquero [Vaqueros] Formation.

Hanna, G D., 1919, Geological notes on the Pribilof Islands, Alaska, with an account of the fossil diatoms: Am. Jour. Sci., ser. 4, v. 48, p. 216–224.

Mollusks from Black Bluffs and from Tolstoi Point, St. Paul Island (identified by Dall, 1919), are of about the same age. Hanna considers the strata to be of Pliocene age.

HANNA, G D., 1923*, Upper Miocene lacustrine mollusks from Sonoma County, California: California Acad. Sci. Proc., ser. 4, v. 12, p. 31–41, pls. 1–3.

Four brackish-water mollusks, *Mya dickersoni* Clark, *Corbicula gabbiana* Henderson, *Nematurella euzona* n. sp., and *Goniobasis rodeoensis* (Clark) are recorded. All but the *Mya* are figured.

HANNA, G D., 1924, Rectifications of nomenclature: California Acad. Sci. Proc., ser. 4, v. 13, no. 8, p. 151–186.

Proposed many new names for Miocene and Pliocene marine mollusks.

Hanna, G D., 1926a, Expedition to the Revillagigedo Islands, Mexico, in 1925: California Acad. Sci. Proc., ser. 4, v. 15, no. 1, p. 1–113.

Records *Pecten cerrosensis* and *P. veatchii* from Pliocene sands at Cedros Island.

HANNA, G D., 1926b, Paleontology of Coyote Mountain, Imperial County, California: California Acad. Sci. Proc., ser. 4, v. 14, no. 18, p. 427–503, text fig. 1, pls. 20–29.

Basically a descriptive paleontologic account of larger invertebrates, mostly mollusks, collected by the author and earlier investigators from the type area of the Imperial Formation at Coyote [Carrizo] Mountain. Treats 63 mollusks including eight new species in the systematic section. Several other mollusks are figured. Many fragmentary specimens identifiably only to genus are noted but not listed. Concludes that the fauna is of Pliocene age. There is an extensive account of earlier work and age determinations.

Hanna, G D., 1927, Geology of West Mexican Islands: Pan-Am. Geologist, v. 48, p. 1–24.

Fossiliferous limestone of Pliocene age crops out on Maria Madre Island. Molluscan fossils of undetermined age occur on Clarion Island of the Revillagigedo group. Pliocene strata on Cedros Island have yielded many species of mollusks including *Pecten cerrosensis* and *P. veatchii*.

Hanna, G D., 1928, The Monterey Shale of California at its type locality with a summary of its fauna and flora: Am. Assoc. Petroleum Geologists Bull., v. 12, no. 10, p. 969–983, pls. 7–9.

Reviews paleontologic studies on mollusks of the Monterey Formation listing 10 species identified by previous investigators.

Hanna, G D., 1930, Geology of Sharktooth Hill, Kern County, California: California Acad. Sci. Proc., ser. 4, v. 19, no. 7, p. 65–83.

A general discussion of Miocene mollusk assemblages from the Kern River area and from Comanche Point including review of previous work. A few mollusks from well cores near Sharktooth Hill permit correlation with early Miocene assemblages of Anderson's (1911) A Zone at Pyramid Hill. A large pectinid and an ostreid occur in upper Miocene beds at Comanche Point.

Hanna, G D., 1936, Interesting whale jaw from Kern County, California[abs.]: Geol. Soc. America Proc. for 1935, p. 419.

Many specimens of *Phacoides acutilineatus* are associated with the lower jaw of a small-toothed whale in the basal sandstone of Anderson's Temblor Formation in Carneros Creek.

HANNA, G D., 1952*, Geology of the continental slope off Central California: California Acad. Sci. Proc., ser. 4, v. 27 ,no. 9, p. 325–358, pls. 7–14.

Pliocene specimens of *Compsomyax* and *Pecten caurinus* Gould, from the Wildcat Formation dredged in 96 fathoms southwest of Trinidad Head, northern California, are illustrated. Recoveries of similar material from 80 to 120 fathoms and as far as 30 miles offshore are recorded.

Hanna, G D., 1966, Introduced mollusks of western North America: California Acad. Sci. Occasional Papers 48, 108 p., 85 figs., 4 pls.

Mya occurs in Pliocene formations in central California.

Hanna, G D., and Hertlein, L. G., 1927a, VI. Geology and paleontology, *in* Expedition of the California Academy of Sciences to the Gulf of California in 1921: California Acad. Sci. Proc., ser. 4, v. 16, no. 6, p. 137–147.

The first general description of Neogene and Quaternary molluscan paleontology of the Gulf of California area. Mollusks recorded from near Boleo, Baja California, by Arnold in 1906 are of late Pliocene age.

Hanna, G D., and Hertlein, L. G., 1927b, Notes on *Ostrea californica* Marcou: Nautilus, v. 41, no. 2, p. 45–46.

An oyster from the Imperial Formation at Coyote Mountain, Calif., once identified by Hanna (1926) as *Ostrea iridescens* is believed to be *O. virginica* var. *californica* Marcou.

HANNA, G D., and HERTLEIN, L. G., 1938, New Tertiary mollusks from western North America: Jour. Paleontology, v. 12, no. 1, p. 106–110, pl. 21.

Five new species of Miocene mollusks from California are described.

HANNA, G D., and HERTLEIN, L. G., 1941*, Characteristic fossils of California: California Div. Mines Bull. 118, p. 165–182, illus.

Illustrate characteristic Miocene and Pliocene marine mollusks from California (4 plates).

HANNA, G D., and STRONG, A. M., 1949, West American mollusks of the genus *Conus*: California Acad. Sci. Proc., ser. 4, v. 26, no. 9, p. 247–322, pls. 5–10.

Two new species from Pliocene strata in Imperial Valley, Calif., *C. durhami* and *C. bramkampi*, are described.

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Hanna, M. A., 1926, Geology of the La Jolla quadrangle, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 16, no. 7, p. 187–246.

Includes a brief review of earlier work on the San Diego Pliocene.

Harmon, A. K., Jr., 1914, Eel River Valley, Humboldt County, geology and oil possibilities, *in* McLaughlin, R. P., Petroleum industry of California: California Div. Mines Bull. 69, p. 455–459.

Contains a brief description of Pliocene strata and a list of 12 fossils.

Harrison and Eaton [firm], 1920, Report on investigation of oil and gas possibilities of western Oregon: Oregon Bur. Mines and Geology, Mineral Resources Oregon, v. 3, no. 1, p. 3–37, 5 pls.

In describing the Yaquina Sandstone the following characteristic fossils are listed: *Aturia angustata, Acila thracia, Phacoides, Spisula.*

Hawley, H. J., 1917, Stratigraphy and paleontology of the Salinas and Monterey quadrangles, California [abs.]: Geol. Soc. America Bull., v. 28, p. 225.

Lists seven mollusks from the middle Miocene Temblor Sandstone and two from the upper Miocene Santa Margarita Formation.

Hay, E. A., 1963, Age and relationships of the Gold Hill pluton, Cholame Valley, California, *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip, 1963, p. 113–115.

Four mollusks from rocks mapped as Pliocene Jacalitos-Etchegoin (identifications by J. W. Durham and A. M. Keen), one of which was from a redeposited boulder of middle Miocene age, are recorded.

Hazzard, J. C., 1947, Road log, Los Angeles (Biltmore Hotel) to Santa Paula via San Fernando Valley, del Valle oil field, Fillmore, and South Mountain oil field, *in* Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, California, 1947: p. 17–25.

Fossiliferous Pliocene and Pleistocene exposures in Ventura basin traversed by the field trip route are noted in the road log.

Heaslip, W. G., 1968, Cenozoic evolution of the alticostate venericards in Gulf and east coastal North America: Palaeontographica Americana, v. 6, no. 39, p. 55–135, pls. 20–29.

Two living species of *Venericardia, V. crassicostata* and *V. megastropha,* occur in the Pleistocene of Baja California (Gulf coast). These probably were derived from late Miocene species of eastern North America by pre-Pleistocene migration into the Pacific.

Heikkila, H. H., and MacLeod, G. M., 1951, Geology of Bitterwater Creek area, Kern County, California: California Div. Mines Spec. Rept. 6, 21 p.

Miocene mollusks from the Buttonbed Sandstone, Agua Sandstone, and the Twisselman Sandstone Member of the Monterey Formation are listed.

HEILPRIN, ANGELO, 1884*, North American Tertiary Ostreidae [constituting Appendix I of White, Fossil Ostreidae of North America]: U.S. Geol. Survey 4th Ann. Rept., p. 309–316, pls. 62–82.

Seven Miocene and Pliocene oysters from California are recorded; four of these are figured.

Heim, A., 1922, Notes on the Tertiary of southern lower California: Geol. Mag. [Great Britain], v. 59, p. 529–547.

Mollusks identified from the Miocene Purisima Nueva Formation by Clark and Arnold (1918) are listed together with additional comments by T. W. Vaughan and C. W. Cooke as to synchroneity with the fauna of the Gatun Formation of Panama. Generic identifications of mollusks from the Isidro Formation (Miocene) and the Salada Formation (Pliocene) are by B. L. Clark.

Henderson, C. W., and Winstanley, J. B., 1912, Bibliography of the geology, paleontology, mineralogy, petrology and mineral resources of Oregon: Oregon Univ. Bull., new ser., v. 10, no. 4, 49 p.

Reports on Neogene mollusks of Oregon, a few of which are annotated, are included in the bibliography.

Henderson, Junius, 1920, The nomenclature and systematic positions of some fossils and recent mollusks: Nautilus, v. 33, no. 4, p. 118–122.

Yoldia (*Portlandia*) *astoriana* is proposed as a new name for *Nucula impressa* Conrad (1849) from the Astoria Formation at Astoria, Oreg.

HENDRICKSON, A. B., 1928, Report on the Kern front area of the Kern River oil field: California Oil Fields, v. 13, no. 7, p. 5–18, 5 pls.

Casts of *Macoma* [*Cryptomya*] *kerica* n. sp. occur in the Etchegoin Tegeler oil zone and about 5–35 ft above the Lenhardt oil zone.

Henny, Gerard, 1927, Some notes on the geology of the south San Joaquin Valley, California: Am. Assoc. Petroleum Geologists Bull., v. 11, no. 6, p. 611–615.

The basal Miocene sandstone between Cholame and Devil's Den is said to be middle Miocene on the basis of *Turritella ocoyana* and *Pecten andersoni*. In Franciscan Creek, to the south, *Tivela diabloensis* occurs in basal Miocene beds. *Phacoides annulata* occurs in the Santa Margarita Formation in Tent Hills.

Henny, Gerard, 1930, McLure shale of the Coalinga region, Fresno and Kings Counties, California: Am. Assoc. Petroleum Geologists Bull., v. 14, p. 403–410.

An assemblage of seven mollusks is recorded from sandstone unconformably underlying his McLure Shale. These were considered to be of late Miocene age and correlatable with the fauna of the Santa Margarita Formation because of the occurrence of an *Astrodapsis*.

Henny, Gerard, 1943, Dudley Ridge gas field [California]: California Div. Mines Bull. 118, p. 539–541.

The first *Mya* zone occurs at the top of the San Joaquin Clay; the *Mulinia* zone at the top of the Etchegoin.

Herold, C. L., 1937, Further evidence for age of volcanism, Pinnacles National Monument, California: Am. Assoc. Petroleum Geologists Bull., v. 21, no. 10, p. 1341–1344.

"A marine molluscan fauna occurring in a reef near the base of the Poncho [Pancho] Rico formation is that of Miocene-Pliocene transition."

Herold, S. C., 1917, Tertiary Nassidae of the west coast of America [abs.]: Geol. Soc. America Bull., v. 28, p. 227.

A very brief description of the author's review of this gastropod family.

Hershey, O. H., 1902, Some Tertiary formations of southern California: Am. Geologist, v. 29, no. 6, p. 349–372.

Marine shells occur in cores of Pliocene rock from near Humphrey's Station in the eastern part of the Ventura basin. "*Pecten caurinum*" is recorded from an indefinite locality near Gorman.

HERTLEIN, L. G., 1925a, New species of marine fossil Mollusca from western North America: Southern California Acad. Sci. Bull., v. 24, pt. 2, p. 39–46, pls. 3–4.

Described *Pecten vancouverensis fernandoensis* from a core of the Pliocene Repetto Formation from Long Beach oil field. Other new species are described from the Montesano Formation, southwestern Washington.

HERTLEIN, L. G., 1925b, Pectens from the Tertiary of Lower California: California Acad. Sci. Proc., ser. 4, v. 14, no. 1, p. 1–35, pls. 1–6.

Sixteen Neogene pectinids, including 13 new species, are described and illustrated. Fourteen previously described species of pectinids of Pliocene age are also listed.

HERTLEIN, L. G., 1928a, *Pecten* (*Patinopecten*) *lohri*, new name for *Pecten oweni* Arnold, a Pliocene species from California: Nautilus, v. 41, no. 3, p. 93–94.

Pecten lohri is proposed as a new name for *P. oweni* Arnold, a homonym.

HERTLEIN, L. G., 1928b, Preliminary report on the paleontology of the Channel Islands, California: Jour. Paleontology, v. 2, no. 2, p. 142–157, pls. 22–25.

Recognized two Miocene faunal zones on the western Channel Islands—San Miguel and Santa Rosa—the *Turritella inezana* zone of early Miocene age and the *T. ocoyana* zone of middle Miocene age. The two zones are separated by 300 to 400 meters on Santa Rosa but only about 150 meters on San Miguel. The faunas of these zones are not listed but 10 new species of mollusks are described and illustrated.

Hertlein, L. G., 1929a, The Pliocene of San Diego, California [abs.]: Stanford Univ. Bull., ser. 5, p. 81-85.

An abstract of Ph. D. thesis on the geology and paleontology of the Pliocene rocks of San Diego, California.

HERTLEIN, L. G., 1929b, A new *Pecten* from the San Diego Pliocene [California]: California Acad. Sci. Proc., ser. 4, v. 18, no. 5, p. 215, pl. 24.

Pecten (*Plagioctenium*) *ericcllus* is described from the San Diego Formation.

HERTLEIN, L. G., 1929c, Three new specific names for West American fossil Mollusca: Jour. Paleontology, v. 3, no. 3, p. 295-297.

Ostrea erici is described from Pliocene rocks near Scammon's Lagoon, Baja California. This species was previously figured as *O. tayloriana* by Jordan and Hertlein (1926).

Hertlein, L. G., 1931a, Additional Pliocene and Pleistocene fossils from Lower California: Jour. Paleontology, v. 5, no. 4, p. 365–367.

Mollusks from 13 localities of Pliocene or Pleistocene age, most of which are on the Gulf side of the peninsula, are recorded.

HERTLEIN, L. G., 1931b, Changes of nomenclature of some Recent and fossil Pectinidae from Japan, Porto Rico, South America, New Zealand, and California: Jour. Paleontology, v. 5, no. 4, p. 367–369.

Pecten crassicardo biformatis, an upper Miocene taxon from California, is renamed *P. crassicardo nomlandi.*

Hertlein, L. G., 1933, Additions to the Pliocene fauna of Turtle Bay, Lower California, with a note on the Miocene diatomite: Jour. Paleontology, v. 7, no. 4, p. 439–441.

Twenty-three mollusks, mostly pectinids, are recorded from the lower 20–30 meters of Pliocene beds that overlie Miocene sediments at the north end of Turtle Bay.

HERTLEIN, L. G., 1934, New oysters and a new *Pecten* from the Tertiary of California: Southern California Acad. Sci. Bull., v. 33, pt. 1, p. 1–6, pls. 1–2.

Describes *Ostrea ashleyi* from the Kern River area (middle Miocene) and proposes a new name for *O. titan corrugata* Nomland [*O. titan eucorrguata* Hertlein].

Hertlein, L. G., 1935, The Recent Pectinidae, no. 25 *in* The Templeton Crocker Expedition of the California Academy of Sciences, 1932: California Acad. Sci. Proc., ser. 4, v. 21, no. 25, p. 301–328, pls. 18–19.

Stratigraphic ranges of those living species that have fossil records are indicated.

Hertlein, L. G., 1936, Three new sections and rectifications of some specific names in the Pectinidae: Nautilus, v. 50, nos. 1 and 2, p. 24–27, 54–58.

Includes discussion of *Pecten oweni* Gregorio and *P. oweni* Arnold, a Pliocene species from California.

HERTLEIN, L. G., 1937 *Haliotis kotticki*, a new species from the lower Miocene of California: Southern California Acad. Sci. Bull., v. 36, pt. 3, p. 93-97, pl. 42.

The description is based on one specimen from the Vaqueros Formation, Lompoc quadrangle, Santa Barbara County, associated with *Lucinoma acutilineata*, *Lyropecten miguelensis*, and *Trophosycon* cf. *T. ocoyana.* Other Tertiary occurrences of *Haliotis* are reviewed.

Hertlein, L. G., 1941, A summary of the knowledge regarding the faunal area of tropical West America with special reference to mollusks, *in* Hill, H. W., ed., Proceedings of the dedicatory exercises, Hancock Hall, The Allan Hancock Foundation for Scientific Research at the University of Southern California: Southern California Univ., Univ. Chron. Ser., no. 7, p. 21–24.

A discussion of the Caribbean and Indo-Pacific origins of tropical eastern Pacific molluscan fauna. *Chione* (*gnidia* group), Dosinia, and *Solenosteira* are Caribbean immigrants; certain *Conus*, a *Cypraea*, and a *Cymatium* are Indo-Pacific immigrants.

HERTLEIN, L. G., 1951*, Invertebrate fossils and fossil localities in the San Francisco Bay area, *in* Geologic Guidebook of the San Francisco Bay Counties [California]: California Div. Mines Bull. 154, p. 187–192.

Five Miocene and Pliocene mollusks are figured. Some collecting localities are indicated.

Hertlein, L. G., 1952, Description of a new pelecypod of the genus *Lima* from deep water off Central California: California Acad. Sci. Proc., ser. 4, v. 27, no. 12, p. 377–381, pl. 20, figs. 12 and 13.

The newly described *Lima mori* n. sp. is compared with a Pliocene species, *L. hamlini*, from the Los Angeles basin, California.

HERTLEIN, L. G., 1957*, Pliocene and Pleistocene fossils from the southern portion of the Gulf of California: Southern California Acad. Sci. Bull., v. 56, pt. 2, p. 57–75, pl. 13.

A few faunal assemblages of Pliocene age from islands in the southern part of the Gulf of California (San Esteban and Ceralbo Islands) and the adjacent coast of Baja California are listed. These consist mostly of ostreids and pectinids. A few species are treated systematically.

Hertlein, L. G., 1959, Notes on California oysters: Veliger, v. 2, no. 1, p. 5–10, pl. 2.

A late Miocene specimen of *Ostrea titan* measures 457 mm (about 18 inches).

Hertlein, L. G., 1960, The subfamily Drupinae (Gastropoda) in the eastern Pacific: Veliger, v. 3, no. 1, p. 7–8.

Sistrum hannai Howe (1922), a Pliocene species from the Empire Formation, Coos Bay, Oreg. is included in this family. This species is recorded for the first time from Pliocene strata in San Benito County, Calif. (sec. 26, T. 19 S., R. 11 E.).

HERTLEIN, L. G., 1965, A new genus of gastropod (Drupinae) from the Pliocene of Oregon and California: California Acad. Sci. Occasional Paper 49, 5 p., 4 figs.

Condonia occurs in the Coos Conglomerate of the Empire Formation in southwestern Oregon and in the Etchegoin Formation of San Benito County, Calif.

HERTLEIN, L. G., 1966, Pliocene fossils from Rancho El Refugio, Baja California, and Cerralvo Island, Mexico: California Acad. Sci. Proc., ser. 4, v. 30, no. 14, p. 265–284.

Lists 36 mollusks of middle Pliocene age from Rancho El Refugio and nine mollusks of middle Pliocene age from Isla Cerralvo. Several of these taxa are illustrated; new subspecies of *Ostrea* and *Chlamys* are described and illustrated.

Hertlein, L. G., 1968, Three late Cenozoic molluscan faunules from Baja California, with a note on diatomite from west of San Felipe: California Acad. Sci. Proc., ser. 4, v. 30, no. 19, p. 401–405.

Two Pliocene collections from northeastern part of Baja California peninsula about 15.5 and 18.5 miles west of San Felipe, Mexico, include 20 mollusks that are correlated with the Imperial Formation of southeastern California.

HERTLEIN, L. G., and ALLISON, E. C., 1959, Pliocene marine deposits in northwest Baja California, Mexico, with the description of a new species of *Acanthina* (Gastropoda): California Acad. Sci. Bull., v. 58, pt. 1, p. 17–26, 8 pls.

Twenty-seven Pliocene mollusks are recorded from Pliocene strata [Cantil Costero Formation] in northwestern Baja California. *Acanthina*

emersoni n. sp. is described; *Thais transcosana* Arnold, a Pliocene species from central California, is illustrated.

Hertlein, L. G., and Crickmay, C. H., 1925, A summary of the nomenclature and stratigraphy of the marine Tertiary of Oregon and Washington: Am. Philos. Soc. Proc., v. 64, no. 2, p. 224–282.

A thorough review of paleontologic and stratigraphic reports on the marine Tertiary of Oregon and Washington. Many lists of mollusks from Miocene and Pliocene formations are included. Although largely a resume of previous work, the authors conclude that (1) the Sooke Formation may be younger than Oligocene and correlative with the Vaqueros Formation of California, (2) the Astoria Formation contains a mixture of warm-water and cool-water mollusks, (3) the Empire Formation probably is older than the Santa Margarita-San Pablo Formations of California but younger than the Monterey-Temblor Formations of California, possibly being correlative with the Briones Formation of California, (4) the Montesano Formation probably is equivalent to the Empire Formation but the upper part of the formation is younger than the Empire Formation, and (5) the fauna of the Quillayute Formation is older than that of the Quinault Formation and more like the "Upper Miocene in faunal aspect" (p. 271).

Hertlein, L. G., and Emerson, W. K., 1959, Pliocene and Pleistocene megafossils from the Tres Marias Islands, *in* Results of the Puritan-American Museum of Natural History Expedition to Western Mexico: Am. Mus. Novitates, no. 1940, 15 p.

Eighteen mollusks are recorded from localities of Pliocene age of María Madre and María Cleofas Islands.

Hertlein, L. G., and Grant, U.S., 4th, 1939, Geology and oil possibilities of southwestern San Diego County, California: California Jour. Mines and Geology, v. 35, p. 57–78.

Twleve mollusks are recorded from the Pliocene San Diego Formation; earlier studies of fossils by Dall are reviewed.

Hertlein, L. G., and Grant, U.S., 4th, 1943, Southwestern San Diego County [California]: California Div. Mines Bull. 118, p. 367–369.

Typical Pliocene mollusks, such as *Area* (*Anadara*) *trilineata*, *Pecten* (*Palinopecten*) *healeyi*, and *Ostrea vespertina*, definitely prove the Pliocene age of the San Diego formation.

Hertlein, L. G., and Grant, U.S., 4th, 1944a, The Cenozoic Brachiopoda of western North America: California Univ., Los Angeles, Pub. Math. Phys. Sci., v. 3, 235 p., 21 pls., 34 figs.

Include several records of Miocene and Pliocene mollusks that occur with Neogene brachiopds.

Hertlein, L. G., and Grant, U.S., 4th, 1944b, The geology and paleontology of the marine Pliocene of San Diego, California, Part 1, Geology: San Diego Soc. Nat. History Mem., v. 2, 72 p.

Species from San Diego area originally described as Miocene by Conrad (1855) are of Eocene age. Dall's (1874) list of mollusks from the San Diego well is republished with modern nomenclatural assignments. The stratigraphy of Pliocene strata of the San Diego area is discussed in detail with a few notations on mollusks. The San Diego Formation is con-

sidered to be of middle Pliocene age. There is an extensive review of previous paleontologic studies in the San Diego area.

Hertlein, L. G., and Grant, U. S., 4th, 1954, Geology of the Oceanside-San Diego coastal area, southern California, [Pt.] 4 *in* Chap. 2 *of* Jahns, R. H., ed., Geology of southern California: California Div. Mines Bull. 170, p. 53–63.

List characteristic Pliocene mollusks from San Diego Formation which is considered to be of middle or early late Pliocene age. The invertebrate fauna suggests warmer water than now occurs in San Diego area.

HERTLEIN, L. G., and JORDAN, E. K., 1927, Paleontology of the Miocene of Lower California: California Acad. Sci. Proc., ser. 4, v. 16, no. 19, p. 605–647, pls. 17–21.

List 40 mollusks of Miocene age from near La Purisima and San Ignacio, collected, for the most part, by Marland Oil Co. geologists. Include description and illustration of 16 new species. Mollusks from 12 localities in Baja California are recorded. Contains a thorough review of previous geologic and paleontologic investigations on the Neogene of Baja California.

Hickman, C. J. S., 1969, The Oligocene marine molluscan fauna of the Eugene Formation in Oregon: Oregon Univ. Mus. Nat. History Bull. 16, 112 p., 14 pls.

Several molluscan taxa from the early and middle Oligocene are compared with Miocene species. A correlation chart of Oregon and Washington Oligocene strata includes the lower part of the Miocene. Oligocene climates were transitional between the tropical and subtropical climates of the Eocene and the essentially modern climate and highly provincial molluscan faunas of the Miocene.

Higgins, C. G., 1957, Pliocene rocks east of Stewart's Point, Sonoma County, California [abs.]: Geol. Soc. America Bull., v. 68, no. 12, pt. 2, p. 1829.

Strata of Pliocene age ranging up to 20 feet in thickness locally rest on mollusk-bored, wave-cut terrace surfaces.

Higgins, C. G., 1960, Ohlson Ranch formation, Pliocene, northwestern Sonoma County, California: California Univ. Pubs. Geol. Sci., v. 36, no. 3, p. 199–232, pls. 18–20.

Stratigraphic occurrence and collecting localities in the Pliocene Ohlson Ranch Formation are recorded. Paleontology of the mollusks in treated by Peck (1960) in a companion paper.

Hill, F. L., 1960, Cantua Creek area of Fresno County [California]: California Oil Fields, v. 46, no. 1, p. 11–14.

The middle Miocene Temblor Formation is reported to be "fossiliferous."

Hill, F. L., 1964a, Harvester gas field [California]: California Oil Fields, v. 50, no. 1, p. 11–15.

Three mollusks from the San Joaquin Clay and five from the Etchegoin Formation are recorded.

Hill, F. L., 1964b, Northwest Trico gas field [California]: California Oil Fields, v. 50, no. 1, p. 17–20.

Three mollusks from the San Joaquin Formation and five from the Etchegoin Formation are recorded.

Hill, F. L., 1965, Kettleman Middle Dome oil field [California]: California Oil Fields, v. 51, no. 1, p. 39–46.

Characteristic fossils recovered from well cores include: *Mya, Acila* (Pliocene San Joaquin Clay); *Pseudocardium, Anadara, Mitrella,* and *Acila* (Etchegoin-Jacalitos Formation); oysters, pectens, mussels (McLure Shale); *Turritella ocoyana* (Temblor Sands); *Macoma, Mactra* (Felix silt); *Nuculana* (Whepley Shale); *Turritella inezana* (Vaqueros Formation).

Hill, M. L., 1943, Elwood oil field [California]: California Div. Mines Bull. 118, p. 380-383.

A *Robulus* and mud *Pecten* zone occurs 80 ft above the base of the Temblor Formation in the Elwood oil field, Santa Barbara County, Calif.

Hill, M. L., Carlson, A., and Dibblee, T. W., Jr., 1958, Stratigraphy of Cuyama Valley-Caliente Range area, California: Am. Assoc. Petroleum Geologists Bull., v. 42, no. 12, p. 2973–3000.

A few mollusks are recorded from measured sections of marine Miocene formations of the Cuyama Valley-Caliente Range area.

Hill, M. L., and Dibblee, T. W., Jr., 1947, Road log, western end of Cuyama Valley to Maricopa [California], *in* Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, California, 1947: p. 80–81.

Include Eaton's (1939) stratigraphic columns for Cuyama Valley and Caliente Range showing some characteristic Miocene mollusks.

Hillis, Donuil, and Woodward, W. T., 1943, Williams and Twenty-Five Hill-areas of the Midway-Sunset oil field [California]: California Div. Mines Bull. 118, p. 526-531.

Mulinia densata occurs at the top of the Etchegoin Formation.

Holman, W. H., 1958, Correlation of producing zones of Ventura Basin oil fields [California], *in* Higgins, J. W., ed., A guide to the geology and oil fields of the Los Angeles and Ventura regions: Am. Assoc. Petroleum Geologists, Pacific Sec. [Guidebook], Ann. Mtg., Los Angeles, California, 1958, p. 191-199.

A correlation chart of Cenozoic formations includes a column showing macrofossil stages and a few characteristic mollusks.

Hoots, H. W., 1930, Geology and oil resources along the southern border of San Joaquin Valley, California: U.S. Geol. Survey Bull. 812–D, p. 243–332.

Includes lists of Miocene mollusks from the Vaqueros Formation [*Turritella ocoyana* zone] of the San Emigdio Mountains (21 taxa), the Tejon Hills area (seven taxa identified by B. L. Clark), and the Santa Margarita Formation at Comanche Point (25 species also identified by Clark). *Mulinia densata* and other mollusks are reported from the Etchegoin Formation on Little Muddy Creek. Four mollusks of late Miocene or early Pliocene age from near the base of the exposed section in Coaloil Canyon at Wheeler Ridge are listed.

HOOTS, H. W., 1931*, Geology of the eastern part of the Santa Monica Mountains, Los Angeles County, California: U.S. Geol. Survey Prof. Paper 165–C, p. 83–134, pls. 18–33.

Lists 48 mollusks from several collections from the eastern part of the Santa Monica Mountains. A rock specimen with casts of *"Pecten" raymondi brionianus* Trask is figured; 12 other mollusks are reported from the basal part of the Modelo Formation. Sixty-seven mollusks are reported from Pliocene clay shale near the head of Potrero Canyon. Twelve species from exposures of the San Diego Formation in the lower part of Temescal Canyon are listed. A tabulation of fossil localities and remarks by W. P. Woodring on the various mollusk assemblages are included.

Hopkins, D. M., 1965, Chetvertichnye morskie transgressii na Alyaske (Quaternary transgressions in Alaska), *in* Antropogenovye period v Arktike i subarktike (Anthropogene Period in the Arctic and Subarctic): Nauchno-Issled. Inst. Geologii Arktike Trudy, v. 143, p. 131–144 (in Russian; English translation by Am. Geol. Inst., 53 p.).

Original proposal of a series of time-stratigraphic units to classify late Pliocene and Quaternary marine deposits of western Alaska. The fauna of four of these—Beringian (late Pliocene) and the Pleistocene Anvilian, Kotzebuan, and Pelukian—are characterized in a stratigraphic diagram showing some of the more important mollusks and their occurrences. The faunas of the Kruzensternian and Woronzofian are not shown because of meagre faunal data. This report is similar to Hopkins' later account (1967) of the late Pliocene and Quaternary transgressions written in English.

Hopkins, D. M., 1967a, Introduction, *in* Hopkins, D. M., ed., The Bering Land Bridge: Stanford, California, Stanford Univ. Press, p. 1–6.

Biogeographical reports dealing with migration of marine mollusks through Bering Straits during the late Tertiary are reviewed.

Hopkins, D. M., 1967b, Quaternary marine transgressions in Alaska, Chap. 4 *in* Hopkins, D. M., ed., The Bering Land Bridge: Stanford, Calif., Stanford Univ. Press, p. 47–90.

Marine beds of Beringian transgression are considered to be of late Pliocene and early Pleistocene age. Twenty-three significant mollusks are listed in a stratigraphic chart. Correlative molluscan fauna occur on the Arctic Coast, in the Gulf of Alaska, and in the Aleutian Islands.

Hopkins, D. M., and MacNeil, F. S., 1960, A marine fauna probably of late Pliocene age near Kivalina, Alaska, *in* Short papers in the geological sciences: U.S. Geol. Survey Prof. Paper 400–B, p. B339–B342.

Thirteen mollusks are recorded from marine clay near Kivalina, Alaska, and from deposits of late Pliocene and Pleistocene age at Nome, Alaska. The occurrence of *Fortipecten* suggests a late Pliocene age and correlation with the submarine beach deposits at Nome.

Hopkins, D. M., MacNeil, F. S., and Leopold, E. B., 1960, The coastal plain at Nome, Alaska: a late Cenozoic type section for the Bering Strait region: Internat. Geol. Cong., 21st, Copenhagen 1960, pt. 4, p. 46–57.

Marine sand and clay of the "Submarine Beach" at Nome are believed to be of late Pliocene or early Pleistocene age. They contain the large pectinid *Fortipecten hallae* (Dall). Several of the mollusks are identical or closely related to species now confined to more southerly, warmer waters suggesting warmer climate and lack of sea ice. Include list of mollusks and local stratigraphic ranges.

Hopkins, D. M., MacNeil, F. S., Merklin, R. L., and Petrov, O. M., 1965, Quaternary correlations across Bering Strait: Science, v. 147, p. 1107–1114

Correlation of six late Cenozoic transgressions from western Alaska of Hopkins with Chukotka sequence of eastern Russian coast. Alaskan transgressions are briefly reviewed with mention of a few key mollusks and recent radiometric age determinations. Molluscan faunas show a progressive modernization in which warm-water elements disappear and are replaced by elements of the modern Arctic fauna.

Hopkins, D. M., Scholl, D. W., Addicott, W. O., Pierce, R. L., Smith, P. J., Wolfe, J. A., Gershanovich, David, Kotonev, Boris, Lohman, K. E., and Obradovich, John, 1969, Cretaceous, Tertiary and Early Pleistocene rocks from the continental margin in the Bering Sea: Geol. Soc. America Bull., v. 80, no. 8, p. 1471–1480.

Palliolum (*Delectopecten*) *pedroanus* (Trask) is reported from dredge haul from Zemchug Canyon [identified by O. M. Petrov]. A *Neptunea* of late Pliocene or early Pliocene age was recovered from a dredge haul in Pribiloff Canyon.

Hoskins, C. W., 1967, Hydrodynamic significance of mollusks in Pliocene turbidites near Ventura, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, pt. 1, p. 470.

The orientation of a small unnamed species of pelecypod in Pliocene turbidite beds is related to position within a turbidite sequence. Shells are concave up in the lower part and, generally, convex up in the upper part.

HOWARD, P. J., 1935*, Report on Buena Vista Hills, a portion of the Midway-Sunset oil field [California]: California Oil Fields, v. 20, no. 4, p. 5–22, 7 pls.

Pecten peckhami occurs in the Maricopa Shale. Several Pliocene and one Miocene mollusks from well cores in the southern San Joaquin Valley and a few Pliocene specimens from surface exposures are figured.

Howe, H. V., 1921, Correlation of the Empire Formation, Oregon [abs.]: Geol. Soc. America Bull., v. 32, p. 147.

The Empire Formation is classified as early Pliocene on the basis of many species of mollusks that also occur in early Pliocene formations in California; the overlying Coos Conglomerate is also of Pliocene age.

HOWE, H. V., 1922, Faunal and stratigraphic relationships of the Empire Formation, Coos Bay, Oregon: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 14, no. 3, p. 85–114, pls 7–12.

Concludes that the Empire Formation is of early Pliocene age because of the similarity of species to other Pliocene formations and the percentage of living species. Also concludes that the Coos Congomerate is part of the Empire Formation and not of Pleistocene age. Eight new Pliocene mollusks, some of which are from northwestern California, are described and illustrated.

Howe, H. V., 1926, Astoria: Mid-Tertic type of Pacific coast: Pan-Am. Geologist, v. 45, p. 295–306.

The Barker's Ranch fauna of the Temblor Formation in California, and the Astoria Formation of Astoria, Oreg., and Lincoln County, Oreg., are "for all practical purposes, contemporaneous in time of deposition." Forty-

three percent of the 89 determinable species are common to both areas. The Oregon Miocene shows a closer relationship to the Asiatic side of the Pacific Ocean than does the California middle Miocene. Several mollusks with oriental affinities show that the Oregon Miocene is a different temperature province from California. Lists "marker" mollusk species for the California and Oregon standard sections.

Hoylman, H. W., and Chilingar, G. V., 1965, Geologia petrolera y exploracion en Nicaragua: Assoc. Mexicana de Geologos Petroleros Bol., v. 17, nos. 1 and 2, p. 1–16.

The Pliocene El Salto Formation contains extensive reef deposits composed of large oysters and many other kinds of mollusks. There are also widespread coquinas.

Hudson, F. S., and Craig, E. K., 1929, Geologic age of the Modelo Formation, California: Am. Assoc. Petroleum Geologists Bull., v. 13, no. 5, p. 509–518.

Seven middle Miocene mollusks are recorded from the lower Modelo Sandstone at or near the type section (identiification made by A. J. Tieje); nine species of late Miocene age are recorded from near the top of the Modelo. Other late Miocene species occur in Reasoner Canyon to the north. *Turritella inezana* occurs in the Vaqueros Formation.

Huey, A. S., 1948, Geology of the Tesla quadrangle, California: California Div. Mines Bull. 140, 75 p.

Lists 18 mollusks from the Miocene Oursan? Sandstone. Reports a few mollusks of middle and late Miocene age from a nearby area that were listed in an unpublished master's thesis (Harding, J. W., Jr., 1940, University of California, Berkeley). Also listed are 14 species of mollusks from the upper Miocene Cierbo Formation.

Hughes, A. W., 1947, Road log, Gaviota to Santa Maria [California], *in* Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, California, 1947: p. 71–78.

Fossiliferous "reefs" in the Vaqueros Sandstone near Gaviota Creek in the Santa Ynez Mountains are characterized by *Pecten magnolia, Ostrea eldridgei,* and *Turritella inezana.*

Hughes, A. W., 1956, Generalized stratigraphy, Huasna Basin [California], *in* Soc. Econ. Paleontologists and Mineralogists Ann. Spring Field Trip, 1956: 8 p., and map (scale 1 in.=8,000 ft).

Pecten magnolia and *Turritella inezana* occur in the lower Miocene Vaqueros Formation, *Pecten discus* in the upper Miocene Santa Margarita Formation, and *Pecten bellus* in the Pliocene Pismo Formation.

Hughes, A. W., 1963, The two sides of Salinas, a biostratigraphic outline of Salinas Valley sediments [California], *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Spring Field Trip, 1963, p. 94–97.

Ostrea titan reaches an average size of 8 to 12 in. in the type section of the upper Miocene Santa Margarita Formation. A specimen more than 2 ft long is used as a door step at a farmhouse near Creston.

Huguenin, E., 1926, Inglewood oil field [California]: California Oil Fields, v. 11, no. 12, p. 5–15.

Pliocene mollusks from the upper part of the Fernando Formation occur at many localities in the Baldwin Hills east of the Inglewood fault.

Ingle, J. C., Jr., 1967, Foraminiferal biofacies variation and the Miocene-Pliocene boundary in southern California: Am. Paleontology Bull., v. 52, no. 236, p. 217–394.

Includes brief mention of paleoclimatic analyses of middle Miocene, late Miocene, early Pliocene, and late Pliocene molluscan faunas from central and southern California. These are compared with paleoclimatic inferences from planktonic Foraminifera.

Ingle, J. C., Jr., 1969, Foraminiferal trends and paleobathymetry within the Monterey and Santa Margarita Formations, Upper Sespe Creek-Pine Mountain area, Ventura County, California, *in* Dickinson, W. R., chm., Soc. Econ. Mineralogists and Paleontologists, Pacific Coast Sec., 1969 Field Trip [Guidebook], Upper Sespe Creek: p. 79–93.

A coquina composed of *Ostrea* shells occurs stratigraphically above the phosphatic part of the Santa Margarita Formation.

Irwin, W. P., 1960, Geologic reconnaissance of the Northern Coast Ranges and Klamath Mountains, California: California Div. Mines Bull. 179, 80 p.

A marine molluscan fauna of Miocene age occurs in a 2,200-ft thick sandstone and conglomerate unit in the Covelo area. Three mollusks considered to be of Miocene or Pliocene age were recovered from limestone float in the Petrolia area. Mollusks from the Wildcat Group are considered to be of Pliocene(?) age. The marine Neogene formations of coastal northwestern California are reviewed.

Isbister, A. K., 1855, On the geology of the Hudson's Bay territories and of portions of the Arctic and northwestern regions of America; with a coloured geological map: Geol. Soc. London Quart. Jour., v. 11, p. 497–520.

Records 33 mollusks from "the tertiary formation" of the Oregon Territory collected by Dana and identified by T. A. Conrad who considered them to be Miocene. Fourteen mollusks from the Alaskan Territory identified by Grewingk are also recorded.

JACKSON, H.E., 1966*, Concretions: Pacific Discovery, v. 19, no. 1, p. 12–15.

Illustrates *Echinophoria apta* Tegland and large Neogene pectinids from the Olympic Peninsula, Wash.

Jahns, R. H., 1940, Stratigraphy of the easternmost Ventura Basin, California, with a description of a new lower Miocene mammalian fauna from the Tick Canyon formation: Carnegie Inst. Washington Pub. 514 (Contr. to Paleontology, IX), p. 145–194.

Four mollusks from localities in the "Modelo" Formation identified by B. L. Clark and W. P. Woodring are the basis of assigning a late Miocene age to this formation. Further determinations by U.S. Grant 4th, are listed (eight mollusks).

Jahns, R. H., ed., 1954, Geology of southern California: California Div. Mines Bull. 170, 878 p.

Includes many articles with information on Miocene and Pliocene mollusks and correlation of marine Tertiary formations of coastal southern California and the San Joaquin Valley.

James, E. L., 1950, New Marine fauna from Coos Bay, Oregon [abs.]: Geol. Soc. America Bull., v. 61, no. 12, p. 1539.

Dosinia cf. *D. merriami* Clark occurs in a Miocene assemblage dredged in Coos Bay, Oreg.

James, G. T., 1963, Paleontology and nonmarine stratigraphy of the Cuyama Valley badlands, California, pt. 1, Geology, faunal interpretations, and systematic descriptions of Chiroptera, Insectivora, and Rodentia: California Univ. Pubs. Geol. Sci., v. 45, 154 p.

A brief review of the interfingering marine-nonmarine section of the Caliente Range is included. The Miocene provincial mammal ages can be tied into early and middle Miocene molluscan faunas in this section.

Janda, R. J., 1969, Age and correlation of marine terraces near Cape Blanco, Oregon [abs.]: Geol. Soc. America, Abstracts with Programs for 1969, pt. 3, p. 29–30.

Fossiliferous strata of latest Pliocene age crop out north of the mouth of Elk River.

Jeletzky, J. A., 1950, Stratigraphy of the west coast of Vancouver Island between Kyuquot Sound and Esperanza Inlet, British Columbia (preliminary report): Canada Geol. Survey Paper 50–37, 52 p.

A small collection of mollusks (five taxa) from Tertiary rocks at Tatchu Point are most likely Miocene and correlatable with the Sooke Formation according to Ralph Stewart.

Jeletzky, J. A., 1954, Teritary rocks of the Hesquiat-Nootka area, west coast of Vancouver Island, British Columbia: Canada Geol, Survey Paper 53–17, 65 p.

Jeletzky's Division D is correlated with the Sooke Formation of the southern part of Vancouver Island and is considered to be "early Miocene (?)." Thirteen mollusks are listed from this division. The "lower Blakeley" fauna including *Acila gettysburgensis* may be a deeper and quieter water facies of the "upper Blakeley" (and Division D and Sooke Formation). Clark and Arnold (1923) observed an interfingering of typical "Blakeley" (type Blakeley Formation) and Sooke Formation faunas near Carmanah Point, southern Vancouver Island.

Jennings, C. W., and Strand, R. G., 1963, Index to graduate theses on California geology to December 31, 1961: California Div. Mines and Geology Spec. Rept. 74, 39 p.

Approximately 1,200 these titles are listed in two sections. One section includes areal reports keyed to an index map; the other, topical reports.

Jones, W. P., 1911, The geology of the Sargent oil field [California]: California Univ. Pubs., Dept. Geology Bull., v. 6, no. 3, p. 55–78, pls. 13–18.

Records a few mollusks from Member D of his San Pablo Formation and from the Merced Formation.

JORDAN, E. K., and HERTLEIN, L. G., 1926a, Contribution to the geology and paleontology of the Teriary of Cedros Island and adjacent parts of Lower California, *in* Expedition to the Revillagigedo Islands, Mexico, in 1925: California Acad. Sci. Proc., ser. 4, v. 15, no. 14, p. 409–464, pls. 27–34.

List 61 species of mollusks of Pliocene age from localities on Cedros Island and on the mainland between Punta Eugenia and Punta Asuncion.

Eight new species of mollusks are described; a few other mollusks are figured.

JORDAN, E. K., and HERTLEIN, L. G., 1926b, A Pliocene fauna from Maria Madre Island, *in* Expedition to the Revillagigedo Islands, Mexico, in 1925: California Acad. Sci. Proc., ser. 4, v. 15, p. 209–217, pl. 23.

Fourteen species of mollusks, mostly *Ostrea* and *Pecten*, are recorded from localities on Maria Madre Island. Four pelecypods are treated systematically and figured; two of these are new—*Pecten dallasi* and *P. abietis*.

KANAKOFF, G. P., 1954, A new *Kelletia* from the Pliocene of California: California Acad. Sci. Bull., v. 53, pt. 2, p. 114–117, pls. 29–31.

Kelletia vladimiri is described from the Pliocene Pico Formation [Towsley Formation] of the Ventura basin.

KANAKOFF, G. P., 1956, Two new species of *Nassarius* from the Pliocene of Los Angeles County, California: Southern California Acad. Sci. Bull., v. 55, pt. 2, p. 110–113, pls. 30, 31.

Nassarius stocki and *N. hildegardae* are described from the Pliocene Pico Formation [Towsley Formation] of the Ventura basin.

KANAKOFF, G. P., 1966, A new species of *Boetica* from the Pliocene of California: Los Angeles County Mus. Contr. Sci. no. 103, 4 p., 3 figs.

Boetica hertleini is described from expoures of the Pliocene Pico Formation [Towsley Formation] of the Ventura basin.

Kanno, Saburo, and Addicott, W. O., 1969, Summary of current investigations on Cenozoic marine mollusks of western North America, *in* Kotaka, Tamio, ed., Symposium on Japanese Neogene molluscan faunas [in Japanese]: Fossils, Paleont, Soc. Japan Jour., no. 18, p. 55–61.

Résumé of current research and recent publications on fossil marine mollusks of the eastern North Pacific Ocean.

Kaplow, E. J., 1942, East Coalinga Extension oil field [California]: California Oil Fields, v. 28, no. 1, p. 15–29.

The "upper *Mulinia*" [bed] defines the subsurface contact between the San Joaquin and the underlying Etchegoin Formation.

Kasline, F. E., 1941, Edison oil field [California]: California Oil Fields, v. 26, p. 12–18.

Dentalium is characteristic of cores from the Miocene "Freeman-Jewett undifferentiated" [Silt] which is 257 feet thick in Jergens well "Hay" no. 1 (sec. 22, T. 30 S., R. 20 E.).

KAUFFMAN, E. G., 1969, Systematics and evolutionary position of a new Tertiary *Thyasira* (Bivalvia) from Alaska: Jour. Paleontology, v. 43, no. 5, p. 1099–1100, pl. 127.

Thyasira alaskana is described from the upper part of the Nuwok Formation (Miocene or Pliocene) of the Arctic coast of Alaska.

Keen, A. M., 1936a, Revision of cardiid pelecypods [abs.]: Geol. Soc. America Proc. for 1936, p. 367.

A new name [unspecified] for a distinctive group of cardiids including "*Cardium*" *nuttallii* and "*C.*" *meekianum* is needed. Ten species can be referred to this genus; the earliest occurrence of the unnamed genus is in the late Miocene.

Keen, A. M., 1936b, A new pelecypod genus of the family Cardiidae: San Diego Soc. Nat. History Trans., v. 8, no. 17, p. 119–120.

Three Neogene cardiids are assigned to the newly proposed genus *Clinocardium*: *C. coosense* (Dall), *C. meekianum* (Gabb), and *C. yakatagense* (Clark).

Keen, A. M., 1937, An abridged check list and bibliography of West North American marine Mollusca: Stanford, Calif., Stanford Univ. Press, 87 p.

A useful compilation of geographic distribution of modern shallow-water mollusks of the eastern North Pacific in which ranges are reported to nearest degree of latitude. Bibliography (1908–36) includes several papers dealing in part with fossil mollusks.

Keen, A. M., 1939, New *Typhis* from the California Miocene [abs.]: Geol. Soc. America Bull., v. 50, no. 12, pt. 2, p. 1972.

A new species of *Typhis* is recorded from the Round Mountain Shale [Silt] near Bakersfield, Calif. Other mollusks from this unit indicate correlation with the Gatun Formation of Panama.

Keen, A. M., 1940, The percentage method of stratigraphic dating: Pacific Sci. Cong., 6th, Proc., v. 2, p. 659–663.

A critical discussion of the Lyellian method of correlation of Tertiary strata based upon percentages of living species of mollusks. The consequence of plotting Lyell's original percentages, and a more modern interpretation of these percentages, on a time scale based upon Teritary epochs of equal duration and on an absolute time scale is indicated. In neither do these percentages approximate a straight line as would be expected if speciation proceeded at a constant rate during the Tertiary. It is concluded that Lyellian correlation is useful for establishing the general sequence of faunal units in a given region but that it cannot be used for refined age determination.

Keen, A. M., 1942, A statistical analysis of the percentage of living species of mollusks in the Vaqueros Formation, *in* Schenck, H. G., and Childs, T. S., Jr., Significance of *Lepidocyclina* (Lepidocyclina) *californica*, new species, in the Vaqueros formation (Tertiary), California: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 35–37.

By eliminating doubtful identifications of living mollusks from the Vaqueros lists of Loel and Corey (1932) [aff., cf., or sp.] the living component of the fauna is greatly reduced—to less than 3 percent—suggesting an Oligocene age in terms of Lyellian correlation. Modern workers concede the Oligocene to have from 1 to 3 percent of living species.

KEEN, A. M., 1943, New mollusks from the Round Mountain silt (Temblor) Miocene of California: San Diego Soc. Nat. History Trans., v. 10, no. 2, p. 25–60, pls. 3–4.

Describes 19 new species of mollusks, and one new pelecypod subgenus, from the middle Miocene of the Kern River area. A columnar section and a geologic map are included. The fauna of Kern River area is correlated with Caribbean, Gulf Coast, and European sections. Seventy-seven mollusks are recorded from a locality in the lower part of the Round Mountain Silt.

Keen, A. M., 1944, Catalogue and revision of the gastropod subfamily Typhinae: Jour. Paleontology, v. 18, no. 1, p. 50–72, 20 text figs.

Typhis lampada, a Miocene species from the San Joaquin basin, California, is included in the subgenus *Talityphus*.

Keen, A. M., 1951, Outline of a proposed classification of the pelecypod family Cardiidae: Southern California Conchological Club Min., no. 111, p. 6–8.

Familial and generic classification of cardiids including many genera represented in the Pacific coast Neogene.

Keen, A. M., 1951, Outline of a proposed classification of the pelecypod family Veneridae: Southern California Conchological Club Min., no. 113, p. 1–10.

Familial and generic classification of venerids including many genera represented in the Pacific coast Neogene.

Keen, A. M., 1954a, Nomenclatural notes in the pelecypod family Veneridae: Southern California Conchological Club Min., no. 139, p. 50–55.

An undescribed species of *Ventricolaria* occurs in the California Miocene.

KEEN, A. M., 1954b, Five new species and a new subgenus in the pelecypod family Cardiidae: Am. Paleontology Bull., v. 35 (no. 153), 24 p., 1 pl.

Describes *Clinocardium praeblandum* from the Briones Formation, California, *C. pristinum* from the Neroly Formation, California, *C. hannibali* from the Montesano Formation, southwestern Washington, and *Nemocardium griphus* from the Astoria Formation of southwestern Washington. *Arctopratulum* is proposed as a new subgenus of *Nemocardium*. The known Neogene species of *Nemocardium* and *Clinocardium* are reviewed.

Keen, A. M., 1958, Sea shells of tropical West America, marine mollusks from Lower California to Colombia: Stanford, Calif., Stanford Univ. Press, 624 p., illus.

A valuable systematic catalog of the modern shallow, warm-water fauna of the eastern Pacific. Included are taxonomic notes, geographic and bathymetric ranges, and illustrations of almost all of the species.

Keen, A. M., with the assistance of Eugene Coan, 1963*, Marine molluscan genera of western North America, an illustrated key: Stanford, Calif., Stanford Univ. Press, 126 p.

A key to modern molluscan genera of the Pacific coast that is very useful in the identification of Neogene mollusks. Includes a section in which bathymetric ranges, substrate associations, and generalized geographic range data are indicated for each genus.

Keen, A. M., 1968, Cenozoic invertebrate paleontology, western United States, *in* Moore, R. C., and others, Developments, trends, and outlooks in paleontology: Jour. Paleontology, v. 42, no. 6, p. 1334.

A brief résumé of the development of invertebrate paleontology of the Pacific coast. Periods of activity in paleontological research have been keyed to periods of exploration for mineral resources. Future work is expected to permit greater refinement in age dating.

Keen, A. M., [n.d.], Supplement to "An abridged check list * * *": Papers on west American marine mollusca, published during the years 1937 to 1956. [n.p., n.d.] 13l.

A supplement to the bibliography in Keen (1937) including 186 additional references.

Keen, A. M., and Bentson, Herdis, 1940, Check list of California Tertiary marine mollusca [abs.]: Geol. Soc. America Bull., v. 51, no. 12, pt. 2, p. 1972–1973.

An objective listing of literature pertaining to Tertiary mollusks of California in which all references containing illustrations of fossil specimens are arranged alphabetically by class. The work was later published by Keen and Bentson (1944).

Keen, A. M., and Bentson, Herdis, 1944, Check list of California Tertiary marine Mollusca: Geol. Soc. America Spec. Paper 56, 280 p.

An extremely useful report that includes citations arranged alphabetically by genus and species of all illustrated Tertiary fossils up to and including 1941 (1,737 species of pelecypods, gastropods, and scaphopods). Each entry includes bibliographic reference, locality, formation, specimen number, and, usually, an indication of the most up-to-date generic allocation. Brief consideration is given to the paleogeographic significance of the number of species per epoch, history of molluscan paleontology in California, and broad aspects of faunal composition. A list of frequently mentioned fossil localities of the U.S. Geological Survey, California Academy of Science, Stanford University, University of California (Berkeley), and San Diego Society of Natural History is included.

Keenan, M. F., 1932, The Eocene Sierra Blanca Limestone at the type locality in Santa Barbara County, California: San Diego Soc. Nat. History Trans., v. 7, no. 8, p. 53–84.

Pecten lompocensis and other unnamed Miocene fossils belived to represent the "Temblor age" occur in strata directly overlying the Sierra Blanca Limestone.

Kennett, W. E., 1952, San Miguel Island, Santa Rosa Island south of Santa Rosa fault, Santa Rosa Island north of Santa Rosa fault, Santa Cruz Island south of Santa Cruz fault, *in* Redwine, L. E., chm., and others, Cenozoic correlation section paralleling north and south margins [of the] western Ventura basin from Point Conception to Ventura and Channel Islands, California: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

Pecten crassicardo, P. miguelensis, and *Turritella ocoyana* are reported from the Monterey Formation. *T. ocoyana and P. crassicvardo* are reported from the Conejo Volcanics. *Turritella inezana, T. ocoyana, T. tritschi, T. temblorensis, Pecten miguelensis, Rapana vaquerosensis,* and *Spondylus* occur in the Rincon Formation. *Tivela* occurs in the Vaqueros Formation.

Keroher, G. C., and others [14], 1966, Lexicon of geologic names of the United States for 1936–1960: U.S. Geol. Survey Bull. 1200, 4341 p.

This a companion volume to Wilmarth (1938) but with narrower coverage—Mexican and Canadian names are not included and paleontologic terms are omitted. Includes age, geographic distribution, location of type section, original reference and brief description. Fossil names are included in some descriptions, that is, *Pecten estrellanus* in the original description of the middle Miocene Bitter Creek Sandstone of Dibblee (1951).

Kerr, P. F., and Schenck, H. G., 1925, Active thrust faults in San Benito County, California: Geol. Soc. America Bull., v. 36, no. 3, 465-494.

Three mollusks are recorded from the Vaqueros Formation (lower Miocene). *Ostrea titan corrugata* is reported from upper Miocene Santa Margarita Formation east of the San Andreas fault. Seven mollusks are reported from "marine lower Pliocene" in the San Benito area.

Kew, W. S. W., 1914, Tertiary echinoids of the Carrizo Creek region in the Colorado Desert: California Univ. Pubs., Dept. Geology Bull., v. 8, no. 5, 39–60, pls. 1–5.

Includes a list of 39 mollusks that occur with echinoids at three localities in his Carrizo Formation: Carrizo Creek, Coyote Mountain, and Yuha Buttes.

Kew, W. S. W., 1919, Geology of a part of the Santa Ynez River district, Santa Barbara County, California: California Univ. Pubs., Dept. Geology Bull., v. 12, no. 1, p. 1–21.

Both the *Turritella inezana* and *Turritella ocoyana* faunas are recognized in his Vaqueros Sandstone. A few species are recorded from each. Pliocene rocks mapped as the Fernando Formation contain *Nassa californica* Conrad.

Kew, W. S. W., 1923, Geologic formations of a part of southern California and their correlations: Am. Assoc. Petroleum Geologists Bull., v. 7, no. 4, p. 411–420.

Turritella inezana and *Pecten magnolia* are characteristic of the Vaqueros Formation. *Pecten raymondi* is the most common species in the Modelo Formation.

Kew, W. S. W., 1924, Geology and oil resources of a part of Los Angeles and Ventura Counties, California: U.S. Geol. Survey Bull. 753, 202 p.

Mollusks are recorded from the Vaqueros Formation, Topanga Formation, Modelo Formation, Pico Formation, and Saugus Formation.

Kew, W. S. W., 1927, Geologic sketch of Santa Rosa Island, Santa Barbara County, California: Geol. Soc. America Bull., v. 38, no. 4, p. 645–654.

The Vaqueros Formation includes *Turritella inezana* and other fossils characteristic of the Vaqueros Formation elsewhere. Strata containing *T. ocoyana* are included in the upper part of this unit.

Kew, W. S. W., and Stoner, R. C., 1913, Monterey Series on the south side of Mount Diablo, California [abs.]: Geol. Soc. America Bull., v. 24, p. 129.

The fauna from this unit includes both early and late Miocene assemblages.

Kilkenny, J. E., 1948, Geology and exploration for oil in Salinas Valley, California: Am. Assoc. Petroleum Geologists Bull., v. 32, p. 2254–2268.

The Vaqueros Formation in its type section on Vaqueros Creek consists of 2,000 feet of marine sandstone containing [in the upper part] "the *Turritella inezana* megafossil assemblage" (p. 2258).

Kilmer, F. H., 1965, A Miocene dugongid from Baja California, Mexico: Southern California Acad. Sci. Bull., v. 64, pt. 2, p. 57–74.

Subtropical marine genera *Lyropecten*, *Codakia*, *Strombus*, *Turritella*, *Cypraea*, *Terebra*, and *Chione* occur with dugongid remains in the Ysidro Formation near La Purisima, Baja California. The age of the Ysidro is considered to be early or middle Miocene.

Kilmer, F. H., 1968, Preliminary report on the geology of Cedros Island, Baja California, Mexico [abs.]: Geol. Soc. America Program, 64th Ann. Mtg., Tucson, Ariz., Apr. 11–13, 1968, p. 72.

Fossiliferous Pliocene sandstone and conglomerate occur on Cedros Island.

Kincaid, Trevor, 1957, Local races and clines in the marine gastropod *Thais lamellosa*, a population study: Seattle, The Calliostoma Co., 75 p., 55 pls.

This species, referred to the subgenus *Nucella*, had its origin in the North Pacific during the late Miocene, having undergone notable expansion and differentiation during the Pliocene and Pleistocene. The stock from which the modern *N. lapillus* of the North Atlantic fauna was derived originated in the North Pacific. The local races of *N. lapillus* exhibit remarkable parallelism with those of *T. lima* of the North Pacific.

Klausing, R. L., and Lohman, K. E., 1964, Upper Pliocene marine strata on the east side of the San Joaquin Valley, California: U.S. Geol. Survey Prof. Paper 475–D, p. D14–D17.

Macoma and *Cryptomya*, identified by E. J. Moore, are reported from core of Pliocene (?) marine strata near Richgrove, Tulare County, Calif. The occurrence is stratigraphically below beds containing late Pliocene marine diatoms.

Kleinpell, R. M., 1930, Zonal distribution of the Miocene Foraminifera in Reliz Canyon, California: Micropaleontology Bull., v. 2, no. 2, p. 27–32.

Turritella inezana occurs in the upper part of the Vaqueros Formation on the divide between Reliz and Vaquero Canyons. Sandstone generally mapped as Santa Margarita [Formation] in Reliz Canyon contains *Crepidula*.

Kleinpell, R. M., 1934, Difficulty of using cartographic terminology in historical geology: Am. Assoc. Petroleum Geologists Bull., v. 18, no. 3, p. 374–379.

The newly proposed Zemorrian Stage based upon benthonic foraminifers from the California Coast Ranges includes strata that contain the *Turritella inezana* "horizons" of Loel and Corey (1932).

Kleinpell, R. M., 1938, Miocene stratigraphy of California: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 450 p.

Definitive biostratigraphic study of benthonic foraminiferal assemblages of the California Miocene. Many stratigraphic records of Miocene mollusks are reviewed as is the relationship of the molluscan sequence to the newly proposed sequence of Miocene foraminiferal stages.

Kleinpell, R. M., and Weaver, D. W., 1961, Oligocene boundary problems in the Transverse Ranges, California [abs.]: Soc. Econ. Paleontologists and Mineralogists-Am. Assoc. Petroleum Geologists-Soc. Explor. Geophysicists, Pacific Sec., and San Joaquin Geol. Soc., Guidebook, Spring field trip, 1961, p. 40.

Molluscan and foraminiferal biostratigraphy play an important role in the delineation of Oligocene time-stratigraphic boundaries in the Transverse Ranges.

Kleinpell, R. M., and Weaver, D. W., 1963a, Foraminiferal faunas from the Gaviota and Alegria Formation, *in* Kleinpell, R. M., and Weaver, D. W.,

Oligocene biostratigraphy of the Santa Barbara embayment, California: California Univ. Pubs. Geol. Sci., v. 43, pt. 1, p. 1–77.

Included is a check list of mollusks from the Vaqueros Formation (18 species).

KLEINPELL, R. M., and WEAVER, D. W., 1963b, Oligocene biostratigraphy of the Santa Barbara embayment, California: California Univ. Pubs. Geol. Sci., v. 43, 250 p., 38 pls.

Includes three parts, each of which contains data on Miocene mollusks: (1) Oligocene foraminiferal faunas, (2) Oligocene mollusks, and (3) systematic catalog and locality descriptions. Parts 1 (Kleinpell and Weaver, 1963a) and 2 (Weaver and Kleinpell, 1963) are listed separately in this bibliography.

Kleinpell, R. M., Weaver, D. W., and Doerner, D. P., 1967, Glimpses of the Paleogene depositional record west, north, northeast, and east of the Gabilan Mesa: Am. Assoc. Petroleum Geologists-Pacific Section, Pacific Section Soc. Econ. Paleontologists and Mineralogists, Guidebook, Gabilan Range and adjacent San Andreas Fault, p. 38–44.

Four species of mollusks are recorded from the type section of the Vaqueros Formation. The upper few hundred feet of the Vaqueros in the type area contains foraminiferal assemblages referable to the lower part of the Saucesian Stage.

Kobal, A. L., Jr., 1967, Index to graduate theses and dissertations on California geology—1962 through 1965: California Div. Mines and Geology, Mineral Inf. Service, v. 20, no. 8, p. 98–103.

A supplement to Jennings and Strand (1963) in which 236 theses are listed in two sections. One section includes areal reports keyed to an index map; the other, topical reports.

Kobayashi, Teiichi, and Shikama, Tokio, 1961, The climatic history of the Far East, *in* Nairn, A. E. M., Descriptive paleoclimatology: New York Interscience Publishers, Inc., p. 292–306.

The fauna of the Asagian State of Japan (early Miocene) is related to Vaqueros fauna of California.

Koch, J. G., 1966, Late Mesozoic stratigraphy and tectonic history, Port Orford-Gold Beach area, southwestern Oregon coast: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 25–71, 22 figs.

Five mollusks from an unnamed Miocene(?) formation near Port Orford are recorded.

Kotaka, Tamio, 1960, Similarity in the turritellid phylogeny in the later Cenozoic: Tohoku Univ. Sci. Repts., 2d ser. (Geology), spec. v. 4, p. 301–308.

Includes a review of the middle Miocene to Recent [Holocene] *Turritella cooperi* stock of California. Phylogenetic development is represented by appearance and strengthening of secondary spiral sculpture in this stock.

Kummel, Bernhard, 1956, Post-Triassic nautiloid genera: Harvard Univ. Mus. Comp. Zoology Bull., v. 114, no. 7, p. 324–494, illus.

The distribution of *Aturia angustata* is indicated in a table.

Kundert, C. J., 1952, Geology of the Whittier-La Habra area, Los Angeles County, California: California Div. Mines Spec. Rept. 18, 22 p.

Lists nearly 50 species of mollusks from 20 localities in the Pliocene Pico Formation and eight species from a locality in the upper part of the underlying Repetto Formation, also of Pliocene age. The Repetto mollusks suggest a shallow water environment whereas Foraminifera from surrounding localities indicate bathyal depths: 2,000–4,000 ft.

Landes, Henry, 1902, Creation of a state geological survey and an outline of the geology of Washington: Washington Geol. Survey, v. 1, Ann. Rept. for 1901, pt. I, p. 11–35.

A *Mytilus* bed at Bruceport in southwestern Washington is believed by W. H. Dall to be of Pliocene age.

La Pérouse, J. F. de G., 1797, Voyage de La Pérouse autour du monde, publié conformément au décret du 22 avril 1791, et rédigé par M. L. A. Miet-Mureau: Paris, Imprimerie de la République, v. 2, 298 p.

According to Miller (1961) "manteau royal" found on an expedition in the Lituya District is the earliest known record of a fossil pectinid from the west coast of North Ameica.

LaRocque, Aurele, 1953, Catalogue of the Recent Mollusca of Canada: Canada Natl. Mus. Bull. 129, p. 1–406.

Includes Miocene and Pliocene records for some modern marine mollusks from western Canada.

Lawrence, E. D., 1960, Morales oil field [California]: California Oil Fields, v. 46, no. 2, p. 96–105.

Ostrea titan occurs in the upper Miocene Santa Margarita Formation and several taxa, including *Turritella inezana* var. *hoffmani*, occur in the lower Miocene Painted Rock Sandstone Member of the Vaqueros Formation.

Lawrence, E. D., 1964, Guadalupe oil field [California]: California Oil Fields, v. 50, no. 2, p. 71–77.

Megafossil fragments are characteristic of the upper Pliocene Careaga Formation.

Lawson, A. C., 1893a, The geology of Carmelo Bay, with chemical analyses and cooperation in the field, by Juan de la C. Posada: California Univ. Pubs., Dept. Geology Bull., v. 1, no. 1, p. 1–59.

Eight mollusks from exposures of his Monterey Series near Carmelo Bay, Monterey County, identified by W. H. Dall, are recorded.

Lawson, A. C., 1893b, The Post-Pliocene disatrophism of the coast of Southern California: California Univ. Pubs., Dept. Geology Bull., v. 1, no. 4, p. 115–160.

Contains a list of Pliocene and Recent [Holocene] fossils found in the vicinity of Mussel Rock.

Lawson, A. C., 1894, The geomorphogeny of the coast of northern California: California Univ. Pubs., Dept. Geology Bull., v. 1, p. 241–271.

Includes a list of mollusks identified by J. C. Merriam that are considered to be of Pliocene age because 39 percent of the species are extinct.

Lawson, A. C., 1914, San Francisco, California (Tamalpais, San Francisco, Concord, San Mateo, and Hayward quadrangles): U.S. Geol. Survey Geol. Atlas, Folio 193, 25 p.

Molluscan assemblages from three faunal zones of the Monterey Group (Sobrante Sandstone; Claremont Shale, Oursan Sandstone, Tice Shale, Hambre Sandstone, and Rodeo Shale; Briones Sandstone) are listed. Mollusks from the San Pablo Formation are also listed. Identifications are by J. C. Merriam and B. L. Clark.

Lawson, A. C., and Palache, Charles, 1901, The Berkeley Hills, a detail of Coast Range geology [California]: California Univ. Pubs., Dept. Geology Bull., v. 2, no. 12, p. 349–450.

Report two mollusks from shales in their Monterey Series and eight from sandstone and limestone units in the Monterey.

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Includes a list of fossils of late Tertiary age from Carter Creek, northeastern Arctic Coast of Alaska identified by W. H. Dall (p. 130). These were subsequently listed, some as new species, by Dall (1920).

Leith, C. J., 1949, Geology of the Quien Sabe quadrangle [California]: California Div. Mines Bull. 147, p. 1–35.

Includes the statement that Taliaferro found "upper Vaqueros fossils" in a sedimentary unit overlying strata of Cretaceous age and underlying the Quien Sabe volcanics. The statement came from an unpublished report that no one has been able to find subsequently.

Lerbekmo, J. F., 1961, Genetic relationship among Tertiary blue sandstones in central California: Jour. Sed. Petrology, v. 31, no. 4, p. 594–602.

Late Miocene and Pliocene marine blue sand formations of central California are related to source areas and paleogeography. They are believed to have been derived from andesitic sources. Includes a correlation chart and paleogeographic maps but no mollusk identifications.

LINDSAY, G. E., 1965*, A fossil hunt: Pacific Discovery, v. 18, no. 6, p. 18–24, illus.

Figures *Pecten refugioensis* Hertlein, a late Miocene species from the Cape region of Baja California. Many other mollusks occur with this pectinid.

LIVINGSTON, VAUGHAN E., JR., 1959*, Fossils in Washington: Washington Div. Mines and Geology Inf. Circ. 33, 35 p.

Lists a few fossil localities of late Tertiary age and includes line drawings of some later Tertiary molluscan genera.

Loel, W. F., 1918, Vaqueros Formation in California [abs.]: Geol. Soc. America Bull., v. 29, p. 165.

Abstract: "The horizon markers and principal features show this division of the Lower Miocene to be a distinct and true formation, both faunally and lithologically."

Loel, Wayne, and Corey, W. H., 1931, Geologic history of the Vaqueros period in California: Petroleum World, v. 28, no. 8, p. 55, 77.

A connection between the Pacific and Caribbean permitted a Caribbean fauna to migrate northward along the California coast during the early

Miocene. A paleogeographic map of their Vaqueros Period indicating the greatest extent of the early Miocene sea depicts northwest-oriented embayments and insular masses in the southern part of the California Coast Ranges.

LOEL, WAYNE, and COREY, W. H., 1932, The Vaqueros formation, Lower Miocene of California; [pt.] 1, Paleontology: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 22, no. 3, p. 31–140, pls. 4–65.

The definitive work on the Vaqueros Formation together with a comprehensive review of mollusks from the Temblor Formation. Both names are used as time-stratigraphic terms although not specified as such. Included are a paleogeographic map, locality map, locality descriptions, lists of fossils by localities and regions, illustrations and descriptions of most of the Vaqueros mollusks, and sections on biozones and paleoecology. In the latter, authors considered the Temblor faunas to be more diverse than those of the Vaqueros; the increase in diversity was attributed to new tropical immigrants and cooler water species that inhabited new niches provided by deepening of marine basins in the Temblor.

Longinelli, A., and Nuti, S., 1968, Oxygen-isotope ratios in phosphate from fossil marine organisms: Science, v. 160, p. 879–882.

Record oxygen-isotope composition of phosphate and carbonate for Miocene and Pliocene oysters from California: *Ostrea titan*, *O. vespertina*, *O. herrmanni*, and *O.* sp.

Louderback, G. D., 1913, The Monterey series in California: California Univ. Pubs., Dept. Geology Bull., v. 7, no. 10, p. 177–241.

The concept of the Monterey series is extended to include the *Turritella hoffmanni* or *T. inezana* zone [early Miocene of current usage and now disassociated from the Monterey Formation]. Concludes that the Vaqueros Formation and the Temblor Beds were coeval. The bulk of the report consists of an extended discussion of previous work on the Monterey including reference to several paleontologic studies.

Louderback, G. D., 1951, Geologic history of San Francisco Bay [California]: California Div. Mines Bull. 154, p. 75–94.

Exposures of the Merced Formation between Mussel Rock and Lake Merced yield abundant marine fossils [mollusks]. The southern part of the exposures include a fauna of which about 63 percent are still living whereas in the northern part about 100 percent are still living. These units are regarded as upper Pliocene and lower Pleistocene.

Lowe, D. R., 1969, Santa Margarita Formation (Upper Miocene), upper Sespe Creek area, Ventura, County, California, *in* Dickinson, W. R., Soc. Econ. Mineralogists and Paleontologists, Pacific Coast Section, 1969 Field Trip [Guidebook], Upper Sespe Creek: p. 56–62.

Aequipecten discus (Conrad) is reported from the lowermost member of the Santa Margarita Formation (White Sandstone Member) and *Ostrea titan* and *Cerithium* sp. are reported from the Middle Sandstone Member.

LUTZ, G. C., 1951, The Sobrante sandstone: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 28, no. 13, p. 367–406, pls. 15–18, 3 text figs.

Thirty-four mollusks are recorded from the Sobrante Sandstone including two newly named species; 23 mollusks are illustrated. A geologic map

of the Pacheco syncline and columnar sections of the Pacheco syncline and the Bear Creek anticline show the position of fossil localities.

McCulloch, D. S., 1967, Quaternary geology of the Alaskan shore of Chukchi Sea, Chap. 5 *in* Hopkins, D. M., ed., The Bering Land Bridge: Stanford, Calif., Stanford Univ. Press, p. 91–120.

Neptunea n. sp. aff. *N. despecta*, *Astarte hemicymata*, and *Fortipecten hallae* are listed from marine sediment on wave-cut bedrock platform at Kivalina, on the Bering coast of Alaska. The molluscan fauna including 22 taxa (not listed) suggests a late Pliocene or early Pleistocene age.

McLAUGHLIN, R. P., and WARING, C. A., 1914*, Petroleum industry of California: California Mining Bur. Bull. 69, 519 p., atlas.

Characteristic mollusks from the Vaqueros, Monterey, Puente, Santa Margarita, Jacalitos, Fernando, and Etchegoin Formations (17 spp.) are illustrated.

McLEAN, J. H., 1964, New species of Recent and fossil West American Aspidobranch gastropods: Veliger, v. 7, no. 2, p. 129–133.

Macrarene diegensis is described from the Pliocene San Diego Formation.

McLean, J. H., 1969, Marine shells of southern California: Los Angeles County Mus., Sci. Ser. 24, Zoology no. 11, 104 p., 54 figs.

A useful reference for identification of shallow water mollusks of the modern California molluscan province, many of which occur in rocks of Pliocene age in southern and central California. Includes bathymetric, substrate, and geographic range data and illustrations of 318 species.

McMasters, J. H., 1943, Buena Vista Hills area of the Midway-Sunset oil field [California]: California Div. Mines Bull. 118, p. 517–518.

Subsurface zones in the Etchegoin Formation include (from highest to lowest) the *Mulinia densata* zone, *Bittium* zone, sub-*Mulinia* or sub-*Bittium* zone, and *Pecten oweni* zone. Some of these are shown in a generalized geologic column.

McMasters, J. H., 1947, Cymric oil field, Kern County, California, *in* Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, California, 1947: p. 100–106.

Lists a few "fossil markers" [mollusks] for Pliocene formations in a composite stratigraphic column for Cymric field.

MacKenzie, J. D., 1916, Geology of Graham Island, British Columbia: Canada Geol. Survey Mem. 88, 221 p.

Includes a list of 17 mollusks from the Skonun Formation of northern Graham Island identified by Whiteaves and originally listed by Dawson (1880); four other taxa identified by Ralph Arnold are also listed. The fauna was considered to be of Miocene or Pliocene age.

MACNEIL, F. S., 1957, Cenozoic megafossils of Northern Alaska: U.S. Geol. Survey Prof. Paper 294–C, p. 99–123, pls. 11–17.

Lists 26 mollusks from Tertiary strata (Nuwok Formation of Dall, 1919) along Carter Creek, Camden Bay, Alaska, most of which are also figured and treated systematically. Two new species are described from

this unit. The fauna shows relationship to the North Atlantic but not to the Pacific suggesting that there was no communication between the polar sea and the Pacific at that time. Some of the Quaternary pelecypods are believed to be related to Miocene species from the western North Pacific.

MacNeil, F. S., 1957, Selected mollusks from the Poul Creek and Yakataga Formations, Yakataga and Malaspina Districts, Alaska, showing tentative identifications and stratigraphic range: U.S. Geol. Survey Oil and Gas Inv. Map OM–187, sheet 2, table 1.

The stratigraphic ranges of 69 significant mollusks of Oligocene and Miocene age and the number of collections upon which these local ranges are based are shown on the chart. There are a few taxonomic notations on the chart.

MACNEIL, F. S., 1961, *Lituyapecten* (new subgenus of *Patinopecten*) from Alaska and California: U.S. Geol. Survey Prof. Paper 354–J, p. 225–237, pls. 35–46.

Treats eight species of *Lituyapecten*, a new subgenus, from Miocene and Pliocene formations of California and Alaska; three of these are new. Traces the development of two stocks of this subgenus during the Neogene.

MACNEIL, F. S., 1965, Evolution and distribution of the genus *Mya*, and Tertiary migrations of Mollusca: U.S. Geol. Survey Prof. Paper 483–G, 51 p., 11 pls.

The definitive report on the genus *Mya* with particular reference to North Pacific species. All of the Miocene and Pliocene species from western North America are figured; one new species is described from the late Miocene of California. The genus reached the Atlantic during the late Miocene by way of the Arctic Ocean. Migrations within the Pacific have generally been from west to east. The genus is divided into two subgenera, *Mya* (*Mya*) and *Mya* (*Arenomya*), based on configuration of the ligamental callus.

MACNEIL, F. S., 1967, Cenozoic pectinids of Alaska, Iceland, and other northern regions: U.S. Geol. Survey Prof. Paper 553, 57 p., 25 pls.

The definitive account of fossil pectinids of the North Pacific in which all of the known Alaskan pectinids are described and figured. A new subgenus, *Leochlamys*, and several new species of Miocene and Pliocene pectinids are described. Several pectinids migrated from the Pacific to the Atlantic during the late Cenozoic but none are known to have migrated from the Atlantic into the North Pacific. Middle Tertiary pectinids of the Pacific coast that have European affinities migrated into the North Pacific by way of an Indian Ocean or a Tethyan route.

MACNEIL, F. S., MERTIE, J. B., JR., and PILSBRY, H. A., 1943, Marine invertebrate faunas of the buried beaches near Nome, Alaska: Jour. Paleontology, v. 17, no. 1, p. 69–96.

The high percentage of extinct species in the Intermediate Beach and the Inner Submarine Beach deposits (27–46 percent) indicates a Pliocene age. The marine climate was warmer than at present during deposition of these fossiliferous strata. Fifteen new species or subspecies are described by MacNeil from the Intermediate Beach. Many other species are figured and treated systematically. Thirty-nine species are listed from the Inner

Submarine Beach, 41 are listed from the Intermediate Beach; almost all of these are mollusks.

MacNeil, F. S., Wolfe, J. A., Miller, D. J., and Hopkins, D. M., 1961, Correlation of Tertiary formations of Alaska: Am. Assoc. Petroleum Geologists Bull., v. 45, no. 11, p. 1801–1809.

Include marine sections from the Gulf of Alaska Tertiary province, Alaska Peninsula, Aleutian Islands, and Arctic coast. Many previously unpublished age determinations are included.

Maddern, A. G., 1914, Mineral deposits of the Yakataga district [Alaska]: U.S. Geol. Survey Bull. 592–E, p. 119–153.

Miocene fossils determined by W. H. Dall from a 1,000- to 1,500-ft upper Miocene sandstone, shale, and conglomerate unit (24 localities) are recorded. The fossils are correlated with the Empire Formation of Oregon. Miocene and Oligocene fossils occur in an underlying unit consisting of 3,000 ft of sandstone, shale, and conglomerate.

Maher, J. C., and Trollman, W. M., 1968, Geological literature on the San Joaquin Valley of California: U.S. Geol. Survey, prepared in cooperation with the U.S. Dept. Navy, Office of Naval Petroleum and Oil Shale Reserves, 415 p. [on 208 p.]. Released to open files, March 27, 1967.

Includes published and unpublished reports on the San Joaquin Valley including parts or all of 11 countries—Alameda, Calaveras, Contra Costa, Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. The report includes literature pertaining to petroleum geology: stratigraphy, paleontology, structure, and geophysics.

MANDRA, Y. T., 1949, A new species of *Mytilus* from the Pliocene of Humboldt County, California: Jour. Paleontology, v. 23, no. 1, p. 104–105.

Lists 11 common mollusks from unnamed Pliocene strata on Boulder Creek, Blue Lake quadrangle, Humboldt County, Calif.; *Mytilus highoohiae* is described.

Mandra, Y. T., 1963, Buttle Diatomite, a new member of the Monterey Formation, Salinas Valley, California, *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip, 1963, p. 104–105.

Sixteen mollusks from the basal conglomerate of the Pancho Rico Formation at the type locality of the Miocene Buttle Diatomite member of the Monterey Formation are listed (identifications by L. G. Hertlein). Two pectinids from the same stratigraphic position about 5 miles to the northwest were considered to be of Delmontian Age by J. W. Durham.

Mangum, Doris, 1967, Geology of Cape Lookout State Park, near Tillamook, Oregon: Ore Bin, v. 29, no. 5, p. 85–111.

Lists seven mollusks from the Astoria Formation identified by W. O. Addicott. The fossil locality, near Cape Lookout, is shown on a geologic map.

MANNING, G. A., and OGLE, B. A., 1950, Geology of the Blue Lake quadrangle, California: California Div. Mines Bull. 148, p. 1–36, pls. 1–13, text figs. 1, 2.

List mollusks from four localities in their Falor Formation (Pliocene). The largest assemblage includes 27 mollusks. Identifications are by Ogle and L. G. Hertlein. *Mytilus* aff. *M. middendorffi* Grewingk, n. sp., and "*Mytilus edulis* Linneaus," n. var., are figured.

Mansfield, W. C., 1932, Pliocene fossils from limestone in southern Florida: U.S. Geol. Survey Prof. Paper 170–D, p. 43–56, pls. 14–18.

Compares five newly named Pliocene pelecypods from Florida with species occurring in the Imperial Formation of southeastern California. Reviews published accounts of age of Imperial Formation noting the similarities between certain Florida Pliocene mollusks and species from the Imperial.

MARCOU, JULES, 1858, Geology of North America; with two reports on the prairies of Arkansas and Texas, the Rocky Mountains of New Mexico, and the Sierra Nevada of California, originally made for the United States government; Zurich, 144 p., + vi, 7 pls., 3 maps [From GSA Spec. Paper 56—Keen and Bentson].

Ostrea virginica californica is described from Tertiary strata near Carrizo Creek, Imperial County, Calif.

Marks, J. G., 1943, Type locality of the Tejon formation: California Div. Mines Bull. 118, p. 534–538.

B. L. Clark collected a pelecypod from the Tecuya Formation in Reed Canyon that resembles *Macoma nasuta* and further suggests that the Tecuya interfingers with the marine Vaqueros Formation.

Marks, J. G., 1951, Miocene stratigraphy and paleontology of southwestern Ecuador: Am. Paleontology Bull., v. 33, no. 139, 163 p., pls. 1–9.

Several species from the Round Mountain Silt near Bakersfield, Calif., are compared with species from the Miocene Subibaja Formation of southwestern Ecuador.

Marsh, O. T., 1960, Geology of the Orchard Peak area, California: California Div. Mines Spec. Rept. 62, 42 p.

Lists *Pecten andersoni* from his lower Temblor Sandstone and *Lyropecten crassicardo* from his upper Temblor Sandstone.

Martin, Bruce, 1912, Fauna from the type locality of the Monterey Series in California: California Univ. Pubs., Dept. Geology Bull., v. 7, no. 7, p. 143–150.

Lists 10 mollusks from the lower part of the type Monterey Formation and three each from the middle and upper parts.

Martin, Bruce, 1913, Faunal relations of the upper Neocene in the Sargent oil fields, California [abs.] (with discussion by A. C. Lawson, B. L. Clark, F. M. Anderson, and J. C. Martin): Geol. Soc. America Bull., v. 24, p. 129.

Abstract: "The results of recent work in this field and the close faunal relations with the Etchegoin formation of the Coalinga region were discussed."

MARTIN, BRUCE, 1914, Descriptions of new species of fossil Mollusca from the later marine Neocene of California: California Univ. Pubs., Dept. Geology Bull., v. 8, no. 7, p. 181–202, pls. 19–22.

A systematic report in which 16 new gastropods and one new pelecypod from the Pliocene of the California Coast Ranges are described and illustrated.

Martin, Bruce, 1916, The Pliocene of middle and northern California: California Univ. Pubs., Dept. Geology Bull., v. 9, no. 15, p. 215–259, tables 1–3.

Lists Pliocene mollusks from the lower part of the type Merced Formation, upper type Merced Formation, Bolinas Bay Merced Formation, "Merced Formation" of Año Nuevo Bay, "Merced Formation" of Pillar Point, "Merced Formation" of Sargent oil field, two divisions of the Wildcat Formation, "upper Miocene" at mouth of Bear River, Purisima Formation south of Halfmoon Bay; Etchegoin of the Sargent oil field. Pliocene strata at Cape Blanco, Oreg., are reviewed but no species are listed.

Martin, G. C., 1905, The petroleum fields of the Pacific coast of Alaska ***: U.S. Geol. Survey Bull. 250, 64 p.

A few molluscan genera from exposures of the Katalla Formation near Controller Bay, identified by T. W. Stanton and considered by him to be of Tertiary age, are listed. A small assemblage of mollusks of late Oligocene or early Miocene age collected from Kayak Island is recorded; the identifications are by W. H. Dall and Ralph Arnold.

Martin, G. C., 1908, Geology and mineral resources of the Controller Bay region, Alaska: U.S. Geol. Survey Bull. 335, 141 p.

Mollusks from the Katalla Formation identified by W. H. Dall and Ralph Arnold are recorded. Nine mollusks from middle Tertiary strata on Kayak Island are also listed. Several doubtfully identified genera are listed from the Stillwater Formation. Two doubtfully identified marine genera, *Nassa*? and *Mactra* or *Spisula*?, occur in the Kushtaka Formation. Several molluscan genera are recorded from localities in the Tokun Formation. All identifications are by Dall. Martin concluded that the entire sequence was of post-Eocene age.

Martin, G. C., 1921, Preliminary report on petroleum in Alaska: U.S. Geol. Survey Bull. 719, 83 p., 11 pls., 6 figs.

A Miocene pectinid occurs in the Katalla Formation. W. H. Dall's determinations of fossils from Katalla area (in Maddren, 1914) are reviewed.

Martin, H. A., and Rouse, G. E., 1966, Palynology of late Tertiary sediments from Queen Charlotte Islands, British Columbia: Canadian Jour. Botany, v. 44, p. 171–208.

A review of work on marine invertebrates from the Skonun Formation. The formation is believed to be of "either late Miocene or early Pliocene" age (p. 173) at Skonun Point on megafossil evidence.

Martin, Lewis, 1952, Some Pliocene Foraminifera from a portion of the Los Angeles Basin, California: Cushman Found. Foram. Research Contr., v. 3, pt. 3, p. 107–141.

Pecten fragments occur in a 300-ft measured section of Pliocene siltstone in downtown Los Angeles.

Masuda, Koichiro, 1962, Tertiary Pectinidae of Japan: Tohoku Univ. Sci. Repts., ser. 2, v. 33, no. 2, 238 p., 27 pls.

Many pectinids from the eastern North Pacific Neogene are similar to Japanese species.

MAXSON, J. H., 1933*, Economic geology of portions of Del Norte and Siskiyou Counties, northwesternmost California: California Jour. Mines and Geology, v. 29, nos. 1 and 2, p. 123–160, illus.

The Wimer Formation contains a marine molluscan fauna including *Pecten discus* Conrad which is indicative of Miocene age. Casts of a *Macoma* and a pectinid are figured. *Pecten parmeleei* occurs in the St. George Formation once exposed beneath the wharf at Crescent City.

Meade, R. F., 1966, Nature of the Santa Barbara Zone [California] [abs.]: Geol. Soc. America Program 1966 Ann. Mtgs., p. 137–138.

The Santa Barbara faunal zone includes many extinct, northward-living, submergent mollusks of late Pliocene and (or) early Pleistocene age. Volcanic ash from near the base is dated by Yeats and others (1966) at 8.7 m.y. The base of the Santa Barbara faunal zone is temperature controlled. All of the molluscan assemblages are of inner sublittoral aspect.

Meade, R. F., 1967, Paleoecology of Santa Barbara zone, Pliocene of southern California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, pt. 1, p. 474–475.

The Santa Barbara faunal zone is composed of Pliocene and Pleistocene mollusks including extinct, extralimital northern, submergent forms. The mollusks lived in 15–50 fathoms of water but were subsequently displaced into deeper water—depths of 100 fathoms or more. The Fernando Formation below the Santa Barbara zone contains assemblages indicative of water temperatures about the same as today, whereas the stratigraphically higher Santa Barbara zone includes mollusks living today in cooler waters off southernmost Canada. The highest part of the Cenozoic section includes mollusks indicative of water temperatures not markedly different from modern temperatures at this latitude.

Meek, F. B., 1864, Check list of the invertebrate fossils of North America, Miocene: Smithsonian Misc. Colln., v. 4, pub. 183, p. 1–32.

Many species from California and Oregon are listed. There is a section with taxonomic notes.

Mendenhall, W. C., 1910, Notes on the geology of Carrizo Mountain and vicinity, San Diego County, California: Jour. Geology, v. 18, no. 4, p. 336–355.

Lists descriptions for several Miocene fossil localities with brief comments on a few localities—pectens, oysters, *Malea*, *Strombus*, etc. The collections had not as yet been studied by paleontologists at the time the report was written.

MERRIAM, C. W., 1941, Fossil Turritellas from the Pacific coast region of North America: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 26, no. 1, p. 1–214, pls. 1–41.

A comprehensive treatment of one of the most important goups of Cenozoic mollusks of the Pacific coast. Species are classified according to "stocks" [subgenera], most of which show clear-cut phylogenetic development. Stratigraphic ranges of the five Neogene "stocks" are indicated on a chart. The systematic section includes extensive discussions of variation, ontogenetic changes, and geographic occurrence. Eight new specific or subspecific Neogene taxa are described.

Merriam, J. C., 1895, A list of type specimens in the Geological Museum of the University of California, which have served as originals for figures and

descriptions in the paleontology of the State Geological Survey of California under J. D. Whitney. Compiled for the use of workers in California geology, by John C. Merriam: California Univ. Dept. Geology Bull., 3 p.

Seventeen species of Miocene and Pliocene mollusks described by W. M. Gabb are listed [reference from Vogdes (1896, p. 21–23)].

Merriam, J. C., 1896, Note on two Tertiary faunas from the rocks of the southern coast of Vancouver Island [British Columbia]: California Univ. Pubs., Dept. Geology Bull., v. 2, no. 3, p. 101–108.

Mollusks from the type Sooke Formation and from rocks near Carmanah Point to the northwest are recorded. The latter fauna was considered to be significantly older than that of the Sooke Formation which was considered to be of middle "Neocene" age.

MERRIAM, J. C., 1897, New species of Tertiary molluscs from Vancouver Island [British Columbia]: Nautilus, v. 2, p. 64–65.

Contains description of four new species of mollusks from the Sooke Formation and one from beds at Carmanah Point. These were subsequently illustrated by Merriam (1899).

MERRIAM, J. C., 1899, The fauna of the Sooke Beds of Vancouver Island [British Columbia]: California Acad. Sci. Proc., ser. 3, v. 1, no. 6, p. 175–180, pl. 23.

The redescription and initial illustration of five species of mollusks named by Merriam in 1897. Lists 25 molluscan taxa from the Sooke and the known Miocene, Pliocene, and Holocene occurrences of these concluding that the fauna is of middle "Neocene" age.

Merriam, J. C., 1900, List of fossils in the oil and gas yielding formations of California, *in* Watts, W. L., Oil and gas yielding formations of California: California Mining Bur. Bull. 19, p. 218–224.

Lists Miocene fossils from Santiago Canyon, Piru Creek, and Big Tar Canyon [as lower Neocene]; middle Neocene ("San Pablo Group" [Pliocene, in part]) from Puente Hills and Piru Creek area; upper Neocene ("Pliocene") from shallow well near San Juan Capistrano.

Merriam, J. C., 1904, A note on the fauna of the lower Miocene in California: California Univ. Pubs., Dept. Geology Bull., v. 3, no. 16, p. 377–381.

Three divisions of the Miocene are recognized in Contra Costa County: the lowest division is characterized by *Agasoma gravida* [San Ramon Formation]; the middle or Monterey Shale fauna is characterized by *Pecten peckhami, Tellina congesta,* and *Leda;* the upper differs from the overlying San Pablo by the presence of *Trochita costellata* and other mollusks. The *Agasoma* zone of Contra Costa County includes both the *Turritella hoffmani* [*T. inezana*] and *T. ocoyana* zones found farther south in California. The *T. ocoyana* zone, as developed at Kern River, is more modern in appearance and contains more recent living species than the *T. hoffmani* zone. The *T. hoffmani* zone is found principally in coastal California; the *T. ocoyana* zone in both coastal and inland areas. This suggests that the sea reached farther east during the deposition of the latter zone.

Merriam, J. C., 1916, Mammalian remains from the Chanac Formation of the Tejon Hills, California: California Univ. Pubs., Dept. Geology Bull., v. 10, no. 8, p. 111–127.

Includes a note on two Miocene faunas of the Tejon Hills furnished by B. L. Clark in which seven mollusks are listed from the Vaqueros or Temblor and 21 are listed from the Santa Margarita. The latter assemblage is correlated with the Santa Margarita of the Coalinga area to the northwest.

Merriam, J. C., 1921, An outline of progress in paleontological research on the Pacific coast: California Univ. Pubs., Dept. Geology Bull., v. 12, no. 3, p. 237–266.

A résumé of paleontological studies on marine invertebrates including a bibliography.

Merriam, J. C., and Pack, R. W., 1913, Suggested paleontologic correlations between continental Miocene deposits of the Mohave region and marine Tertiary beds of San Joaquin Valley, California [abs.]: Geol. Soc. America Bull., v. 24, p. 128.

Marine mollusks of early Miocene age are associated with continental vertebrates of late Miocene age at a locality in the Tejon Hills, Kern County, Calif. The discrepant ages may indicate incorrect correlation with marine standards of the Atlantic coast and vertebrate standards of the Great Plains area.

Merrill, F. J. H., 1914, The counties of San Diego, Imperial [California]: California Jour. Mines and Geology, v. 14, p. 635–743.

A bed of *Ostrea vespertina* Conrad occurs near Carrizo Creek, Imperial County.

Mertie, J. B., Jr., 1931, Notes on the geography and geology of Lituya Bay, Alaska: U.S. Geol. Survey Bull. 836–B, p. 117–135.

A fauna collected from Ctenopah Island and identified by W. H. Dall includes more than 40 genera considered to be of Miocene age. Other collections from ths area identified by Dall and by W.C. Mansfield were correlated with the Empire Formation (Pliocene) of coastal Oregon. There are 20 mollusks in the largest collection.

Mertie, J. B., Jr., 1938, The Nushagak District, Alaska: U.S. Geol. Survey Bull. 903 p., 96 p.

Twelve mollusks from a locality in the Nushagak Formation near Nushagak identified by W. H. Dall are listed. These were regarded as correlative with the Astoria Formation of Oregon.

Metzger, D. G., 1969, The Bouse Formation (Pliocene) of the Parker-Blythe-Cibola area, Arizona and California, *in* Geological Survey research: U.S. Geol. Survey Prof. Paper 600–D, p. D126–D136.

Six marine mollusks identified by A. Myra Keen and Dwight W. Taylor (*Halodakra*, *Diplodonta*, *Macoma*, *Mulina?*, *Batillaria*, *Barleeia?*) suggest a brackish-water environment.

Metzner, L. H., 1935, The Del Rey Hills area of the Playa del Rey oil field [California]: California Oil Fields, v. 21, no. 2, p. 5–26.

Mollusks from cores of the conglomerate overlying schist basement identified by W. H. Corey are considered to be of late Miocene age [*Mytilus* cf. *mathewsoni* Gabb, *Ostrea* sp., *Pecten raymondi brionianus* Trask, *Pecten crassicardo* var., *Calyptraea inornata* (Gabb)].

MILLER, A. K., 1947*, Tertiary nautiloids of the Americas: Geol. Soc. America Mem. 23, 234 p., 100 pls.

Pacific coast Miocene occurences of *Aturia angustata* and *A. alaskensis* are noted. *Aturia* sp. occurs in the San Ramon Formation in association with five mollusks of late Oligocene or early Miocene age. These taxa are illustrated.

MILLER, A. K., and DOWNS, H. R., 1950*, Tertiary nautiloids of the Americas: Supplement: Jour. Paleontology, v. 24, no. 1, p. 1–18, 10 pls.

Figure Miocene specimens of *Aturia angustata* (Conrad)? from the upper part of the Twin River Formation, Wash., and from the Temblor Formation near Mt. Poso oil field, Kern County, Calif.

Miller, D. J., 1951, Preliminary report on the geology and oil possibilities of the Katalla District, Alaska: U.S. Geol. Survey open-file Rept., 66 p.

Part of the Katalla Formation may be of Miocene age. The Yakataga Formation is of Miocene age. Many of the species listed by Clark (1932) from the Yakataga Formation are actually from the underlying Poul Creek Formation. Some of the stratigraphic ranges of diagnostic mollusks in the Poul Creek and Yakataga Formations are shown on a correlation chart. Paleontologic determinations are by H. E. Vokes.

Miller, D. J., 1953, Late Cenozoic marine glacial sediments and marine terraces of Middleton Island, Alaska: Jour. Geology, v. 61, no. 1, p. 17–42.

Twenty-four species of mollusks identified by F. S. MacNeil are listed together with ecologic and zoogeographic inferences. A Pliocene or Pleistocene age is indicated. Includes stratigraphic section and geologic map showing fossil localities.

Miller, D. J., 1957, Geology of the southeastern part of the Robinson Mountains, Yakataga district, Alaska: U.S. Geol. Survey Oil and Gas Inv. Map OM–187, scale 1:63,360.

Lists 69 mollusks in a stratigraphic range chart for the Poul Creek and Yakataga Formations; the localities are shown on a geologic map and on measured sections.

Miller, D. J., 1961, Stratigraphic occurrence of *Lituyapecten* in Alaska: U.S. Geol. Survey Prof. Paper 354–K, p. 241–248.

Includes correlation chart showing stratigraphic occurrence of eight Miocene and Pliocene species of *Lituyapecten* and *Patinopecten* in southeastern Alaska. The Tertiary sequence of the Gulf of Alaska is divided into three parts. The lower Tertiary is in part nonmarine but includes marine invertebrates indicative of tropical or subtropical conditions. The middle Tertiary consists of marine strata of somewhat deeper bathymetric aspect and warm temperate to subtropical water conditions. The upper Tertiary unit is wholly marine, of shallow water aspect, and includes marine tillite. It contains mollusks indicative of cool temperate to boreal marine climate.

Miller, D. J., Payne, T. G., and Gryc, George, 1959, Geology of possible petroleum provinces in Alaska: U.S. Geol. Survey Bull. 1094, 127 p.

Local glaciation which began during the middle or late Miocene is indicated by the marine invertebrate fauna [mostly mollusks] and marine glacial deposits in the Gulf of Alaska area.

Miller, R. H., and Bloom, C. V., 1937, Mountain View oil field [California]: California Oil Fields, v. 22, no. 4, p. 5–36.

"*Pholas* borings are common" in the lower part of the Chanac Formation. "*Clementia pertenuis*, large variety," was recovered from a core from the Chanac Formation suggesting a Miocene age. Casts of *Mya* and *Cryptomya* occur in cores from the lower part of the Chanac Formation in the northwestern edge of the oil field.

Miller, R. H., and Ferguson, G. C., 1943, Mountain View oil field [California]: California Div. Mines Bull. 118, p. 565–570.

Pholas, or possibly worm borings, are of common occurrence in the Chanac Formation. A megafossil assemblage from the Wharton sand is similar to those occurring in the type Santa Margarita Formation.

Miller, R. H., and Ledingham, G. W., 1943, Fruitvale oil field [California]: California Div. Mines Bull. 118, p. 562–564.

A few pelecypods are recorded from the upper 600 feet of the Santa Margarita Formation and from the Etchegoin Formation.

Milow, E. D., and Ennis, D. B., 1961, Guide to geologic field trip of southwestern San Diego County [California], *in* Field Trip Guidebook, San Diego County, 57th Ann. Mtg. Cordilleran Sec., Geol. Soc. America, 1961: p. 23–43.

List seven mollusks from the Pliocene San Diego Formation.

Mina U., Federico, 1956, Bosquejo Geológico de la parte sur de la Peninsula de Baja California: Internat. Geol. Cong., 20th, Mexico City, 1956, Excursiones A–7, 79 p.

Pliocene mollusks are recorded from the Almejas Formation.

Mina U., Federico, 1957, Bosquejo geológico del Territoria sur de la Baja California [Mexico]: Asoc. Méxicana Geologos Petroleros Bol., v. 9, nos. 3 y 4, p. 139–269.

Lists mollusks from the San Raymundo Formation (middle Miocene), the San Ignacio Formation (upper Miocene), and the Almejas Formation (Pliocene). Paleogeographic maps of the Miocene (three divisions) and the Pliocene are included.

Minch, J. A., 1966, Franciscan detritus in the Mid-Tertiary succession between Tijuana and Rosarito Beach, northwestern Baja California, Mexico [abs.]: Geol. Soc. America Program, Ann. Mtg., Reno, Nev., April 6–9, 1966, p. 56.

Miocene (?) marine fossils occur in the lower 200 ft of a succession of basalt, tuff, conglomerate, and sandstone along the northwestern coast of Baja California.

Minch, J. A., 1967, Stratigraphy and structure of the Tijuana-Rosarito Beach area, northwestern Baja California, Mexico: Geol. Soc. America Bull., v. 78, no. 9, p. 1155–1178.

Includes list of 18 mollusks from two localities in his Rosarito Beach Formation (Miocene or Pliocene). Lists a few mollusks from the Pliocene San Diego Formation.

Mitchell, E. D., Jr., 1961, A new walrus from the Imperial Pliocene of southern California: with notes on odobenid and otariid humeri: Los Angeles County Mus. Contr. Sci., no. 44, 28 p.

The new walrus, *Valenictus imperialensis* n. sp., was collected from an *Ostrea-Anomia* bioherm in the mouth of Painted Gorge on the east Flank of Coyote Mountain.

Mitchell, E. D., Jr., 1965, History of research at Sharktooth Hill, Kern County, California: Kern County History Soc. and Kern County Mus. Spec. Pub., 45 p.

A résumé of investigations on middle Miocene vertebrate fossils from Sharktooth Hill with brief mention of reports dealing with mollusks.

Mitchell, E. D., Jr., 1966, The Miocene pinniped *Allodesmus*: California Univ. Pubs. Geol. Sci., v. 61, 46 p.

The middle Miocene sharktooth bed and bone bed at Sharktooth Hill near Bakersfield, Calif., lacks marine invertebrates excepting one pectinid. This may have been the result of recurrent noxious water-blooms of dinoflagellates that would not have affected relatively fast-moving marine vertebrates. Selective leaching of marine invertegrates is ruled out because no casts have been found in the extensively collected deposit. Two Miocene pectinids occur with *Allodesmus* on San Clemente Island, southern California.

Mitchell, E. D., Jr., and Lipps, J. H., 1965, Fossil collecting on San Clemente Island [Californial]: Pacific Discovery, v. 18, no. 3, p. 2–8.

Miocene pelecypods occur in sandstones exposed in the "south basin," near the middle of San Clemente Island.

Mitchell, E. D., Jr., and Repenning, C. A., 1963, The chronologic and geographic range of Desmostylians: Los Angeles County Mus. Contr. Sci., no. 78, 20 p.

List a few mollusks occurring with early, middle, and late Miocene specimens of *Desmostylus* in California and a late Miocene occurrence of *Paleoparadoxia*. A chart depicts the chronologic range of Desmostylians and Sirenians in terms of the late Tertiary marine chronologies of Europe, the northeastern Pacific, and the western Pacific.

Mongin, Denise, 1959, Study of some American Miocene lamellibranchs and comparison with related European species: Am. Paleontology Bull., v. 39, no. 180, p. 283–343, pls. 24–27.

Neogene species of *Lyropecten* and *Patinopecten* from California are related to certain Atlantic coast and European pectinids.

Mongin, Denise, 1968, Les Pectinides du Miocene de la Guadeloupe (Antilles Françaises): Am. Paleontology Bull., v. 54, no. 245, p. 471–510, pls. 40–50.

Pacific coast *Lyropecten*, characteristic of the Miocene, is the equivalent of Mediterranean *Gigantopecten* and western Atlantic *Nodipecten*.

MOODY, C. L., 1916, Fauna of the Fernando of Los Angeles: California Univ. Pubs., Dept. Geology Bull., v. 10, no. 4, p. 39–62, pls. 1–2.

One hundred forty-seven mollusks, including 11 new species, are recorded from Pliocene strata uncovered during excavation for a building in downtown Los Angeles. The fauna is of boreal aspect representing a comparatively shallow water environment; more than 16 percent of the living component is restricted to more northern waters.

Moore, B. N., 1930, Stratigraphic relations of the *Turritella inezana?* and *Turritella ocoyana?* zones of the Santa Ana Mountains, Orange County, California [abs.]: Geol. Soc. America Bull., v. 41, p. 212.

Turritella inezana and *T. ocoyana* are reported to have nonoverlapping stratigraphic ranges and to be separated, in this area, by a discon-

formity. One specimen of *T. inezana* occurring in the basal part of the *T. ocoyana* zone is believed to have been reworked.

Moore, E. J., 1962, Conrad's Cenozoic fossil marine mollusk type specimens at the Academy of Natural Sciences of Philadelphia: Acad. Nat. Sci. Philadelphia Proc., v. 114, no. 2, p. 23–120.

Cenozoic mollusks from the western United States described by Conrad that were deposited in the Academy of Natural Sciences of Philadelphia are reviewed. Many of the types are missing. A biographic sketch of Conrad and an extensive bibliography of his publications are included.

MOORE, E. J., 1963, Miocene mollusks from the Astoria Formation in Oregon: U.S. Geol. Survey Prof. Paper 419, 109 p., 33 pls.

The definitive paleontologic treatment of the larger marine invertebrate fauna of the middle Miocene Astoria Formation of Oregon. The systematic section includes treatment of 97 species of mollusks, 11 of which are new. The report includes an extensive annotated list of reports dealing with the Astoria Formation and its fossils.

MOORE, E. J., 1968*, Fossil mollusks of San Diego county [California]: San Diego Soc. Nat. History Occasional Paper 15, 76 p., 34 pls.

Figures 19 Pliocene mollusks from localities in San Diego County.

Moore, G. W., 1969, New formations on Kodiak and adjacent islands, Alaska: U.S. Geol. Survey Bull. 1274–A, p. A27–A35.

Middle and early Miocene mollusks occur in the Narrow Cape Formation on Kodiak and Sitkinak Islands. *Nassarius* cf. *N. andersoni* is reported from the Pliocene Tugidak Formation.

Moore, G. W., and Silver, E. A., 1968, Geology of the Klamath River Delta, California, in Geological Survey research: U.S. Geol. Survey Prof. Paper 600–C, p. C144–C148.

Two pelecypods from the St. George Formation are identified by W. O. Addicott and are considered to corroborate an earlier age determination of Pliocene.

MOORE, R. C., ed., and COX, L. R., NEWELL, N. D., BOYD, D. W., BRANSON, C. C., CASEY, RAYMOND, CHAVAN, ANDRÉ, COOGAN, A. H., HERTLEIN, L. G., KAUFFMAN, E. G., KEEN, A. M., LaROCQUE, AURÈLE, McALESTER, A. L., MOORE, R. C., NUTTAL, C. P., PERKINS, B. F. PURI, H. S., SMITH, L. A., SOOT-RYEN, T., STENZEL, H. B., TRUEMAN, E. R., TURNER, R. D., and WEIR, JOHN, 1969*, Mollusca b, Bivalvia, pt. N of the Treatise on invertebrate Paleontology: Lawrence, Kans., Kansas Univ. Press, v. 1 and 2, illus.

Includes many references and figures pertaining to eastern North Pacific taxa.

MOORE, R. C., ed., and KNIGHT, J. B., COX, L. R., KEEN, A. M., SMITH, A. G., BATTEN, R. L., YOCHELSON, E. A., LUDBROOK, N. H., ROBERTSON, ROBERT, YONGE, C. M., and MOORE, R. C., 1960*, Mollusca 1 *** Scaphopoda Amphineura, Monoplacophora, Gastropoda [in part]*** pt. I of the Treatise on Invertebrate Paleontology: Lawrence, Kans., Kansas Univ. Press, 351 p., 216 figs.

Includes many references and figures pertaining to eastern North Pacific taxa.

Morse, R. R., and Bailey, T. L., 1935, Geological observations in the Petaluma district, California: Geol. Soc. America Bull., v. no. 10, p. 1437–1456.

A middle Miocene faunal assemblage characterized by *Arca montereyana* occurs in Carneros Creek about 20 miles east of Petaluma. A pelecypod resembling *Monia* (*Pododesmus*) has been recovered from a well core about 300 ft above the base of the Petaluma Formation in strata considered to be of Pliocene age.

Musser, E. H., 1930, Buttonwillow gas field [California]: California Oil Fields, v. 15, no. 3, p. 5–20.

Characteristic mollusks (genera) mark the change from nonmarine to marine deposition at about 2,700 ft in wells (upper part of the Etchegoin Formation). At 3,730 ft another fossiliferous bed is found in which marine and freshwater forms occur together.

Nations, J. D., 1968, A new species of Cancroid crab from the Pliocene of California: Jour. Paleontology, v. 42, no 1., p 33–36, pl. 10.

Three mollusks occur at the type locality of *Cancer davidi* n. sp. Mollusks from the Etchegoin Formation suggest a minimum average winter temperature of 13°C or higher.

Natland, M. L., 1957, Paleoecology of west coast Tertiary sediments, chap 17. *in* Ladd, H. S., ed. Treatise on marine ecology and paleoecology: Geol. Soc. America Mem. 67, p. 543–572, illus.

Some common Miocene and Pliocene molluscan index species are indicated on stratigraphic columns for some California Tertiary basins.

Natland, M. L., and Rothwell, W. T., Jr., 1954, Fossil Foraminifera of the Los Angeles and Ventura regions, California, [pt.] 5 *in* chap. 3 *of* Jahns, R. H., ed., Geology of southern California: California Div. Mines Bull. 170, p. 33–42.

A few Oligocene to Miocene [early Miocene] mollusks from the Vaqueros-Sespe Formations and middle Miocene mollusks from the Topanga Formation are indicated on a composite stratigraphic section of the Los Angeles basin.

Nelson, E. W., 1899, General description of the Tres Marias Islands: Mexico: North Am. Fauna, no. 14, p. 7–12.

Marine fossils occur on Maria Madre Island.

Nelson, R. N., 1925, Geology of the hydrographic basin of the upper Santa Ynez River, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 15, no. 10, p. 327–396.

The Temblor Sandstone contains a *Turritella ocoyana* fauna. A *Turritella* resembling *T. inezana* and *Pecten peckhami* are reported from rocks mapped as undifferentiated Monterey Formation. Elsewhere this formation contains fossils characteristic of the Temblor Sandstone.

Neuerberg, G. J., 1953, Geology of the Griffith Park area, Los Angeles County, California: California Div. Mines Spec. Rept. 33, 29 p.

Twenty-two species from localities in the Topanga Formation are recorded.

Newton, V. C., Jr., 1969, Subsurface geology of the Lower Columbia and Willamette basin, Oregon: Oregon Dept. Geology and Mineral Industries Oil and Gas Inv. no. 2, 121 p.

Includes a correlation chart showing Pacific coast microfaunal stages, molluscan stages, and the stratigraphic sequence of Tertiary formations of northwestern Oregon.

Nicol, David, 1964, An essay on size of marine pelecypods: Jour. Paleontology, v. 38, no. 5, p. 968–974.

Ostrea titan from California Miocene reaches as much as 300 mm by 140 mm in size.

NOMLAND, J. O., 1916a, Fauna from the lower Pliocene at Jacalitos Creek and Waltham Canyon, Fresno County, California: California Univ. Pubs., Dept. Geology Bull., v. 9, no. 14, p. 199–214, pls. 9–11.

Nine new species of mollusks are described from the Jacalitos Formation. Seventy-eight mollusks are recorded from localities on Jacalitos and Waltham [?Warthan] Creeks.

NOMLAND, J. O., 1916b, Relation of the invertebrate to the vertebrate faunal zones of the Jacalitos and Etchegoin formations in the North Coalinga region, California: California Univ. Pubs., Dept. Geology Bull., v. 9, no. 6, p. 77–88, pl. 7.

Describes and illustrates three new species of Pliocene gastropods. The Pliocene invertebrate fauna of the Etchegoin Formation north of Coalinga is subdivided into four faunal zones; the lowest zone, the *Glycymeris* zone, has by far the largest number of species. The Jacalitos Formation of this area contains no marine fossils.

NOMLAND, J. O., 1917a, The Etchegoin Pliocene of middle California: California Univ. Pubs., Dept. Geology Bull., v. 10, no. 14, p. 191–254, pls. 6–12.

Includes an index map showing important Pliocene localities (27) in California. Lists 87 species from the lower Etchegoin "Jacalitos." Other lists of Etchegoin mollusks from near Lonoak and Big Sandy Creek are included. Water temperatures were warmer than today during deposition of the Etchegoin; no cold water phases are indicated. The faunas from his *Chione elsmerensis*, *Turritella nova*, *Pecten coalingensis*, and *Mya japonica* zones are listed. Sixteen new species of Pliocene mollusks are described.

Nomland, J. O., 1917b, Fauna of the Etchegoin Pliocene of middle California [abs.]: Geol. Soc. America Bull., v. 28, p. 229–230.

The Etchegoin Formation includes all post-Santa Margarita strata and is of Pliocene age. Four distinct faunal zones are recognized in this formation.

NOMLAND, J. O., 1917c, Fauna of the Santa Margarita beds in the North Coalinga region of California: California Univ. Pubs., Dept. Geology Bull., v. 10, no. 18, p. 293–326, pls. 14–20.

Fifteen new molluscan taxa are described and illustrated. Santa Margarita assemblages from the Tejon Hills, San Luis Obispo area [at base of "Monterey" Shale], Coalinga, type section near Santa Margarita, and Nacimiento River are recorded.

Normark, W. R., and Curray, J. R., 1968, Geology and structure of the tip of Baja California, Mexico: Geol. Soc. America Bull., v. 79, no. 11, p. 1589–1600.

Pecten specimens of Pliocene age were dredged from about 500 meters off the southeast tip of Baja California.

Oakeshott, G. B., 1950, Geology of Placerita oil field, Los Angeles County, California: California Jour. Mines and Geology, v. 46, no. 1, p. 43–79.

A *Cryptomya* resembling upper Pliocene forms from the San Joaquin Valley occurs in the upper part of the Upper Pico Formation. The Sunshine Ranch Member of the Pico Formation contains abundant marine megafossils near the type locality. These extend upwards into the middle part of the formation. The basal coquina beds were once mined for lime.

Oakeshott, G. B., 1958, Geology and mineral deposits of San Fernando quadrangle, Los Angeles County, California: California Div. Mines Bull. 172, 147 p.

Mollusks from the upper Miocene Modelo Formation, the lower Pliocene Repetto Formation, and the lower part of the Pico Formation are listed. Identifications are by several paleontologists. The localities are shown on a map.

OBERLING, J. J., 1964, Observations on some structural features of the pelecypod shell: Sonderdruck aus den Mitteilungen der Naturforschenden Gesellschaft in Bern, Neue Folge, 20 Band, 60 p., 6 pls., 3 figs.

Several Neogene species from the Pacific Coast States are listed among the 230 species examined, thin sections of a few of these fossil species are illustrated. The pelecypod shell consists of two kinds of deposits: palliostracum secreted by the mantle and myostracum secreted over muscle attachment areas. Three kinds of shell structure are recognized: nacroprismatic, foliated, and complex-lamellar.

Obradovich, J. D., 1968, The potential use of glauconite for late-Cenozoic geochronology, *in* Morrison, R. B., and Wright, H. E., Jr., eds., Means of correlation of Quaternary successions: VII Cong. Internat. Assoc. for Quaternary Research, Salt Lake City, Utah Univ. Press, p. 267–279.

A mean age of 3 m.y. was obtained from K–Ar investigation of glauconite from Lomita Marl Member of the San Pedro Formation, Palos Verdes Hills, Calif. The glauconite age of the Fernando Formation (late early Pliocene) from the same area is 6.1±1.2 m.y.

Ogle, B. A., 1953, Geology of the Eel River Valley area, Humboldt County, California: California Div. Mines Bull. 164, p. 1–128.

A check list of 53 mollusks from the Wildcat Group identified by the author and J. Wyatt Durham is included.

Ogle, B. A., 1961a, The Eel River Basin [California], *in* Northwestern California, a traverse of the Klamath Uplift, Northern Coast Ranges, and Eel River Basin: Geol. Soc. Sacramento Ann. Field Trip, 1960, p. 32–33.

The occurrence of mollusks in the Pliocene Wildcat Group is shown on a generalized stratigraphic section. *Pecten caurinus* is reported from the Scotia Bluffs Sandstone and the Rio Dell Formation.

Ogle, B. A., 1961b, Geologic description of a portion of the Eel River Basin, *in* Northwestern California, a traverse of the Klamath Uplift, Northern Coast Ranges, and Eel River Basin: Geol. Soc. Sacramento Ann. Field Trip, 1960, p. 35–39.

Pecten caurinus and *Cerastoderma meekianum* are reported as common in massive sandstone near the base of the Pliocene Scotia Bluffs Sandstone.

Oldroyd, I. S., 1924a, Marine shells of Puget Sound and vicinity: Washington Univ., Puget Sound Biol. Sta. Pub., v. 4, p. 1–272, 49 pls.

A useful reference for geographic and bathymetric records of the modern molluscan fauna of Puget Sound. Fossil occurrences of a few of these mollusks are indicated.

Oldroyd, I. S., 1924b, The marine shells of the West Coast of North America, v. 1, no. 1, v. 2, pts. 1–3: Stanford, Calif., Stanford Univ. Press, v. 1, 247 p., 57 pls.; v. 2, pt. 1, 297 p., pls. 1–29; v. 2, pt. 2, 304 p., pls. 30–72; v. 2, pt. 3, 339 p., pls. 73–108.

A very useful systematic catalog of the modern mollusks of the Pacific coast with original descriptions, range data, and many figured specimens. The stratigraphic range of each genus is indicated.

Olmsted, F. H., 1958, Geologic reconnaissance of San Clemente Island, California: U.S. Geol. Survey Bull. 1071–B, p. 55–68.

Mollusks collected from marine strata of Miocene age are identified as *Lyropecten crassicardo* and *Aequipecten* cf. *A. andersoni*. Abundant shell fragments occur at one locality.

Olsson, A. A., 1922, The Miocene of northern Costa Rica with notes on its general stratigraphic relations: Am. Paleontology Bull., v. 9, no. 39, pt. 1, 1–168; pt. 2, p. 169–288, pls. 1–32.

Twenty-four species of Miocene mollusks from the Caribbean coast of Costa Rica are considered to be a Pacific element. Pacific analogs are listed for most of these.

Olsson, A. A., 1932, Contributions to the Tertiary Paleontology of northern Peru—Pt. V. The Peruvian Miocene: Am. Paleontology Bull., v. 19, no. 68, 272 p., 24 pls.

A few species are compared with Miocene and Pliocene species from Baja California and California.

Olsson, A. A., 1961, Mollusks of the tropical eastern Pacific particularly from the southern half of the Panamic-Pacific faunal province (Panama to Peru); Panamic-Pacific Pelecypods: Ithaca, N.Y. Paleont. Research Inst., 574 p., 86 pls.

Includes a summary of the principal modern molluscan provinces of the eastern Pacific with a lengthy discussion of the Panamic-Pacific molluscan province (lat 30°30′ N. [head of Gulf of California] to lat 5°40′ S.). Principal gastropod and pelecypod genera and families are reviewed. This province includes an estimated 2,200 species of shelled mollusks including about 500 species of pelecypods and 1,660 species of gastropods. The Peruvian province is also treated in detail.

Omori, Masae, 1952, A new species of fossil *Pholadomya* from the Japanese Miocene: The Venus: Japan Jour. Malacology, v. 17, no. 1, p. 23–26.

Pholadomya kawadai n. sp. is compared with the Miocene *P. kernensis* Wiedey, an early and middle Miocene species from California.

Orcutt, C. R., 1889a, Recent and sub-fossil shells of the Colorado desert: West Am. Scientist, v. 6 [whole no. 46], p. 92–93.

Miocene strata on "Carisso Creek" contain marine invertebrates that are older than mixed nonmarine and marine mollusk assemblages that occur at Salton, Calif.

Orcutt, C. R., 1889b, Some notes on Tertiary fossils of California, I: West Am. Scientist, v. 6 [whole no. 45], p. 70–71.

Includes list of 50 molluscan taxa of Pliocene age from Pacific Beach, San Diego County. According to Hertlein and Grant (1941) some of these may be of Pleistocene age.

Orcutt, C. R., 1889c, Some notes on Tertiary fossils of California, II: West Am. Scientist, v. 6 [whole no. 46], p. 84–87.

Includes a copy of Dall's (1874) list of Pliocene megafossils from the San Diego well. The San Diego well was drilled to a depth of 160 ft near the corner of Ash and 11th Streets. Mollusks of Pliocene age collected from the well cuttings and originally identified by Dall (1874) are listed. The shell-bearing stratum has been penetrated in almost every well drilled in San Diego.

Orcutt, C. R., 1890, The Colorado Desert [California]: California Jour. Mines and Geology, v. 10, p. 899–919.

Lists nine molluscan taxa of Pliocene age from the San Jacinto and San Bernardino Mountains; there are other unidentified mollusks in the collection. Oyster beds at Carrizo Creek consist of *Ostrea subfalcata* of Cretaceous age. A list of known Tertiary Ostreidae of California (13 spp.) is included.

Orcutt, C. R., 1901a, The Colorado Desert [California]: West Am. Scientist, v. 12 [whole no. 102], p. 1–11.

Recapitulates an earlier account of the occurrence of fossil *Ostrea* on Carrizo Creek made by Dr. Charles C. Parry, botanist and geologist of the United States boundary commission in a report on explorations made in 1849.

Orcutt, C. R., 1901b, Some desert fossils: West Am. Scientist, v. 12, no. 1 [whole no. 102], c. 11–13.

Lists five species of pelecypods from Miocene strata on Carrizo Creek.

OSMONT, V. C., 1904, Arcas of the California Neocene: California Univ. Pubs., Dept. Geology Bull., v. 4, no. 4, p. 89–100, pls. 8–11.

Five species of *Arca* from the Neogene of California are described and illustrated; two species, *A. montereyana* and *A. camulosensis*, are new.

Osmont, V. C., 1905, A geological section of the Coast Ranges north of the Bay of San Francisco [California]: California Univ. Pubs., Dept. Geology Bull., v. 4, no. 3, p. 39–87, pls. 6, 7.

Eight mollusks from the San Pablo Formation(?) at the mouth of Estero San Antonio near Valley Ford, and 15 species from Wilson's Ranch about 1,000 ft above the Sonoma Tuff are recorded.

Pack, R. W., 1920, The Sunset-Midway oil field, California: U.S. Geol. Survey Prof. Paper 116, 179 p.

Miocene megafossils occur in the Vaqueros Formation (none are listed); *Pecten eldridgei* occurs in the Etchegoin Formation north of McKittrick; *Pecten estrellanus* and a large *Ostrea* occur in the Santa Margarita Formation between Santiago and San Emigdio Creeks; *Pseudocardium gabbi* and other megafossils occur at several localities in the Etchegoin Formation.

Pack, R. W., and English, W. A., 1915, Geology and oil prospects in Waltham, Priest, Bitterwater, and Peachtree Valleys, California: U.S. Geol. Survey Bull. 581–D, p. 119–160.

Pecten wattsi, P. coalingensis, and *Thais etchegoinensis* are reported from exposures of upper Miocene [Pliocene] strata in Waltham and Priest Valleys.

Packard, E. L., 1914, Some West Coast Mactridae [abs.]: Geol. Soc. America Bull., v. 25, p. 151–152.

Includes brief taxonomic notations on species of *Mulinia* from the Pacific coast Pliocene.

Packard, E. L., 1915, Evolution of the Pacific Coast Mactridae [abs.]: Geol. Soc. America Bull., v. 26, p. 170.

Spisula reached its peak during the Miocene; mulinoid species first appeared during the early Miocene.

PACKARD, E. L., 1916, Mesozoic and Cenozoic Mactrinae of the Pacific coast of North America: California Univ. Pubs., Dept. Geology Bull., v. 9, no. 16, p. 261–360, pls. 12–35.

A comprehensive systematic review of Pacific coast mactrids including more than 20 taxa of Miocene and Pliocene age, five of which are newly described. The mactrid hinge is the least variable shell characteristic of a given species and is, therefore, the most important basis for species determination.

Packard, E. L., and Kellogg, Remington, 1934, A new cetothere from the Miocene Astoria formation of Newport, Oregon: Carnegie Inst. Washington Contr. Paleontology, Pub. no. 447, p. 1–62.

Nine mollusks are recorded from a locality in the Yaquina Formation on Yaquina Bay. Three mollusks from the overlying "Nye shales" are listed. Forty-five mollusks identified by H. G. Schenck, L. G. Hertlein, and C. W. Merriam from the Astoria Formation are recorded from several different localities in the Astoria Formation near Newport, Oreg., together with stratigraphic occurrences elsewhere in Oregon and Washington.

Page, B. M., Marks, J. G., and Walker, G. W., 1951, Stratigraphy and structure of mountains northeast of Santa Barbara, California: Am. Assoc. Petroleum Geologists Bull., v. 35, no. 8, p. 1727–1780.

Eight mollusks are recorded from the "Temblor" Formation.

Page, B. M., and Tabor, L. L., 1967, Chaotic structure and décollement in Cenozoic rocks near Stanford University, California: Geol. Soc. America Bull., v. 78, no. 1, p. 1–12.

Middle Miocene and Pliocene marine mollusks occur in formations exposed near Stanford University. The Pliocene mollusks occur in what are considered to be marine tongues in the nonmarine Santa Clara Formation.

Palmer, R. H., 1927a, Geology and petroleum possibilities for the Olympic Peninsula, Washington: Am. Assoc. Petroleum Geologists Bull., v. 11, no. 12, p. 1321–1328.

Thyasira biscca and *Phacoides acutilineatus* occur in Oligocene? shale of the Hoh Formation between Hoh River and Agglomerate Ridge. The

Quillayute Formation is exposed in a limited area near the junction of the Solduc and Bogachiel Rivers. It is composed of gray sandstone carrying a plentiful fauna. It is "probably not more than 50 feet thick."

Palmer, R. H., 1927b, The Hoh Formation of Washington: Jour. Geology, v. 35, p. 276–278.

Fifty-nine species [not listed] of fossil mollusks occur in the uppermost of three units in the Hoh Formation; correlation with the Clallam Formation, Astoria Formation, and Kern River Temblor Formation is indicated. The lowermost unit includes seven mollusks [listed] of indeterminate age. These localities are on the coast 1 mile north of the mouth of Hoh River.

Pantoja Alor, Jerjes, and Carrillo Bravo, Jose, 1966, Bosquejo geológico de la región de Santiago-San José del Cabo, Baja California [Mexico]: Asoc. Mexicana Geólogos Petroleros Bol., v. 18, nos. 1 and 2, p. 1–11.

A few species of Miocene and Pliocene age identified by Gloria A. de Cserna are recorded.

Park, W. H., 1965, Kern Front oil field [California]: California Oil Fields, v. 51, no. 1, p. 13–22.

Poorly preserved megafossil fragments occur in the Vedder Sand and in the overlying Freeman-Jewett Silt. The middle part of the Etchegoin Formation contains abundant *Macoma kerica*.

Park, W. H., 1966, Main area of Mountain View oil field [California]: California Oil Fields, v. 52, no. 1, p. 37–45.

The upper Miocene Santa Margarita Formation contains common megafossils; scattered gastropods occur in the Fruitvale Shale (upper and possibly middle Miocene).

Park, W. H., Land, P. E., and Bruce, D. C., 1957, Belgian anticline oil field [California]: California Oil Fields, v. 43, no. 1, p. 5–12.

"Locally abundant megafossils" are reported from the Etchegoin Formation.

Park, W. H., and Weddle, J. R., 1959, Correlation study of southern San Joaquin Valley [California]: California Oil Fields, v. 45, no. 1, p. 33–34, pls. 1–3.

Pliocene "stages" apparently described informally by W. F. Barbat (Pacific Sci. Congress, Los Angeles, 1939) and based upon marine mollusks are utilized in correlation charts.

Park, W. H., Weddle, J. R., and Barnes, J. A., 1963, Main, Coffee Canyon, and Pyramid areas of Round Mountain oil field [California]: California Oil Fields, v. 49, no. 2, p. 23–37 [1964].

A few Miocene mollusks are recorded from the Pyramid Hill Sand Member and Jewett Sand Member of the Freeman-Jewett Silt, the Olcese Sand, and the Round Mountain Silt.

PARKER, PIERRE, 1949, Fossil and Recent species of the pelecypod genera *Chione* and *Securella* from the Pacific Coast: Jour. Paleontology, v. 23, no. 6, p. 577–593, pls. 89–95.

A review of Tertiary species of *Securella*, n. gen., and three subgenera of *Chione*: *Gnidiella*, n. subgen., *Chione* s.s., and *Anomalocardia*; all species are illustrated.

Parker, R. H., 1964, Zoogeography and ecology of some macro-invertebrates, particularly mollusks, in the Gulf of California and the continental slope off Mexico: Vidensk, Medd. fra Dansk Naturh. Foren., v. 126, 178 p., 15 pls.

There is a brief discussion of the Tertiary faunal history of the Gulf of California and its relationship to Neogene molluscan faunas from tropical America. Data on the bathymetric distribution of the modern molluscan fauna are useful in paleoecologic studies.

Payne, M. B., 1951, Type Moreno Formation and overlying Eocene strata on the west side of the San Joaquin Valley, Fresno and Merced Counties, California: California Div. Mines Spec. Rept. 9, 29 p.

Three mollusks are recorded from the basal part of the "Temblor" Formation about half a mile south of Moreno Gulch.

Pease, M. H., and Hoover, Linn, 1957, Geology of the Doty-Minot Peak area, Washington: U.S. Geol. Survey Oil and Gas Inv. Map OM–188.

Megafossils [mollusks] from the Lincoln Formation of Weaver (1912) are in part of early Miocene age according to Ellen J. Trumbull. Most of the molluscan assemblages from the Astoria Formation are of middle Miocene age but a few near the top are correlated with the fauna of the Montesano Formation and are considered to be of late Miocene age. Megafossil localities are shown on the geologic map.

Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dole, H. M., 1964, Geology of the central and northern parts of the Western Cascade Range in Oregon: U.S. Geol. Survey Prof. Paper 449, 56 p.

Marine tuff and sandstone near Scotts Mills has yielded several small collections of marine mollusks (eight species) indicative of an early Miocene age and of correlation with the Scappoose Formation. A map showing the early Miocene shoreline in the Willamette Valley and a correlation chart of coastal and inland Tertiary formations are included.

Peck, J. H., Jr., 1957, Marine Pliocene fauna in northwestern Sonoma County, California [abs.]: Geol. Soc. America Bull., v. 68, no. 12, pt. 2, p. 1840–1841.

An assemblage of about 45 species of marine invertebrates of Pliocene age, mostly mollusks, is reported from the coastal area between the Russian River and Gualala on the northeast side of the San Andreas fault. Correlation with the lower part of the type Merced Formation is suggested.

PECK, J. H., JR., 1960, Paleontology and correlation of the Ohlson Ranch Formation [California]: California Univ. Pubs. Geol. Sci., v. 36. no. 4, p. 233–242, pl. 21.

Forty-one mollusks including one new species, *Arca* n. sp., are recorded. His lower faunal unit contains species never reported from the lower part of the type Merced Formation and is considered, therefore, to be somewhat older than it. The upper fauna is correlated with the Pliocene part of the type Merced. Ten mollusks are illustrated.

Perilliat Montoya, M. C., 1968, Fauna del Cretacico y del Terciario del norte de Baja California: México Univ. Nac. Autónoma Inst. Geología, Paleontologia Mexicana no. 25, 36 p., 8 pls.

One of the Pleistocene mollusks occurring in the Punta Baja-Bahia San Quintin area, *Dentalium neohexagonum*, is recorded from strata of Pliocene age in southern California.

Pierce, R. L., 1956, Upper Miocene Formaminifera and fish from the Los Angeles area, California: Jour. Paleontology, v. 30, no. 6, p. 137–144.

Pecten (Pseudamusium) peckhami is reported from localities in the upper Miocene Modelo Formation.

Pierce, R. L., 1962, Age determinations of representative paleontological samples along route of field trip, *in* Geology of Carrizo Plains and San Andreas Fault: San Joaquin Geol. Soc. and Pacific Sec. Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Guidebook, p. 51.

Three mollusks are recorded from localities in the lower Miocene Vaqueros Formation along route of field trip (identifications by L. G. Hertlein).

Plafker, George, 1967, Geologic map of the Gulf of Alaska Tertiary Province, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I–484.

The occurrence of marine fossils [mostly mollusks] is indicated in the explanation of map units. A review of molluscan faunas from the Yakataga Formation by F. S. MacNeil indicates that the formation is of middle Miocene to early Pleistocene age.

Plafker, George, and Miller, D. J., 1957, Reconnaissance geology of the Malaspina District, Alaska: U.S. Geol. Survey Oil and Gas Inv. Map OM–189.

Mya and *Mytilus* occur in the Yakataga Formation which is considered by R. B. Stewart, H. E. Vokes, and F. S. MacNeil to be of both Miocene and Pliocene age. This report was released as a U.S.G.S. open-file report in 1954.

Popenoe, F. W., 1958, Imperial Formation [California], *in* Imperial Valley, Soc. Econ. Paleontologists and Mineralogists-Am. Assoc. Petroleum Geologists, Ann. Spring Field Trip, 1958: 2 p.

Six mollusks from the upper Tertiary Imperial Formation are listed.

Porter, W. W., II, 1932, Lower Pliocene in Santa Maria district, California: Am. Assoc. Petroleum Geologists Bull., v. 16, no. 2, p. 135–143, 2 figs.

The Sisquoc Formation is of early Pliocene age according to faunal studies by Mrs. Dorothy A. Castle.

Powell, A. W. B., 1966, The molluscan families Speightiidae and Turridae: Auckland Inst. and Museum Bull. no. 5, 184 p., 23 pls.

Includes Pliocene and Miocene records of turrids from Pacific Coast States.

Pressler, E. D., 1929, The Fernando Group in the Las Posas-South Mountain District, Ventura County, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 18, no. 13, p. 325–345.

Three faunal "horizons" in the upper 2,000 ft of Fernando Formation of the western Ventura basin are recognized: Santa Barbara (considered Pliocene—cool-water), Kalorama (warm-water, about 12 percent extinct species, considered Pleistocene), and Long Canyon (warmer water, about 7 percent extinct species, considered Pleistocene). The latter two are

referred to the Las Posas Formation. Others' statements that sharp faunal breaks occur in the Pliocene-Pleistocene sequence of the Ventura basin are doubtful because faunal change in this section is gradual.

Preston, H. M., 1931, Report on Fruitvale oil field [California]: California Oil Fields, v. 16, no. 4, p. 5–24.

Lists of 55 mollusks from the Santa Margarita Formation and 13 mollusks from the *Cryptomya californica* zone of the Jacalitos or lower Etchegoin Formation (identifications by H. R. Gale) are included. Gale believed *Macoma kerica* to be a synonym of *Cryptomya californica*.

Preston, H. M., 1932, Report on North Belridge oil field [California]: California Oil Fields, v. 18, no. 1, p. 5–24.

Pecten peckhami occurs a few feet stratigraphically above the top of the *Valvulineria californica* zone and also within the zone. In wells the top of the "Button Bed" may be represented by the first occurrence of *Pecten andersoni*.

Primmer, S. R., 1964, Preliminary report of the type Kirker Formation [California], *in* Guidebook to the Mount Diablo field trip, 1964: Davis, Calif., Geol. Soc. Sacramento, p. 60–69.

Seven mollusks from his Tuff Member of the Kirker Formation are listed and are correlated with the *Echinophoria apta* zone of western Washington. Several mollusks are also recorded from the upper Miocene Briones? Formation and Cierbo Formation.

Rand, W. W., 1931, Preliminary report of the geology of Santa Cruz Island, Santa Barbara County, California: California Div. Mines 27th Rept. State Mineralogist, no. 2, p. 214–219, 1 map.

Five pelecypods from the lower Miocene Vaqueros Formation and three from siliceous shale of the middle Miocene Monterey Formation are recorded.

RANSOME, J. E., 1964*, Fossils in America: New York, Harper and Rowe, Publishers, 402 p., illus.

A few line drawings of Neogene mollusks from California are included. Some of the well-known collecting localities in California, Oregon, and Washington are listed together with brief notation of common mollusks at many of these.

RAYMOND, W. J., 1904, A new species of *Pleurotoma* from the Pliocene of California: Nautilus, v. 18, no. 1, p. 14–16.

Genota riversiana n. sp. is described from Pliocene strata at Santa Monica, Calif. Also included is a list of five late Cenozoic species from California assigned to this genus.

RAYMOND, W. J., 1906*, The west American species *Pleurotoma*, subgenus *Genota*: Nautilus, v. 20, no. 4, p. 37–39, pl. 2.

Five late Cenozoic species of *Genota* are figured and treated systematically. Two of these, *G. carpenteriana* Gabb and *G. riversiana* Raymond, are recorded from Pliocene strata in California.

REAGAN, A. B., 1909, Some notes on the Olympic Peninsula, Washington: Kansas Acad. Sci. Trans., v. 22, p. 131–238, 6 pls.

Mollusks from six localities in his Clallam Formation [in part Twin River Formation of later workers] are recorded and are correlated with

names used by Arnold (1906). Lists about 35 molluscan taxa from his Clallam Formation of which eight are newly described. A similar number of mollusks are listed from his Quillayute Formation of which eight are newly described. Many of the Clallam and Quillayute mollusks are illustrated by line drawings.

Reagan, A. B., 1910, Die Fossilien der Clallamformation mit denjenigen der Tertiärformationen in Vancouver-Insel und mit denjenigen der Astoria-Miocänformation in Oregon vergleichen: Centralblatt für Mineral., Geol. und Paleo., no. 20, p. 646–651.

Includes lists of Miocene mollusks compiled from earlier workers—Merriam, Conrad, Arnold, and Reagan.

Redwine, Lowell, 1947, Road log, Ventura to Carpinteria [California], *in* Field Trip Guidebook, Am. Assoc. Petroleum Geologists-Soc. Econ. Geologists-Soc. Econ. Paleontologists and Mineralogists Joint Ann. Mtg., Los Angeles, California, 1947: p. 59–62.

Megafossils representing the Pliocene *Pecten bellus* zone and Pleistocene *Pecten caurinus* zone of the Santa Barbara Formation crop out along Rincon Creek, western Ventura County, Calif.

Redwine, L. E., chm., and others, 1952, Cenozoic correlation section paralleling north and south margins, western Ventura basin, from Point Conception to Ventura and Channel Islands, California: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

Many of the stratigraphic columns [Channel Islands (Kennett), Capitan Canyon (Simonson), Goleta Point (Trefzger, Webster, and Redwine), Summerland and Ventura River areas (Bailey), Los Sauces Creek (Redwine, Bailey, and Webster), and Point Conception (Dibblee)] contain names or mention of mollusks. Each is described as a separate entry in the bibliography.

Redwine, L. E., Bailey, T. L., and Webster, Cutler, 1952, Los Sauces Creek area, *in* Redwine, L. E., Chm., and others, Cenozoic correlation section paralleling north and south margins [of the] western ventura basin from Point Conception to Ventura and Channel Islands, California: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

An oyster reef occurs in the lower part of the Vaqueros Formation. There are rare fragments of poorly preserved megafossils in the Vaqueros.

Reed, R. D., 1925, The post-Monterey disturbance in the Salinas Valley, California: Jour. Geology, v. 33, p. 588–607, 2 tables, 3 figs.

Santa Margarita fossils [mollusks] occur in the Highland monocline area of the Northern La Panza Range, San Luis Obispo County.

Reed, R. D., 1926, Miocene paleogeography in the central Coast Ranges, California: Am. Assoc. Petroleum Geologists Bull., v. 10, p. 130–137.

References pertaining to marine and terrestrial climates during the Miocene in California are reviewed. Molluscan studies of Smith (1919) showing shallow seas to have been warm conflict with foraminiferal data indicating cool-water conditions.

REED, R. D., 1933*, Geology of California: Tulsa, Okla, Am. Assoc. Petroleum Geologists, 355 p., 60 figs.

Some of the common mollusks from Neogene formations in California are listed. A few turritellas and pectinids are figured.

Reed, R. D., and Hollister, J. H., 1936, Structural evolution of southern California: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 157 p., 9 pls., 57 figs.; also *in* Am. Assoc. Petroleum Geologists Bull., v. 20, no. 12, p. 1529–1704, 10 pls. incl. geol. map, 56 figs., incl. geol. sketch maps.

Brief stratigraphic summaries of Miocene and Pliocene sequences include reference to fossils.

Rehder, H. A., 1943, The molluscan genus *Trochita* Schumacher with a note on *Bicatillus* Swainson: Biol. Soc. Washington Proc., v. 56, p. 41–46, figs. 7–11.

The Miocene species *Trochita costellata* Conrad, *T. diabloensis* (Clark) and *T. martini* (Clark) may be close to the living *T. radians* Lamarck.

Reichert, W. H., 1960, Bibliography and index of the geology and mineral resources of Washington, 1937–1956: Washington Div. Mines and Geology Bull. 46, 721 p.

This bibliography includes a detailed index that lists all new species of mollusks described from Washington during the period 1937–56. There is also an indexed list of theses dealing with the geology and paleontology of Washington.

REINHART, P. W., 1935, Classification of the Pelecypod family Arcidae: Belgique Mus. Royal Hist. Nat. Bull., v. 11, no. 12, 68 p.

Names new subgenus *Larkinia* to which the Pacific coast Pliocene species *Anadara camulosensis* is assigned.

REINHART, P. W., 1937, Three new species of the pelecypod family Arcidae from the Pliocene of California: Jour. Paleontology, v. 11, p. 181–185, pl. 28.

Three new Pliocene species from the Santa Maria basin, California, are described: *Arca sisquocensis*, *A. santamariensis*, and *Barbatia pseudoillota*. The latter is placed in a newly named subgenus *Fugleria*.

REINHART, P. W., 1943, Mesozoic and Cenozoic Arcidae from the Pacific slope of North America: Geol. Soc. America Spec. Paper 47, p. 1–117, pls. 1–15, 3 figs.

Includes classification, description, and illustration of species in the subfamilies Anadarinae and Noetiinae. Stratigraphic occurrences of 32 specific and subspecific Miocene and Pliocene taxa are shown in a chart. Three new species of Miocene and Pliocene age are described.

RÉMOND, AGUSTE, 1863, Description of two new species of bivalve shells from the Tertiaries of Contra Costa County [California]: California Acad. Sci. Proc., v. 3, p. 13.

Cardium gabbii and *Ostrea bourgeoisii* are described from upper Miocene strata near Kirker's Pass. Two other pelecypods are recorded from this exposure.

Rensberger, J. M., 1969, A new Iniid Cetacean from the Miocene of California: California Univ. Pubs. Geol. Sci., v. 82, 34 p., 4 pls.

Three specimens of *Thais*, similar to *Thais* n. sp. Lutz, were found 75 ft above the base of Oursan Sandstone of Hall (1958). Foraminifera from

somewhat higher in the section are regarded as Relizian or Luisian by Kleinpell.

Renz, H. H., 1942, Evidence favors Oligocene age of Vaqueros, *in* Schenck, H. G., and Childs, T. S., Jr., Significance of *Lepidocyclina* (*Lepidocyclina*) *californica*, new species, in the Vaqueros formation (Tertiary), California: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 34.

The *Turritella* in the Vaqueros Formation is allied to the *T. altilira*, group which has Oligocene origins in the Caribbean.

Repenning, C. A., 1960, Geologic summary of the Central Valley of California, with reference to disposal of liquid radioactive waste: U.S. Geol. Survey TEI Rept. 769, 69 p.

Correlation chart of San Joaquin and Sacramento Valley Tertiary sections showing relationship of provincial megafaunal, microfaunal, and continental vertebrate stages is included.

Repenning, C. A., and Vedder, J. G., 1961, Continental vertebrates and their stratigraphic correlation with marine mollusks, eastern Caliente Range, California, *in* Geological Survey research 1961: U.S. Geol. Survey Prof. Paper 424–C, p. C235–C239.

Early, middle, and late Miocene faunal divisions occurring in the eastern Caliente Range are correlated with informal megafossil stage names of Weaver and others (1944) and faunal divisions based upon terrestrial vertebrates from intertonguing marine and nonmarine strata. Several characteristic mollusks from each of the three divisions are listed. A stratigraphic diagram indicates intertonguing relationships and generalized stratigraphic position of diagnostic fossils.

Richards, G. L., Jr., 1935a, Foraminiferal, echinoid, molluscan correlations of the Santa Margarita and San Pablo Formations [California] [abs.]: Geol. Soc. America Proc. 1935, p. 386.

The Santa Margarita Formation varies in age from Late Miocene to earliest Pliocene; it is the shallow water facies of the upper part of the Monterey Formation.

Richards, G. L., Jr., 1935b, Revision of some California species of *Astrodapsis:* San Diego Soc. Nat. History Trans., v. 8, no. 9, p. 59–66.

Pecten estrellanus and *Tritonalia* sp. occur at the type locality of *Astrodapsis salinasensis*—2 miles south of San Lucas, Monterey County, Calif.

Richards, G. L., Jr., 1936, *Astrodapsis* faunal zones of California upper Miocene and lower Pliocene formations [abs.]: Geol. Soc. America Proc. for 1935, p. 412–413.

Four zones of late Miocene age are recognized. They contain typical late Miocene mollusks. The highest zone underlies the early Pliocene *Chione cismerensis* zone.

Richardson, J., 1878, Report on the coal fields of Nanaimo, Comox, Cowichen, Burrard Inlet, and Sooke, B. C.: Canada Geol. Survey Rept. Progress 1876–77, p. 160–192.

Fossiliferous strata occur at the mouth of John River, between Otter Point and Sherringham Point; they are packed with *Ostrea*, *Pecten*, and *Saxidomus* and are of Tertiary or post-Tertiary age.

RICHEY, K. A., 1943, A marine invertebrate fauna from the Orinda, California, formation: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 27, no. 2, p. 25–36, pl. 3, 1 fig. in text.

Eleven mollusks are recorded from four localities in the Orinda Formation; fossil localities are shown on a geologic map. Five mollusks are illustrated.

Richmond, J. F., 1952, Geology of Burruel Ridge, northwestern Santa Ana Mountains, California: California Div. Mines Spec. Rept. 21, 16 p.

Turritella ocoyana, *Chione temblorensis*?, and *Arca* occur in the middle Miocene Topanga Formation. Seven species of mollusks are listed from the Pliocene Repetto(?) Formation.

Ricketts, E. F., and Calvin, Jack, [revised by Hedgpeth, J. S.], 1968, Between Pacific tides, fourth edition: Stanford, Calif., Stanford Univ. Press, 614 p.

A general reference dealing with invertebrate marine life of the Pacific coast of the United States. Includes ecologic, distributional, and physiological observations and many photographs of modern mollusks. There is an extensive, partially annotated bibliography. Pliocene specimens of *Opalia* from La Jolla attain almost 3 inches in length. Discusses the early records of *Mya arcnaria* concluding that it is difficult to determine whether or not this pelecypod is native or introduced.

Rivera, N. P., 1965, Informe preliminar sobre un reconocimiento geológico en la costa del Pacifico de Nicaragua: Asoc. Mexicana Geólogos Petroleros Bol., v. 17, nos. 1 and 2, p. 17–27.

The Pliocene El Salto Formation contains massive coquinas composed principally of pelecypod shells. They are best exposed along the river near El Salto.

Rivers, J. J., 1891, Occurrence of a Miocene shell in the living state: Zoe, v. 2, p. 70–72, 1 text fig.

A range extension of the Miocene [Pliocene] species *Nassarius californianus* is noted.

Rivers, J. J., 1904, Descriptions of some undescribed fossil shells of the Pleistocene and Pliocene formations of the Santa Monica Range [California]: Southern California Acad. Sci. Bull., v. 3, no. 5, p. 69–72, pl. 1.

Sandstones of Pliocene age similar to the Pliocene San Diego Formation are reported from the Santa Monica Mountains.

ROBERTS, D. C., 1927*, Fossil markers of Midway Sunset-Elk Hills region in Kern County, California: California Oil Fields, v. 12, no. 10, p. 5–10, 4 pls.; reprinted, in part, Oil Bull., v. 14, no. 1, p. 24–26, 4 pls.

Seven Pliocene mollusks including *Arca trilineata* and *Bittium quadrifilatum* from well cores are figured. Other species are refigured from Arnold (1909). Pliocene "marker fossils" from several areas in the Midway-Sunset and Elk Hills oil fields are indicated.

Roberts, Miriam, 1966, Bibliography of theses and dissertations on Oregon geology from January 1, 1959, to December 31, 1965: Oregon Dept. Geology and Mineral Industries, supplement to Misc. Paper 7, 11 p.

This is an alphabetic compilation of theses together with in index map of the State.

Robinson, G. D., 1956, Geology of the Hayward quadrangle, California: U.S. Geol. Survey Geol. Quad, Map GQ–88, scale 1:24,000.

Fourteen mollusks are recorded from the Sobrante Sandstone as are 10 from the lower sandstone of the Monterey Group. A few species are also listed from the Briones Sandstone and from the San Pablo Formation. Identifications of these Miocene mollusks are by W. P. Woodring and E. J. Trumbull.

Rogers, R. G., 1943, Round Mountain oil field [California]: California Div. Mines Bull. 118, p. 579–583.

Turritella moodyi and *T. ocoyana* occur in diatomite beds of middle Miocene age exposed west of Round Mountain oil field; *Acila conradi*, *Fusinus corpulentus*, and *Cardita subtenta* occur in cores of the lower Miocene Jewett silt.

Rogers, T. H., Gribi, E. A., Jr., Thorup, R. R., and Nason, R. D., 1967, Roadlogs (King City to Bolado Park; Bolado Park to San Juan Bautista and King City; San Juan Grade Road to Gilroy; Alternate road log no. 1—New Idria Loop, p. 25; Pinnacles National Monument, p. 30; Hollister to Gilroy, p. 32; Pajaro Gap, p. 35), *in* Guidebook, Gabilan Range and adjacent San Andreas Fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists Pacific Secs., Guidebook, 1967.

An assemblage of five mollusks of Pliocene age from the Harris Ranch southwest of Hollister is recorded.

Romanes, James, 1912, Geology of a part of Costa Rica: Geol. Soc. London Quart. Jour., v. 68, p. 103–139.

A list of the more common mollusks in the Barranca deposits along the Pacific coast of Costa Rica near Carballo includes eight mollusks of Miocene age.

Rose, R. L., 1965, An occurrence of Oligocene strata east of San Jose, California [abs.]: Geol. Soc. America Spec. Paper 87, p. 227–228.

Unidentified mollusk fragments are reported from an unnamed formation that carries a lower Saucesian foraminiferal assemblage.

Rose, R. L., and Colburn, I. P., 1963, Geology of the east-central part of the Priest Valley quadrangle, California, *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Field Trip, 1963, p. 38–45.

Three mollusks from the upper Miocene Santa Margarita Formation and several others from the Pliocene Etchegoin and their Hans Grieve Formations are recorded.

Ross, C. P., 1923, The Lower Gila region, Arizona; a geographic, geologic, and hydrologic reconnaissance, with a guide to desert watering places: U.S. Geol. Survey Water-Supply Paper 498, 237 p.

First speculated that calcareous strata of Lower Gila region, Arizona, including fossiliferous limestone later named Bouse Formation by Metzger (1968), might have been deposited in an arm of the ancestral Gulf of California.

Roth, Barry, and Coan, Eugene, 1968, Further observations on the West American Marginellidae with the descriptions of two species: Veliger, v. 11, no. 1, p. 62–69, 1 pl., 2 text figs., 1 map.

A late Miocene *Marginella* (*Prunum*) occurs in the Castaic Formation of southern California.

Roth, G. H., and Sullwold, H. H., Jr., 1958, Cascade oil field, *in* Higgins, J. W., ed., A guide to the geology and oil fields of the Los Angeles and Ventura regions [California]: Am. Assoc. Petroleum Geologists, Pacific Sec. [Guidebook], Ann. Mtg., Los Angeles, Calif., 1958, p. 167–171.

The upper Pliocene Sunshine Ranch Formation contains "fairly common molluscan megafossils."

Rothermel, R. V., 1964, Canoga Park oil field [California]: California Oil Fields, v. 50, no. 2, p. 35–38.

The middle Miocene Topanga Formation contains scattered fragments of fossils.

Rowland, R. W., 1968, Paleontology of the San Diego Formation in northwestern Baja California, Mexico [abs.]: Geol. Soc. America 1968 Ann. Mtgs., Program with abstracts, p. 256–257.

The molluscan fauna of the San Diego Formation of northwest Baja California coast includes 109 species. It is indicative of shallow, subtidal depths offshore from an exposed rocky point indented by sandy pocket beaches. The faunal assemblages of the Pliocene San Diego embayment to the north are of a more protected ecology.

Ruckman, J. H., 1913, Evidence indicating an unconformity at the base of the *Tamiosoma* zone in the Coalinga oil field, California [abs.]: Geol. Soc. America Bull., v. 24, p. 132.

Pholas borings mark the base of this zone.

Russell, I. C., 1891, An expedition to Mount St. Elias, Alaska: Natl. Geog. Mag., v. 3, p. 53–204, pls. 2–20.

A few mollusks are recorded from his Pinnacle System. The age of the assemblage was considered to be Pliocene or early Pleistocene by W. H. Dall who identified the fossils.

Russell, I. C., 1893, Second expedition to Mount St. Elias: U.S. Geol. Survey 13th Ann. Rept., pt. 2, p. 1–91.

Paleontologic determinations by W. H. Dall first appearing in Russell (1891) are repeated.

RUTH, J. W., 1942*, The molluscan genus *Siphonalia* of the Pacific coast Tertiary: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 26, no. 3, p. 287–306, pls. 47–48.

Miocene and Pliocene species of *Kelletia*, *K. posoensis* and *K. kelleti*, are described and illustrated.

Sackett, John, and Rogers, T. H., 1969, Index to graduate theses on California geology, 1966 and 1967: California Div. Mines and Geology, Mineral Inf. Service, v. 22, no. 6, p. 91–92, 102.

A second supplement to Jennings and Strand (1963) in which 168 theses are listed in two sections. One section includes areal reports keyed to an index map; the other, topical reports.

Savage, D. E., 1955, Nonmarine lower Pliocene sediments in California: California Univ. Pubs. Geol. Sci., v. 31, no. 1, p. 1–26.

A correlation chart of Pacific coast mammalian, megafossil, and microfossil stages for the late Cenozoic is included. Lyellian correlation is satisfactory for general epochal age assignment in California. A small mollscan fauna from the Santa Margarita Formation at Comanche Point, Kern County (from Merriam, 1916), is reprinted.

SCHENCK, H. G., 1926*, Cassididae of western America: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 16, no. 4, p. 69–98, pls. 12–15.

Three cassidids of Pliocene age from Oregon and southeastern California and a new species from southwestern Washington of late Oligocene or early Miocene age, *Phalium iani* n. sp., are illustrated and treated systematically.

Schenck, H. G., 1927, Marine Oligocene of Oregon: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 16, no. 12, p. 449–460.

Specimens of *Acila packardi* are particularly abundant in the Nye Shale (lower Miocene) of the Newport area. Lists six common mollusks from the overlying Astoria Formation which is correlated with the fauna of the Temblor Formation of California.

Schenck, H. G., 1928, Stratigraphic relations of western Oligocene formations: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 18, no. 1, p. 1–50.

The Oligocene epoch was recognized on the Pacific coast—first by Dall (in Diller, 1896) and later, and more definitively, by Arnold (1906). Common mollusks from the Empire Formation at Coos Bay and from the Nye Shale near Newport are listed. A correlation chart shows his classification of Neogene units used in previous reports on Oregon.

SCHENCK, H. G., 1931, Cephalopods of the genus *Aturia* from western North America: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 19, no. 19, p. 435–490, pls. 66–78.

Miocene occurrences of *Aturia angustata* in the Temblor Formation of Kern County, Calif., near Knappton, Wash., and at Astoria, Oreg., are described and illustrated. A new subspecies from Alaska, *A. angustata alaskensis*, may be from beds of early Miocene age. An undertermined species occurs in the San Ramon Formation of Contra Costa County, Califa. The genus has not been found in rocks younger than middle Miocene on the Pacific coast.

Schenck, H. G., 1934, Classification of nuculid pelecypods: Musée Royal d'Histoire Naturelle de Belgique, v. 10, no. 20, p. 1–78, 5 pls.

Valid described species of *Acila* (*Acila*) and *Acila* (*Truncacila*) including several Pacific coast Tertiary species are listed.

Schenck, H. G., 1935a, What is the Vaqueros Formation of California and is it Oligocene?: Am. Assoc. Petroleum Geologists Bull., v. 19, no. 4, p. 521–536.

The *Turritella inezana* zone is considered to be correlative with the European Aquitanian Stage which Schenck takes to be Oligocene. There is a thorough discussion of previous age classification of the Vaqueros including information on some of the key Vaqueros mollusks such as *T. inezana* and *Lyropecten magnolia*.

Schenck, H. G., 1935b, Valid species of the nuculid pelecypod *Acila*: Musée Royal d'Histoire Naturelle de Belgique, Bull. 11, no. 14, 5 p., chart.

Includes a dichotomous key for identification of species and an alphabetical list of species with complete typological information including geologic

age, subgeneric assignment, allocation of species, and detailed treatment of all described species.

SCHENCK, H. G., 1936*, Nuculid bivalves of the genus *Acila*: Geol. Soc. America Spec. Paper 4, 149 p., 18 pls., 15 figs., tables 1–17.

Three successive *Acila* biozones extend from the Oligocene into the middle Miocene of the Pacific coast. Includes a discussion of faunal migration during the later part of the Tertiary with relation to Japanese Tertiary *Acila* and a geologic range chart for worldwide occurrences of this genus. Systematic descriptions include faunal lists, correlation, and stratigraphic data. Sections on modern biology of *Acila* include bathymetric and latitudinal data on living species.

Schenck, H. G., 1945, Geologic application of biometrical analysis of molluscan assemblages: Jour. Paleontology, v. 19, p. 504–521, pls. 66–67, text figs. 1–3.

Latitudinal midpoints for late Pliocene, early Pleistocene, and late Pleistocene collections from the Los Angeles and Ventura basins show a systematic change from midpoints from about 2°–5° farther north in late Pliocene assemblages to 4°–8° farther north in early Pleistocene assemblages to about the same latitude as today in late Pleistocene assemblages.

Schenck, H. G., and Childs, T. S., Jr., 1942, Significance of *Lepidocyclina* (*Lepidocyclina*) *californica*, new species, in the Vaqueros formation (Tertiary), California: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 27–83, 4 pls., 7 figs. in text.

Columnar sections of the California *Lepidocyclina* locality and the nearby type section of the Vaqueros Formation show the occurrence of three pectinids common to each section and the occurrence of *Turritella inezana* in the type section. A few mollusks from two localities in the Vaqueros—Reliz Canyon area and about 10 miles west of Paso Robles—are recorded.

Schenck, H. G., and Keen, A. M., 1936, West American marine molluscan provinces: Am. Philos. Soc. Proc., v. 76, no. 6, p. 921–938, figs. 1–6, table.

Speculate on the development of molluscan provinces along the eastern Pacific margin. Suggest that northern and southern marine temperature "conditions" may have been established during the late Oligocene or early Miocene possibly accounting for faunal differences between the Vaqueros Formation of California and the Blakeley Formation of Washington. Tropical seas did not extend north of southern California during the late Miocene.

Schenck, H. G., and Keen, A. M., 1937, An index-method for comparing molluscan faunules: Am. Philos. Soc. Proc., v. 57, no. 2, p. 161–182.

This method is suited for analysis of late Tertiary and Quaternary assemblages. Midpoints are plotted on a latitudinal bar graph and are then counted to determine the latitudinal midpoint. Thirty-five Pliocene and Pleistocene assemblages are analyzed showing nearly all of them to have calculated midpoints to the north of the latitude of the fossil locality. Development of a generic index to water temperature would permit comparable analysis of earlier Tertiary faunas.

Schenck, H. G., and Keen, A. M., 1940a, Biometrical analysis of molluscan assemblages, *in* Abrard, R., and others, Contribution a l'étude de la répar-

tition actuelle at passée des organismes dans la zone néritique: Société de Biogeographie Memoires, v. 7, p. 379–392, pls. 1, 2.

A further discussion of the median of midpoints method which is useful in analyzing late Tertiary and Quaternary faunas from western North America. Climatic cooling from the late Pliocene to the early Pleistocene in southern California (that is, Lomita Marl to Timms Point Silt) suggested by this analysis indicates that the Pliocene-Pleistocene boundary might fall between these formations.

SCHENCK, H. G., and KEEN, A. M., 1940b*, California fossils for the field geologist (preliminary edition): Stanford, Calif., privately printed, 86 p., 56 pls. Reprinted 1950, Stanford, Calif., Stanford Univ. Press, 88 p., 56 pls.

About 70 species of Miocene and Pliocene mollusks from Callifornia are figured. A correlation diagram of Cenozoic formations of California by F. R. Kelley and a bibliographic list of reports on Tertiary mollusks are also included.

Schenck, H. G., and Kleinpell, R. M., 1936, Refugian stage of the Pacific coast Tertiary: Am. Assoc. Petroleum Geologists Bull., v. 20, no. 2, p. 215–225.

The base of the Zemorrian Stage is marked by the appearance of *Turritella inezana, Rapana vaquerosensis, Lyropecten miguelensis, Pecton sanctaecruzensis,* and *Acila gettysburgensis.*

Schenck, H. G., and Reinhart, P. W., 1936, Oligocene arcid pelecypods of the genus *Anadara* [abs.]: Geol. Soc. America Proc. for 1935, p. 412.

Anadara mediaimpressa from the San Ramon Formation of central California is assigned to *Anadara* s.s.

SCHENCK, H. G., and REINHART, P. W., 1938*, Oligocene arcid pelecypods of the genus *Anadara*: Musée Royal d'Histoire Naturelle de Belgique Mem., 2d ser., v. 14, 73 p., pls. 1–6.

Six species of *Anadara* from the Pacific coast are correlated with the Tongrian-Aquitainian Stages of Europe. Two Pacific slope specimens are figured.

Schlicker, H. G., 1959, Bibliography of theses on Oregon geology: Oregon Dept. Geology and Mineral Industries Misc. Paper 7, 14 p.

This is an alphabetic compilation of theses together with an index map of the State.

Schoellhamer, J. E., and Kinney, D. M., 1953, Geology of portions of Tumey and Panoche Hills, Fresno County, California: U.S. Geol. Survey Oil and Gas Inv. Map OM–128.

The Temblor Formation includes the *Turritella ocoyana* molluscan fauna. Oysters and other megafossils occur in the Temblor Formation within the area of this map. No fossils are listed.

Schoellhamer, J. E., and Woodford, A. O., 1951, The floor of the Los Angeles basin, Los Angeles, Orange, and San Bernardino Counties, California: U.S. Geol. Survey Oil and Gas Inv. Map OM–117, 2 sheets.

The Vaqueros Formation contains the *Turritella inezana* fauna; the Topanga Formation contains the *Turritella ocoyana* fauna. These formations are of early and middle Miocene age respectively.

Schoellhamer, J. E., and Yerkes, R. F., 1961, Preliminary geologic map of the coastal part of the Malibu Beach quadrangle, Los Angeles County, California: U.S. Geol. Survey open-file map.

Turritella inezana santana and other mollusks of early Miocene age occur in the Vaqueros Formation. Mollusks are locally abundant in the lower part of the Topanga Formation.

Schoellhamer, J. E., Yerkes, R. F., and Campbell, R. H., 1962, Preliminary geologic map of the coastal part of the Point Dume quadrangle, Los Angeles County, California: U.S. Geol. Survey open-file map.

Turritella inezana s.l. and *Chlamys sespcensis*? occur in the Vaqueros Formation. *Turritella ocoyana* occurs in their middle Miocene Unit C. Pectinids of Miocene or Pliocene age occur in their unit A.

Schrader, F. C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901, with notes by W. J. Peters: U.S. Geol. Survey Prof. Paper 20, 139 p.

Six mollusks from the upper part of the Colville Series identified by W. H. Dall and considered to be of Pliocene age are recorded.

Schuchert, Charles, assisted by Dall, W. H. Stanton, T. W., and Bassler, R. S., 1905, Catalogue of the type specimens of fossil invertebrates in the department of geology, United States National Museum: U.S. Natl. Mus. Bull. 53, pt. 1, 704 p.

Many Neogene mollusks from the Pacific coast are included in this compilation. The classification of type material, museum numbers and originial reference are given for each species.

Shea, D. N., 1966, Northwest area of Strand oil field [California]: California Oil Fields, v. 52, no. 1, p. 47–52.

The lower part of the Pliocene Etchegoin Formation, the Macoma Claystone Member, contains casts of *Macoma kerica*; the upper part of the formation is characterized by *Mulinia* [*Pseudocardium*] *densata*.

Shedd, Solon, 1932, Bibliography of the geology and mineral resources of California to December 31, 1930: California Div. Mines Bull. 104, 376 p.

This is a comprehensive general bibliographic reference on California geology.

Shedd, Solon, 1938, Bibliography of the geology and mineral resources of California for the years 1931 to 1936, inclusive (supplementing the master bibliography, Bulletin 104): California Div. Mines Bull. 115, 125 p.

A continuation of Shedd's (1932) bibliography.

Shepard, F. P., Grant, U. S., 4th, and Dietz, R. S., 1939, The emergence of (Santa) Catalina Island [California]: Am. Jour. Sci., v. 237, p. 651–655.

Marine shells from Catalina Island, once thought to be of Pleistocene age, are of Miocene age.

SHIKAMA, TOKIO, 1967*, System and evaluation of Japanese fulgorarid Gastropoda: Yokohama Natl. Univ. Sci. Repts., sec. 2, Biol. and Geol. Sci., no. 13, p. 23–132, 17 pls., text figs.

Most of the Pacific coast fulgorarids are treated systematically; they are classified as *Musashia* (*Mioplciona*). Three species are illustrated by

line-drawings: *M. oregonensis*, *M. weaveri*, and *M. indurata*. The genus ranges from Oligocene to early Pliocene in the northeastern Pacific and from Oligocene to Holocene in the northwestern Pacific.

SHIMER, H. W., and SCHROCK, R. R., 1944*, Index fossils of North America: New York, John Wiley and Sons, Inc., 837 p., 303 pls.

Includes notations on the generalized stratigraphic occurrence and illustrations of several Miocene, Pliocene, and Pleistocene mollusks from the Pacific coast.

SHUMARD, B. F., 1858, Descriptions of new fossils from the Tertiary formations of Oregon and Washington Territories and the Cretaceous of Vancouver Island: St. Louis Acad. Sci. Trans., v. 1, no. 2, p. 120–123.

Two pelecypods from Pliocene strata at Coos Bay, Oreg.—*Pecten coosensis* and *Venus securis*—are described but are not illustrated.

Siegfus, S. S., 1939, Stratigraphic features of Reef Ridge Shale in southern California: Am. Assoc. Petroleum Geologists Bull., v. 23, no. 1, p. 24–44.

Three mollusks that have been reported from the Reef Ridge Shale by earlier workers—*Ficus ocoyana*, *Siliqua* cf. *S. patula*, and *Cryptomya california*—are not diagnostic of age. A very detailed discussion of earlier work bearing on the age and stratigraphic relationships of this formation forms the bulk of the report. It is noted that W. F. Barbat, in an unpublished paper, records the same three mollusks from a zone that he considered to occur stratigraphically above the Reef Shale and to be of Pliocene age.

Simon, L. F., and Reed, C. A., 1945, Miocene fossil found in Oregon kitchen-midden: Am. Antiquity, v. 11, no. 2, p. 118–119.

A Miocene *Psephaea* is reported from a midden at Fogarty Creek, Lincoln County, Oreg.

Simonson, R. R., 1952, Canada del Capitan, *in* Redwine, L. E., chm., and others, Cenozoic correlation section paralleling north and south margins [of the] western Ventura basin from Point Conception to Ventura and Channel Islands, California: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

The Vaqueros Sandstone is fossiliferous. It contains fragments of *Pecten magnolia*.

Simonson, R. R., and Kreuger, M. L., 1942, Crocker Flat landslide area, Temblor Range, California: Am. Assoc. Petroleum Geologists Bull., v. 26, no. 10, p. 1608–1631.

Pecten estrellanus, *P. crassicardo*, and *Ostrea titan* occur in the Santa Margarita Formation in the southern part of the Temblor Range.

SLODKEWTISCH, W. S., 1938, Tertiary Pelecypoda from the Far East, v. 10, pt. 2: USSR Acad. Sci., Paleont. Inst., Paleontology of USSR, v. 10, pt. 3, fasc. 19, 275 p., 106 pls.

A catalog of Neogene mollusks of Sakhalin and Kamchatka with extensive section of illustrations. Many names originally proposed for eastern North Pacific species are used for Russian Neogene pelecypods. A new name, *Variamussium pilarense*, is proposed for a specimen from the Twin River Formation of northwestern Washington originally included in the

type lot of *Pecten clallamensis* Arnold (1906). The original figure is re-illustrated. Contains an extensive bibliography of English language malacological and paleontological reports (p. 17–81). (In English.)

Smith, A. G., 1960, Amphineura, *in* Moore, R. C., ed., and Knight, J. B., Cox, L. R., Keen, A. M., Smith, A. G., Batten, R. L., Yochelson, E. L., Ludbrook, N. H., Robertson, Robert, Yonge, C. M., and Moore, R. C., Mollusca 1 . . . Scaphopoda, Amphineura, Monoplaceophora, Gastropoda [in part] . . . pt. I of the Treatise on Invertebrate Paleontology: Lawrence, Kans., Kansas Univ. press. p. I41–I76.

Neogene records of Amphineuran genera from Pacific coast are noted.

Smith, J. P., 1904, Periodic migrations between the Asiatic and American coasts of the Pacific Ocean: Am. Jour. Sci., v. 17, no. 99, p. 217–233.

The Miocene fauna of California is largely endemic with only slight admixture of southern and northern species of possible Atlantic origin. During the Pliocene the marine faunas of the Pacific coast and Japan had many species in common (32 spp. are listed). Marine climate during the Pliocene was temperate.

Smith, J. P., 1910, The geologic record of California: Jour. Geology, v. 18, no. 3, p. 216–227.

One of two characteristic mollusks from four Miocene "formations" and two Pliocene "formations" are shown in a geologic column. A chart showing geographic relations of western American fossil faunas depicts tropical faunas in the lower Eocene [Paleogene] followed by temperate late Eocene faunas and cold water marine faunas in the Neogene. Cold water faunas in the early Quaternary were succeeded by warm-water marine faunas in the later part of the Quaternary in California.

Smith, J. P., 1912, Geologic range of Miocene invertebrate fossils of California: California Acad. Sci. Proc., ser. 4, v. 3, no. 8, p. 161–182.

A check list includes all known mollusks of Miocene age showing stratigraphic occurence, by formation (used as a time-stratigraphic unit), for the lower Miocene [Vaqueros, Temblor, and Monterey] and upper Miocene [San Pablo-Santa Margarita and Etchegoin]. Oligocene and Pliocene occurrences of these Miocene species also are indicated. Species confined to each of the above formations are listed.

Smith, J. P., 1916, Climatic zones in the Pliocene of the Pacific coast [abs.]: Geol. Soc. America Bull., v. 27, p. 172.

Analysis of marine invertebrate faunas indicates that climates cooled from the early Pliocene to the late Pliocene. During the early Pliocene sub-boreal climate extended almost as far south as Mendocino County, California. The climate of southern California was warm-temperate during the early Pliocene.

Smith, J. P., 1919, Climatic relations of the Tertiary and Quaternary faunas of the California region: California Acad. Sci. Proc., ser. 4, v. 9, no. 4, p. 123–173, pl. 9.

The initial documented interpretation of Cenozoic climatic change based upon zoogeographic analysis of shallow-water molluscan faunas from the Pacific coast. Fossil faunas are compared with a sequence of five modern molluscan provinces extending from southern Alaska to Mexico and two isotherms representing tropical and cool-temperate conditions are fitted to

these inferences. The tropical isotherm retreats from a position off British Columbia during the Eocene to a low point, somewhat south of its modern position, near the Tertiary-Quaternary boundary. The post-Eocene climatic cooling probably was oscillatory; there is no suggestion of climatic zones in Eocene marine faunas. There are extensive lists of species characteristic of Tertiary formations.

Smith, P. B., 1960a, Foraminifera of the Monterey Shale and Puente Formation, Santa Ana Mountains and San Juan Capistrano area, California: U.S. Geol. Survey Prof. Paper 294–M, p. 463–495.

Localities in the Topanga Formation in the northern and central Santa Ana Mountains containing *Turritella ocoyana* are questionably assigned to the Relizian Stage of the provincial microfaunal chronology.

Smith, P. B., 1960b, Fossil Foraminifera from the southeastern California deserts, *in* Short papers in the geological sciences: U.S. Geol. Survey Prof. Paper 400–B, p. B278–B279.

Fossil foraminifers [Pliocene] are associated with gastropods that indicate brackish-water conditions. They are from along the Colorado River between Earp, Calif., and from the Palo Verde Mountains.

Smith, P. B., 1968a, Paleoenvironment of phosphate-bearing Monterey Shale in Salinas Valley, California: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 9, p. 1785–1791.

A molluscan assemblage from the upper part of the Monterey Shale indicates deposition in the inner sublittoral zone—low tide to about 50 fathoms.

Smith, P. B., 1968b, Pliocene(?) foraminifera of the Lower Colorado River area, California and Arizona [abs.]: Geol. Soc. America Program 64th Ann. Mtg., Tucson, Ariz., Apr. 11–13, 1968, p. 111–112.

Mollusks indicative of brackish water to marine environments occur in cores and outcrop samples that also contain Foraminifera of Pliocene age.

Smith, P. B., and Durham, D. L., 1968, Middle Miocene Foraminifera and stratigraphic relations in the Adelaida quadrangle, San Luis Obispo County, California: U.S. Geol. Survey Bull. 1271–A, p. A1–A14.

Six mollusks from the upper Miocene Santa Margarita Formation are recorded.

Smith, W. D. P., and Packard, E. L., 1919, The salient features of the geology of Oregon: Jour. Geology, v. 27, no. 2, p. 79–121, 3 figs., 1 pl. Also in Oregon Univ. Bull., v. 16, no. 7, p. 79–120, 3 figs., 1 pl.

A review of previous geological studies in Oregon is included. A few characteristic mollusks from the so-called Monterey fauna at Astoria, Oreg., are listed. The Empire Formation at Coos Bay, once considered to be of Miocene age, is now considered to be of early Pliocene age.

Smith, W. S. T., 1897, The geology of Catalina Island [California]: California Acad. Sci., ser. 3, v. 1, no. 1, p. 1–71.

Miocene shale contains casts of what is thought to be *Tellina congesta* Conrad.

Smith, W. S. T., 1898, A geological sketch of San Clemente Island [California]: U.S. Geol. Survey 18th Ann. Rept., pt 2, p. 465–496, pls. 85–96.

Impressions of *Pecten peckhami* Gabb occur in Miocene rocks exposed on the island.

Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U.S. Geol. Survey Bull. 1053, 159 p.

Eight mollusks are recorded from two localities in the Astoria(?) Formation in the Centralia syncline.

Snavely, P. D., Jr., Rau, W. W., and Wagner, H. C., 1964, Miocene stratigraphy of the Yaquina Bay area, Newport, Oregon: Ore Bin, v. 26, no. 8, p. 133–151.

Several mollusks identified by W. O. Addicott from the Astoria and Nye Formations are listed. The lowermost part of the Nye contains mollusks that are indicative of correlation with the early Miocene *Echinophoria apta* zone of the "Blakeley Stage." About 30 percent of the Astoria mollusks from this area also occur in the middle Miocene of California.

Snavely, P. D., Jr., and Vokes, H. E., 1949, Geology of the coastal area between Cape Kiwanda and Cape Foulweather, Oregon: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 97.

Mollusks from the Astoria and the Yaquina Formations identified by Vokes are listed. These formations are considered to be of middle Miocene and late Oligocene age, respectively.

Soot-Ryen, Tron, 1932, Pelecypoda, with a discussion of possible migrations of Arctic pelecypods in Tertiary times: Norwegian North Polar Expedition "Maud," 1918–1925, Sci. Results (pub. by Geofysisk Inst., Bergen), v. 5, no. 12, 35 p.

The modern Arctic pelecypod fauna originated, for the most part, in the North Pacific during the Miocene. Subsequent migration took place along the Arctic coast of North America to the North Atlantic, principally during the Pliocene. Miocene migration routes were by way of Central America and Tethys as the Bering Straits were closed by a land bridge during most of the Miocene. Many reports dealing with the zoogeography of arctic mollusks are reviewed.

Soot-Ryen, Tron, 1955, A report on the family Mytilidae (Pelecypod): Allan Hancock Pacific Exped., v. 20, no. 1, 175 p., pls. 1–10, figs. 1–78.

California Miocene and Pliocene species assigned to *Crenomytilus* include: *C. mathewsoni* (Gabb), *C. trampasensis* (Clark), *C. coalingensis* (Arnold), *C. kewi* (Nomland) "and perhaps also other species listed as *Mytilus*" (p. 23).

Soper, E. K., 1938, Geology of the central Santa Monica Mountains, Los Angeles County, California: California Jour. Mines and Geology, v. 34, p. 134–180.

Includes a list of 41 mollusks from the middle Miocene Topanga Formation identified by U. S. Grant.

Soper, E. K., and Grant, U. S., 4th, 1932, Geology and paleontology of a portion of Los Angeles, California: Geol. Soc. America Bull., v. 43, no. 12, p. 1041–1068, 7 figs.

List 173 mollusks from excavations in upper Pliocene strata in downtown Los Angeles. About 13 percent of the mollusks are extinct; those

that are still living suggest water temperatures comparable to today. A late Pliocene age is suggested by the percentage of extinct mollusks. Normal salinity is suggested.

Soper, E. K., and Grant, U. S., 4th, 1933, Geology and paleontology of a portion of the Metropolitan District of Los Angeles, California [abs.]: Geol. Soc. America Bull., v. 44, pt. 1, p. 148–149.

A late Pliocene molluscan assemblage indicates cool water conditions. Other assemblages occur in stratigraphically lower units in Pliocene sandstones. Practically no molluscan fossils occur in the underlying sandstone of Miocene age.

Spurr, J. E., 1900, A reconnaissance in southwestern Alaska in 1898: U.S. Geol. Survey 20th Ann. Rept., pt. 7, p. 43–264.

Thirty mollusks of Miocene age from Cape Yaktag [Yakataga] are listed. The material is mostly from water-worn pebbles. The assemblage is correlated, by Dall, with the Empire Formation of coastal Oregon.

Stanley-Brown, Joseph, 1892, Geology of the Pribilof Islands [Alaska]: Geol. Soc. America Bull., v. 3, p. 496–500.

Collected fossil mollusks from rounded, apparently water-worn pebbles from Black Bluff, St. Paul Island, Alaska. Nine mollusks were identified in later report by Dall (1899, p. 545). Sixteen species identified by W. H. Dall are listed, nine of these had not been previously identified from the locality.

Stanton, R. J., Jr., 1962, Paleoecology of the upper Miocene Castaic Formation, Los Angeles County, California [abs.]: Geol. Soc. America Spec. Paper 68, p. 278.

Molluscan assemblages indicate that the northern part of the Castaic depositional basin was embayed and that the southern part was an open, exposed coast. Faunal assemblages deposited in water of less than 25 fathoms indicate a warm-water marine climate similar to that found off the southwest Coast of Baja California today.

STANTON, R. J., JR., 1966*, Megafauna of the upper Miocene Castaic Formation, Los Angeles County, California: Jour. Paleontology, v. 40, no. 1, p. 21–40, 3 pls.

About 100 mollusks are listed from the Castaic Formation. About one-fourth of these were previously unknown from rocks of Miocene age, having only been recorded from Pliocene or younger strata. The fauna is of warm-water, tropical aspect and probably lived near the northern limit of the late Miocene equivalent of the modern Panamic molluscan province. Many of the mollusks are treated systematically and are illustrated.

Stanton R. J., Jr., 1967a, The effects of provenance and basin-edge topography on sedimentation in the basal Castaic Formation (Upper Miocene, marine), Los Angeles County, California: California Div. Mines Spec. Rept. 92, p. 21–31.

Thirty-four species of late Miocene mollusks are recorded from the Castaic Formation; they represent, for the most part, a bathymetric environment of about five fathoms. They were, however, transported into a different, deeper water environment prior to burial. *Crassostrea* as large as 18 in. and *Lyropecten* as large as 8 in. are recorded.

Stanton, R. J., Jr., 1967b, Role of marine larger invertebrates in the recognition of the Miocene-Pliocene boundary in the California Coast Ranges [abs.]: Geol. Soc. America Program, 63d Ann. Mtg., Santa Barbara, Calif., Mar. 22–25, 1967, p. 62.

Larger invertebrates are useful in local zonation in California but do not permit detailed correlation with European type sections for the Miocene and Pliocene. Phylogenetic series permit more precise correlation than broad-scale faunal comparisons, which may be in part due to variations in climate rather than evolutionary phenomena.

Stanton, R. J., Jr., 1969, Cyclic Tertiary shallow marine sedimentation, California [abs.]: Geol. Soc. America, Program with abstracts for 1969, pt. 7, p. 214.

Analysis of the macro-invertebrate fauna [mostly mollusks] of the Pliocene sequence at Kettleman Hills indicates repeated transgressive-regressive cycles of deposition. The environments at the time of the transgressive peak graded from relatively open, shallow marine conditions at the north to non-marine toward the south. Similar patterns occurred during the Miocene in California.

Stanton, R. J., Jr., and Dodd, J. R., 1969, Faunal and geochemical analysis of paleoenvironments, Kettleman Hills, California [abs.]: Geol. Soc. America, Program with abstracts for 1969, pt. 3, p. 63.

Pliocene assemblages of the Kettleman Hills area indicate a marine climate similar to that of the northern part of the California molluscan province, just south of Point Conception (mean temperature 13°C). Strontium paleotemperatures on *Crenomytilus* suggest a mean of 14°C (range 11.5°–17.8°). Salinities based on paleontologic and oxygen isotopic studies varied from normal marine to brackish, freshening abruptly during deposition of the Tulare Formation.

Starke, F. W., and Howard, A. D., 1968, Polygenetic origin of Monterey submarine canyon [California]: Geol. Soc. America Bull., v. 79, no. 7, p. 813–326.

Pecten andersoni(?) was recovered from the Monterey Shale in a well near Moss Landing, Monterey County, Calif.

STEARNS, R. E. C., 1876, Descriptions of new fossil shells from the Tertiary of California: Acad. Nat. Sci. Philadelphia Proc., v. 27, p. 463–464, pl. 27.

Opalia anomala and *O. varicostata*, new species from Pliocene strata about 8 miles north of San Diego, Calif., are described and illustrated.

Stearns, R. E. C., 1879, Remarks on fossil shells from the Colorado Desert: Am. Naturalist, v. 13, no. 3, p. 141–154.

A quotation from J. G. Cooper indicates that a bed of *Crassostrea titan* of Miocene age occurs along the western edge of the Colorado Desert at an altitude of about 1,000 ft. During the Pliocene the site of the present Colorado Desert was occupied by the sea. Fossils described in the report are of fresh water origin.

Stearns, R. E. C., 1900, The fossil shells of the Los Angeles tunnel clays [California]: Science, new ser., v. 12, no. 247, p. 247–250.

A giant *Lima* and two species of "*Plagiostoma*" occur in clay penetrated during excavation of the Third Street tunnel in Los Angeles, Calif.

Steere, M. L., 1953, Bibliography of the geology and mineral resources of Oregon (second supplement), January 1, 1946, to December 31, 1950: Oregon Dept. Geology and Mineral Industries Bull. 44, 61 p.

This is a useful, well-indexed compilation of reports published during the period 1946–50; unpublished theses are also included.

Steere, M. L., 1954, Fossil localities of Lincoln County beaches, Oregon: Ore Bin, v. 16, no. 4, p. 21–26.

Eight mollusks are recorded from the middle Miocene Astoria Formation. Four collecting localities in this formation are shown on a geologic index map.

Steere, M. L., 1955, Fossil localities in the Coos Bay area, Oregon: Ore Bin, v. 17, no. 6, p. 39–43.

Pliocene mollusk localities in the Empire Formation are listed.

Steere, M. L., and Owen, L. F., 1962, Bibliography of the geology and mineral resources of Oregon (third supplement), January 1, 1951, to December 31, 1955: Oregon Dept. Geology and Mineral Industries Bull. 53, 97 p.

This is a useful, well-indexed bibliography including many references to Neogene mollusks. Unpublished theses on Oregon geology and paleontology are included.

STEWART, R. B., 1927, Gabb's California fossil type gastropods: Acad. Nat. Sci. Philadelphia Proc., v. 78, p. 287–447, pls. 20–32, 5 text figs.

This is a comprehensive review and taxonomic treatment of Gabb's (1866, 1869) fossil gastropods from California, most of which are of Cretaceous and early Tertiary age. About 20 species are from post-Eocene strata of California. A new Oligocene and Miocene genus, *Bruclarkia*, is proposed.

STEWART, R. B., 1930, Gabb's California Cretaceous and Tertiary type lamellibranchs: Acad. Nat. Sci. Philadelphia Spec. Pub. 3, 314 p., 17 pls., 5 text figs.

About 20 of Gabb's species are from the Neogene, from localities mostly in California but also from Cedros Island, Mexico. The San Ramon Formation of Central California is considered to be of Miocene rather than Oligocene age. Many new genera and subgenera are named; a few conclusions from his earlier gastropod report are corrected or amended. All of Gabb's Neogene pelecypod types are figured. There is a section on Tertiary climatic history and origins of the temperate fauna of the eastern Pacific.

STEWART, R. B., 1946*, Geology of Reef Ridge, Coalinga district, California: U.S. Geol. Survey Prof. Paper 205–C, p. 81–115, pls. 9–17. [1947]

A large molluscan fauna from the middle Miocene Temblor Sandstone is listed. It is divided into two zones, a lower *Vertipecten* zone, probably representing deeper less agitated water than the upper zone, the *Aequipecten* zone. A smaller faunal assemblage is recorded from the basal sand of the overlying McLure Shale. This is correlated with the molluscan assemblages from the Santa Margarita Formation north of Coalinga and is considered to be of late Miocene age. Nine Miocene mollusks are figured. Pliocene formations and a few characteristic mollusks are briefly reviewed.

Stewart, R. B., 1949, Lower Tertiary stratigraphy of Mount Diablo, Marysville Buttes, and west border of lower Central Valley of California: U.S. Geol. Survey Oil and Gas Inv. Prelim. Chart 35 (in 2 sheets).

Eight late Tertiary mollusks are recorded from measured sections near Mount Diablo, Calif.

Stewart, R. B., Popenoe, W. P., and Snavely, P. D., Jr., 1944, Columnar sections showing correlation and subdivisions of Tertiary and late upper Cretaceous rocks, in Panoche Hills, Laguna Seca area, and Orestimba area, Fresno, Merced, and Stanislaus Counties, Calif.: U.S. Geol. Survey Oil and Gas Inv. Prelim. Chart 6.

Ten feet of strata exposed in the first canyon south of Moreno Gulch referred to the Temblor(?) Formation contain 10 species of mollusks that were identified by W. P. Woodring.

Stewart, R. E., and Stewart, K. C., 1949, Local relationships of the Mollusca of the Wildcat coast section, Humboldt County, California, with related data on the foraminifera and ostracoda: Oregon Dept. Geology and Mineral Industries Bull. 37, pt. 8, p. 165–208, pls. 19–22, text fig. 7, table.

Two molluscan faunal zones separated by "barren zones" occur in the Wildcat Formation; one subzone is recognized in the lower faunal zone and three are recognized in the upper zone. Species of mollusks restricted to each zone are listed. The stratigraphic ranges of Pliocene mollusks are shown on a chart.

Stinemeyer, E. S., Beck, R. S., Ortalda, R. A., Espenscheid, E. K., Bainton, J. D., and O'Keefe, M. S., 1959, Guidebook, Chico Martinez Creek area field trip [California]: San Joaquin Geol. Soc., May 9, 1959, 15 p.

The Buttonbed sandstone contains *Pecten andersoni* and *Pecten estrellanus*. The so-called *Phacoides* reef contains *Lucina acutilineata*, *Clementia pertenuis*, *Amiantis mathewsoni*, *Chlamys sespeensis*, *Chlamys branneri*, *Bruclarkia barkeriana*, and *Ostrea* sp. *Pecten peckhami* occurs in the Antelope Shale Member of the McLure Shale. *Pecten miguelensis* and *P. estrellanus* occur in the Carneros Sandstone. A chart of stratigraphic units of the Temblor and Monterey Formations in the Chico Martinez Creek area is included.

Stirton, R. A., 1936, Cenozoic mammal remains from the San Francisco Bay region [California]: California Univ. Pubs. Geol. Sci. Bull., v. 24, no. 13, p. 339–409.

Shallow water mollusk assemblages of provincial late Miocene age occur with continental vertebrates assigned to the early Pliocene at localities in the Tejon Hills and near Tracy, Calif. Marine invertebrates from the Merced Formation of Sonoma County are regarded by C. W. Merriam as "not older than Middle Pliocene."

Stirton, R. A., 1952, Are Petaluma horse teeth reliable in correlation?: Am. Assoc. Petroleum Geologists Bull., v. 36, no. 10, p. 2011–2025.

There are five species of mollusks common to the Merced Formation of the Santa Rosa area and the Pliocene sequence of Kettleman Hills; one species—*Nassarius moranianus*—suggests correlation with the upper part of the Kettleman Hills Pliocene (San Joaquin Formation). Two brackish water mollusks also occur in the Petaluma Formation.

Stirton, R. A., 1960, A marine carnivore from the Clallam Miocene formation, Washington, its correlation with nonmarine faunas: California Univ. Pubs. Geol. Sci., v. 36, no. 7, p. 345–368.

The marine mammal locality (Slip Point vertebrate fauna) is correlated with the Temblor Formation from California and the *Turritella ocoyana* biozone as shown by Kleinpell (1938).

Stock, Chester, 1946, Progress in paleontological research on the Pacific Coast, 1917–1944: Geol. Soc. America Bull., v. 57, p. 319–354.

Reviews invertebrate paleontology (p. 322–326) including reference to some of the more important studies of Miocene and Pliocene mollusks.

Sullivan, J. C., 1961, Southeast Burrel oil field [California]: California Oil Fields, v. 47, no. 1, p. 51–56.

"Abundant megafossils" occur in the upper Miocene Santa Margarita Formation.

Sullivan, J. C., 1962, Guijarral Hills oil field [California]: California Oil Fields, v. 48, no. 2, p. 37–51.

"Abundant megafossils" occur in the upper Miocene Santa Margarita Formation and the middle Miocene Temblor Formation.

Sullivan, J. C., 1966, Kettleman North Dome oil field [California]: California Oil Fields, v. 52, no. 1, p. 5–21.

"Abundant megafossils" occur in the Temblor Formation (1,200–1,600 ft thick) and the Whepley Shale (30–450 ft thick). The underlying Vaqueros Formation is "sometimes referred to as the 'Mollusk boring sand'."

Susuki, Takeo, 1952, Stratigraphic paleontology of the type section of the Topanga Formation, Santa Monica Mountains, California [abs.]: Geol. Soc. America Bull., v. 63, no. 12, pt. 2, p. 1345.

An abundant molluscan fauna, collected from four stratigraphic intervals within the formation, is divisible into two faunal assemblages separated by about 1,200 ft of unfossiliferous strata. The lower assemblage, occurring through about 200 ft of strata at the base of the Topanga Formation, is characterized by *Turritella ocoyana* s.s. and *Lyropecten crassicardo*, n. var. The higher assemblage ranges through three upper horizons. It is characterized by many specimens of *T. ocoyana topangensis* and by *T. temblorensis*.

Taggart, Larry, and Kraetsch, R. B., compilers, 1963, Fossil register of Salinas Valley area, *in* Guidebook to the geology of Salinas Valley and the San Andreas fault: Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Spring Field Trip 1963, p. 54.

A few middle Miocene, late Miocene, and Pliocene mollusks are recorded from localities in the Salinas Valley.

Taliaferro, N. L., 1932, Geology of the Yakataga, Katalla, and Nichaeak Districts, Alaska: Geol. Soc. America Bull., v. 43, no. 3, p. 749–782.

"Fossils" occur in his Poul Creek and Yakataga Formations. *Neptunea* (*Chrysodomus*) is reported from Umbrella Reef and *Leda fossa* and *Neptunea* (*Chrysodomus*) cf. *tabulatus* from marine morainal material on the west side of Icy Bay.

Taliaferro, N. L., 1933, Oligocene sediments of the Yakataga-Controller Bay Region, Alaska [abs.]: Geol. Soc. America Bull., v. 44, pt. 1, p. 167–168.

Tertiary sediments occurring between Icy Bay and Katalla are very fossiliferous. B. L. Clark has assigned the fauna to the late Oligocene. Shale-

matrix conglomerates and breccias in the Yakataga Formation containing marine fossils are regarded as marine moraines indicative of glaciation during the late Oligocene. The marine climate is considered to have been as cool as at present.

Taliaferro, N. L., 1943, Bradley-San Miguel district [California]: California Div. Mines Bull. 118, p. 456–462.

The Santa Margarita Formation is fossiliferous; the Etchegoin Formation has yielded large collections of fossils that B. L. Clark refers to the "Jacalitos stage."

Taliaferro, N. L., and Schenck, H. G., 1933, *Lepidocyclina* in California: Am. Jour. Sci., v. 225, p. 74–80.

Three pectinids occur in the Vaqueros Formation at the *Lepidocyclina* locality in the Salinas basin: *Pecten vanvlecki*, *P. miguelensis*, and *P.* cf. *P. sespeensis*. Other mollusks characteristic of the Vaqueros Formation are reviewed.

Talmadge, R. R., 1964, The races of *Haliotis fulgens* Philippi (Mollusca: Gastropoda): San Diego Soc. Nat. History Trans., v. 13, no. 18, p. 371–376.

Miocene *Haliotis lasia* Woodring and Pliocene *H. elsmerensis* Vokes are identical; they are either *H. fulgens* or an ancestral species.

Talmadge, R. R., 1968, Additional notes on benthic invertebrates from northern California [abs.]: The Echo, Western Soc. Malacologists, First Ann. Mtg., p. 9–10.

Modern counterparts of Pliocene mollusks from the Wildcat Group have been taken by fishing boats (trawlers) off Eureka, Calif. Included is a range extension of a Pliocene *Trophon* described by Martin (1914).

Taylor, D. W., 1966, Summary of North American Blancan nonmarine mollusks: Malacologia, v. 4, no. 1, p. 1–172.

"*Goniobasis rodeoensis* (Clark)" figured by Hanna (1923) from the Petaluma Formation, Sonoma County, Calif., is a nonmarine species and it differs on a familial level from Clark's species which probably belongs to the Potamididae.

Tegland, N. M., 1928, "*Thyasira Disjuncta* Gabb not *Thyasira Bisecta* Conrad. The Recent West Coast Shell": Nautilus, v. 41, p. 129–130.

Thyasira disjuncta ranges from the Pliocene to Holocene on the Pacific coast; *T. bisecta* is a Miocene species found so far only in the Astoria Formation.

TEGLAND, N. M., 1929, Correlation and affinities of certain species of *Pitaria:* California Univ. Pubs., Dept. Geol. Sci. Bull., v. 18, no. 10, p. 275–290, 2 pls.

An assemblage of eight mollusks from a locality in the middle Miocene Clallam Formation near Slip Point, Clallam Bay, Wash., is listed. One of these, *Pitaria arnoldi etheringtoni* n. subsp., is described and illustrated.

TEGLAND, N. M., 1931, Gastropod genus *Galeodea* in the Oligocene of Washington: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 19, no. 18, p. 397–444, pls. 59–65.

Two Miocene species, *Galeodea apta* n. sp. and *G. petrosa* (Conrad), are described and illustrated.

TEGLAND, N. M., 1933, The fauna of the type Blakeley upper Oligocene of Washington: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 23, no. 3, p. 81–174, pls. 2–15.

There are many similarities between the late Oligocene fauna of the type Blakeley Formation and the middle Miocene fauna of the type Astoria Formation of northwestern Oregon. Faunal evidence suggests that the upper part of the Twin River Formation is at least of a different facies and possibly of somewhat younger age than the Blakeley Formation at its type section. Twelve new molluscan taxa are described from the Twin River fauna which is of late Oligocene and/or early Miocene age.

Templeton, E. C., 1913, General geology of the San Jose and Mount Hamilton quadrangles [California] [abs.]: Geol. Soc. America Bull., v. 24, p. 96.

The lowest Miocene sandstone in this area belongs to the Temblor ["Temblor Stage"] on the basis of an abundant age diagnostic fauna [mollusks are reported from this area by Crittenden (1951)].

TERRY, J. S., 1968, *Mediargo*, a new Tertiary genus in the Family Cymatiidae: Veliger, v. 11, no. 1, p. 42–44, 1 pl.

Mediargo mediocris (Dall) occurs in the Pliocene of Oregon and Washington. Eight specimens are figured.

Terry, R. D., 1955, Bibliography of marine geology and oceanography, California coast: California Div. Mines Spec. Rept. 44, 131 p.

This report lists many papers on the late Cenozoic of coastal California; a few of these include molluscan data.

Thorup, R. R., 1943, Type locality of the Vaqueros formation [California]: California Div. Mines Bull. 118, pt. 4, p. 463–466, 3 figs. in text.

The stratigraphic occurrence of some characteristic mollusks is shown on a composite columnar section of the type Vaqueros Formation and in the text.

Tieje, A. J., 1926, The Pliocene and Pleistocene history of the Baldwin Hills, Los Angeles County, California: Am. Assoc. Petroleum Geologists Bull., v. 10, no. 5, p. 502–512.

Fossiliferous upper Pliocene sands exposed in Los Angeles outfall sewer trench include a faunal assemblage of 53 species, chiefly mollusks, that are of a "notably cold-water facies."

Tieje, A. J., 1930, Miocene oysters of California [abs.]: Geol. Soc. America Bull., v. 41, p. 213.

Several valid species of oysters are recognized from the California Miocene. "The unpublished *Ostrea vaquerosensis* Loel" which occurs in the Vaqueros Formation is distinct from *O. titan*. *Ostrea titan* probably occurs in the middle Miocene "Temblor-Topanga."

Touwaide, M. E., 1930, Origin of the Boleo copper deposit, Lower California, Mexico: Econ. Geology, v. 25, p. 113–144.

A list of Pliocene mollusks identified by U. S. Grant, 4th, is recorded. Two pectinids are listed from the lower part of his Salada Formation; six pelecypods are listed from the upper part of the formation.

TRASK, J. B., 1855a, Descriptions of fossil shells: California Acad. Sci. Proc., v. 1, p. 40–42.

Three species are described from exposures near Santa Barbara, Calif. They were regarded as of Tertiary age by Trask but may have been collected from lower Pleistocene strata (Santa Barbara Formation).

Trask, J. B., 1855b, *** Report on the geology of the Coast Mountains; and embracing their agricultural resources and mineral production—also, portions of the middle and northern mining districts: California Legislature, Senate Doc. 14, 95 p.

Noted fossiliferous nature of sandstone and shale above his "infusorial group" [Monterey Shale].

TRASK, J. B., 1856, Description of three new species of the genus *Plagiostoma* from the Cretaceous rocks of Los Angeles [California]: California Acad. Nat. Sci. Proc., v. 1, p. 86, pl. 3 (1856; 2d ed., 1873, p. 93–94).

Plagiostoma pedrona [*pedroana*], *P. annulatus*, and *P. truncata* from rocks thought to be of Mesozoic age [Monterey Shale, Miocene] are described and illustrated.

Trask, P. D., 1921, A study of the fauna and stratigraphy of the Briones Formation of middle California [abs.]: Geol. Soc. America Bull., v. 32, p. 145–146.

The Briones Formation is assigned to the lowest part of the upper Miocene San Pablo Series because nearly 60 percent of the determinable species also occur in the San Pablo whereas only 15 percent occur in the underlying Monterey Formation. The upper and lower contacts are marked by pholad borings.

TRASK, P. D., 1922, The Briones formation of middle California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 13, no. 5, p. 133–174, pls. 1–8.

Twenty new mollusks are described from the Briones Formation. A new gastropod genus, *Koilopleura*, is named. Eighty-six mollusks are listed from the Briones Formation together with their known geologic ranges.

Trask, P. D., 1926, Geology of Point Sur quadrangle, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 16, no. 6, p. 119–186.

Mollusks occur in three fossiliferous horizons in the middle Miocene Temblor Formation. Three mollusks are listed from stratigraphically higher Miocene rocks mapped as San Pablo Group.

Travis, R. B., 1952, Geology of the Sebastopol quadrangle, California: California Div. Mines Bull. 162, 33 p.

Nineteen mollusks from several localities in the Pliocene Merced Formation are listed. The fossils are regarded as of middle or late Pliocene age and indicative of marine climate somewhat cooler than occurs at this latitude today.

Treasher, R. C., and Hodge, E. T., 1936, Bibliography of the geology and mineral resources of Oregon with digests and index to July 1, 1936: Oregon State Planning Board, 224 p.

Includes many references to Neogene mollusks. Each reference is annotated.

Trefzger, R. E., Webster, Cutler, and Redwine, L. E., 1952, Goleta Point-Tecolote Tunnel, *in* Redwine, L. E., chairman, and others, Cenozoic correlation section paralleling north and south margins [of the] western Ventura

basin from Point Conception to Ventura and Channel Islands, Calif.: Am. Assoc. Petroleum Geologists, Subcommittee on the Cenozoic of the Geologic Names and Correlations Committee, 2 sheets.

Megafossils and an oyster reef occur in the Vaqueros Formation.

Trimble, D. E., 1963, Geology of Portland, Oregon, and adjacent areas: U.S. Geol. Survey Bull. 1119, 119 p.

Two molluscan assemblages from the Scappoose Formation northwest of Portland, Oreg., identified by E. J. Trumbull and Ralph Stewart, are listed. The assemblages are believed to be of "probable early Miocene age" and "probably late Oligocene or early Miocene" (p. 17–18).

TRUMBULL, E. J., 1958*, Shumard's type specimens of Tertiary mollusks from Oregon and other types at Washington University, St. Louis: Jour. Paleontology, v. 32, no. 5, p. 893–906, pls. 115–117.

Patinopecten coosensis and *Chione* (*Securella*) *securis* are illustrated and described. *Securella* is an extinct subgenus of *Chione* of northern distribution as contrasted with *Chionopsis*, a Miocene to Holocene southern subgenus of *Chione*.

Tudor, R. B., 1962, Recent developments in the Kraft-York area of Placerita oil field [California]: California Oil Fields, v. 48, no. 1, p. 47–53.

The upper part of the Pliocene Pico Formation (180–620 ft. thick) contains abundant marine molluscan fossils.

Turner, H. W., 1891, The geology of Mount Diablo, California: Geol. Soc. America Bull., v. 2, p. 383–414, pl. 15.

Miocene beds contain *Ostrea titan* Conrad; 15 mollusks are listed from stratigraphically higher beds near Kirker Pass that are also of Miocene age.

Turner, H. W., 1898, Notes on some igneous, metamorphic, and sedimentary rocks of the Coast Ranges of California: Jour. Geology, v. 6, no. 5, p. 483–499.

Mollusks from the San Pablo Formation near Kirker Pass are listed.

Turner, H. W., and Stanton, T. W., 1894, Notes on the geology of the Coast Ranges of California: Am. Geologist, v. 14, p. 92–98.

A few Miocene molluscan genera from localities in San Benito and Fresno Counties are recorded.

Turner, R. D., 1954, The family Pholadidae in the western Atlantic and the eastern Pacific, pt. 1, Pholadinae: Johnsonia, v. 3, no. 33, p. 1–63.

The geologic ranges of pholadid genera are shown on a chart.

Tyson, P. T., 1850, Information in relation to the geology and topography of California, *in* Report of the Secretary of War: U.S. 31st Cong., 1st Sess., Senate Ex. Doc. 47, p. 1–74.

According to Ashley (1895a), Tyson noted a large oyster in beds near Martinez and in Livermore Valley which led him to assign them to the Eocene or Miocene.

Valentine, J. W., 1961, Paleoecologic molluscan geography of the Californian Pleistocene: California Univ. Pubs. Geol. Sci., v. 34, no. 7, p. 309–442.

A correlation chart of medial Pliocene to late Pleistocene formations of California, based in large part on molluscan data, is presented.

Valentine, J. W., 1962, Molluscan biofacies of the Santa Barbara Formation, California [abs.]: Geol. Soc. America Spec. Paper 68, p. 289.

The fauna of the Santa Barbara Formation includes about 250 species of mollusks. These are found in at least three associations related to sediment texture and depth. The formation is considered to be of Pliocene and Pleistocene age.

Valentine, J. W., and Mallory, Bob, 1965, Recurrent groups of bonded species in mixed death assemblages: Jour. Geology, v. 73, no. 5, p. 683–701.

Computer analysis of data from 225 late Cenozoic fossil localities in California indicates a series of 16 recurrent groups. These are assigned to nine fossil communities representing littoral to deep sublittoral biotopes. Data from 40 localities in the Pliocene-Pleistocene Santa Barbara Formation are included in the analysis. Mixed late Cenozoic depth assemblages are attributed to the existence of environmental conditions different from the modern marine environment off California rather than to mechanical mixing or physiologic change.

Valentine, J. W., and Meade, R. R., 1960, Isotopic and zoogeographic paleotemperatures of Californian Pleistocene mollusks: Science, v. 132, no. 3430, p. 810–811.

Paleontologic and isotopic analysis of Pleistocene mollusks from southern California provide independent evidence of similar Pleistocene climatic trends. Isotopic data from the Lomita Marl indicate temperatures of from 13.2° to 19.0°C.

Valentine, J. W., and Meade, R. F., 1961, Californian Pleistocene paleotemperatures: California Univ. Pubs. Geol. Sci. Bull., v. 40, no. 1, p. 1–46.

A critical review of zoogeographic-based inferences of Cenozoic marine climate of the Pacific coast with particular reference to the California Pleistocene. The paleoecologic approach is contrasted with oxygen isotope paleotemperatures on Pleistocene shells from northern Baja California and California. There is a useful tabulation of extralimital mollusks including range end-points, depth ranges and average summer and winter surface water temperatures at the range end-points. Isotopic determinations of three mollusks from the lower Pleistocene Lomita Marl are indicative of rather warm water but there is also evidence of water temperatures at times cooler than today during deposition of the Lomita.

Valentine, W. W., 1943, Semitropic gas field [California]: California Div. Mines Bull, 118, p. 542.

A "first *Mya-Elphidium* zone" occurs at the top of the "San Joaquin Clays."

van Amringe, J. H., and Kilkenny, J. E., 1964, San Andreas fault cross sextions no. 10, 11, and 12 from Valyermo, California, to the Mexican Border: Am Assoc. Petroleum Geologists, Pacific Section, Committee for the study of lateral faulting in California.

Early Miocene mollusks from the Vaqueros Formation near Cajon Pass (five taxa), San Bernardino County, Calif., identified by W. H. Corey, are recorded.

VanCouvering, Martin, and Allen, H. B., 1943, Devils Den oil field [California]: California Div. Mines Bull. 118 p. 496–501.

Pecten andersoni occurs in their Escudo Formation and *Anadara osmonti* and *Lucina acutilineata* in the upper member of their Hannah Formation [Kern County, Calif.].

Vanderhoof, V. L., 1942, Bearing of sea-cows on age of Vaqueros, *in* Schenck, H. G., and Childs, T. S., Jr., Significance of *Lepidocyclina* (*Lepidocyclina*) *californica*, new species, in the Vaqueros Formation (Tertiary), California: Stanford Univ. Pub., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 40–42.

Turritella ocoyana is reported from north of Coalinga. The Sooke Formation is equivalent to the Vaqueros Formation based on sea-cow evidence, that is, "The 'Vaqueros" does not represent a long time interval between the 'Sooke' and the 'Temblor' but should be considered at least in part, as being equal to Sooke time ***"

Vanderhoof, V. L., 1956, Correlation chart, central California Coast Ranges: California Oil Fields, v. 42, no. 1, p. 43.

Some common mollusks are recorded in a correlation chart.

Vander Leck, Lawrence, 1921, Petroleum resources of California with special reference to unproved areas: California Mining Bur. Bull. 89, 186 p., 6 pls., 12 figs.

Some characteristic Miocene or Pliocene mollusks are recorded.

Vaughan, F. E., 1918, Evidence in San Gorgonio Pass, Riverside County, of a Late Pliocene extension of the Gulf of Lower California [abs.]: Geol. Soc. American Bull., v. 29, p. 164–165.

An invertebrate assemblage from near San Gorgonio Pass is correlated with fossiliferous exposures at Carrizo Creek. A post-Miocene age is suggested.

Vaughan, F. E., 1922, Geology of the San Bernardino Mountain north of San Gorgonio Pass [California]: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 13, no. 9, p. 319–411, pls, 17–23, 1 map, 12 text figs.

The Lion sandstone contains *Turritella*, *Spondylus*, *Pecten subnodosus*, and other pectinids.

Vaughan, T. W., 1917, The reef-coral fauna of Carrizo Creek, Imperial County, California, and its significance: U.S. Geol. Survey Prof. Paper 98–T, p. 355–395, figs. 43–46, pls. 91–102.

Gastropods and pelecypods indentified by W. S. W. Kew from the lower and upper divisions of his Carrizo Formation are listed; these indicate a Pliocene age.

Vedder, J. G., 1960, Previously unreported Pliocene mollusca from the southeastern Los Angeles Basin [California], *in* Short papers in the Geological Sciences: U.S. Geol. Survey Prof. Paper 400–B, p. B326–B328.

The megafauna of the Niguel Formation exposed near San Juan Capistrano and an unnamed sandstone of Pliocene age exposed in the upper part of Newport Bay contain a combined fauna of 205 taxa many of which were not previously known from rocks of Pliocene age and were not previously reported from the Los Angeles basin. Stratigraphically diagnostic and restricted mollusks from each formation are listed along with their occurrence in other Pliocene sections from California and Mexico.

Vedder, J. G., 1968, Geologic map of Fox Mountain quadrangle, Santa Barbara County, California: U.S. Geol. Survey Misc. Geol. Inv. Map I–547, scale 1:24,000.

Characteristic mollusks from lower to upper Miocene formations are noted in the map explanation. Megainvertebrate localities are plotted on the map.

Vedder, J. G., Gower, H. D., Clifton, H. E., and Durham, D. L., 1967, Reconnaissance geologic map of the central San Rafael Mountains and vicinity, Santa Barbara County, California: U.S. Geol. Survey Misc. Geol. Inv. Map I–487, scale 1:48,000.

Fourteen mollusks from lower and middle Miocene rocks are listed.

Vedder, J. G., and Repenning, C. A., 1965, Geologic map of the southeastern Caliente Range, San Luis Obispo County, California: U.S. Geol. Survey Oil and Gas Inv. Map OM–217, scale 1:24,000.

Marine mollusks occur in several map units of Miocene age. Fossil localities are plotted on the geologic map.

Vedder, J. G., Yerkes, R. F., and Schoellhamer, J. E., 1957, Geologic map of the San Joaquin Hills-San Juan Capistrano area, Orange County, California: U.S. Geol. Survey Oil and Gas Inv. Map OM–193, scale 1:24,000.

Turritella ocoyana and other mollusks occur in the Topanga Formation. Three species of Pliocene mollusks are listed from the Niguel Formation. Megafossil localities are plotted on the geologic map.

Vogdes, A. W., 1896, A bibliography relating the geology, paleontology and mineral resources of California: California Mining Bur. Bull. 10, 121 p.

Included are many reports containing paleontologic data. References are arranged by journal and, in many cases, include extensive annotations indicating new fossil names. The reports are indexed by author and generalized title.

Vogdes, A. W., 1904, A bibliography relating to the geology, paleontology, and mineral resources of California: California Mining Bur. Bull. 30, 290 p.

Included in this useful annotated bibliography are all references in Vogdes (1896) in addition to subsequently published reports through 1903. The names of new species of mollusks are indicated in annotations of paleontologic reports.

Vokes, E. H., 1969, The genus *Trajana* (Mollusca: Gastropoda) in the New World: Tulane Studies in Geology and Paleontology, v. 7, no. 2, p. 75–83.

Described *Trajana* (*Nerva*) *woodringi* n. sp. from the Miocene Gatun Formation of Panama. This is the type species of *Nerva*, a nassariid gastropod with apertural denticles by which it can be differentiated from *Trajana* s.s.

VOKES, H. E., 1935, A new species of *Haliotis* from the Pliocene of Southern California: Jour. Paleontology, v. 9, no. 3, p. 251–252, pl. 25.

Haliotis elsmerensis n. sp. is described from lower Pliocene strata in Elsmere Canyon, Los Angeles County, Calif.

VOKES, H. E., 1939, Molluscan faunas of the Domengine and Arroyo Hondo formations of the California Eocene: New York Acad. Sci. Annals, v. 38, p. 1–246, pls. 1–22.

The dentition of Miocene *Miltha sanctaecrusis* (Arnold) is compared with Eocene species.

Vokes, H. E., 1955, Notes on Tertiary and Recent Solemyacidae: Jour. Paleontology, v. 29, no. 3, p. 534–545.

Solemya ventricosa from the Miocene Astoria Formation of Oregon and *S.* aff. *S. johnsoni* from the Pliocene Repetto Formation of southern California are reviewed.

Vokes, H. E., 1963, Studies of Tertiary and Recent giant Limidae: Tulane Studies Geology, v. 1, no. 2, p. 75–92, 2 pls.

Two Neogene species from the eastern North Pacific are briefly reviewed: *Lima* (*Acesta*) *twinensis* Durham, and *L.* (*A.*) *hamlini* Dall.

Vokes, H. E., 1969, Observations on the genus *Miltha* (Mollusca: Bivalvia) with notes on the type and the Florida Neogene species: Tulane Studies in Geology and Paleontology, v. 7, no. 3, p. 93–125.

Miltha first appears during the early Miocene in California (*M. sanctaecrusis* Arnold).

Vokes, H. E., Norbisrath, Hans, and Snavely, P.D., Jr., 1949, Geology of the Newport-Waldport area, Lincoln County, Oregon: U.S. Geol Survey Oil and Gas Inv. Prelim. Map 88, scale 1:62,500, geol. map and text.

Mollusks from localities in the Yaquina Formation, Nye Mudstone, and Astoria Formation are listed. The localities are plotted on the geologic map.

Von Estorff, F. E., 1930, Kreyenhagen shale at type locality, Fresno County, California: Am. Assoc. Petroleum Geologists Bull., v. 14, no. 10, p. 1321–1336, 5 figs.

Many shallow-water mollusks including *Turritella ocoyana* and *Pecten andersoni* occur in the middle part of the Temblor Formation on Reef Ridge.

WAGNER, C. M., and SCHILLING, K. H., 1923, The San Lorenzo Group of the San Emigdio region, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 14, no. 6, p. 235–276, pls. 43–50.

Two species from the Miocene Monterey Group, *Pecten vaughani emigdioensis* n. subsp., and *Tivela inezana* (Conrad), are figured. Mollusks from the uppermost fossiliferous zone of Pleito Formation and a few species from the Monterey Group are listed.

Walker, T. R., 1967, Formation of red beds in modern and ancient deserts: Geol. Soc. America Bull., v. 78, no. 3, p. 353–368.

Pliocene intertidal deposits containing *Ostrea californica* occur on the coastal plain about 35–40 miles south of San Felipe, Baja California, Mexico [no other species listed]. *Ostrea californica* and *Argopecten deserti* occur in Pliocene deposits in the Cocopah Mountains about 20 miles south of the United States-Mexico border.

Waller, T. R., 1969, The evolution of the *Argopecten gibbus* stock (Mollusca: Bivalvia), with emphasis on the Tertiary and Quaternary species of eastern North America: Jour. Paleontology Mem. 3 (Paleontol. Soc. Mem. 3) (Jour. Paleontology, v. 43, no. 5, supp.), 125 p.

Argopecten circularis and *A. purpuratus*, Pliocene to Holocene species from the Pacific coast, are reviewed. Neogene species of *Plagioctenium* [*Aequipecten*] of Arnold including P. *discus* and *P. andersoni*, from the Pacific coast are noted but are not considered in detail.

Walling, R. W., 1939, Canal and Strand oil fields [California]: California Oil Fields, v. 24, no. 4, p. 9–15.

"*Mulinia densata* Conrad, a fossil marker for the top of the Etchegoin (Pliocene), was cored at 3,990 feet" in Shell Oil Co. well "Canal A" 21–14.

Waring, C. A., 1914, Geology and possibilities of oil in portions of Monterey, San Luis Obispo, and San Benito Counties, [Chap.] 10 *of* McLaughlin, R. P., Petroleum industry of California: California Mining Bur. Bull. 69, p. 418–438.

A few mollusks are recorded from the Vaqueros, Monterey, Santa Margarita, Jacalitos, and Etchegoin Formations, in part from the vicinity of Vineyard Canyon northeast of San Miguel, Calif.

Warren, W. C., Grivetti, R. M., and Norbisrath, Hans, 1945, Geology of northwestern Oregon, west of Willamette River and north of latitude 45°15′: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 42, geol. map and text.

A few mollusks from beds of Blakeley age [in part early Miocene] and the Astoria Formation [middle Miocene] identified by H. E. Vokes are listed. The localities are plotted on the geologic map.

Warren, W. C., and Norbisrath, Hans, 1946, Stratigraphy of upper Nehalem River basin, northwestern Oregon: Am. Assoc. Petroleum Geologists Bull., v. 30, no. 2, p. 213–237.

Mollusks from the Scappoose Formation identified by H. E. Vokes include 21 taxa that are considered to be of late Oligocene or early Miocene age. The fauna is correlated with the Sooke Formation of Vancouver Island, British Columbia.

Washburne, C. W., 1914, Geology and oil prospects of northwestern Oregon: U.S. Geol. Survey Bull. 590, 111 p.

There is an extensive description of fossiliferous Miocene rocks at Astoria and scattered occurrences of Miocene mollusks at inland localities, many of which would nowadays be included in the Scappoose Formation. Lists of mollusks of Miocene age identified by W. H. Dall are included.

WATERFALL, L. N., 1929, A contribution to the paleontology of the Fernando Group, Ventura County, California: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 18, no. 3, p. 71–92, pls. 5, 6.

Nine new mollusks from the Pliocene Fernando Group are described. Twelve mollusks from the "lower Pico," 84 from the upper Pico Formation, and 92 from the Saugus Formation all from the northwestern part of Ventura basin are listed. The upper Pico fauna is cold temperate; the Saugus fauna warm temperate. Percentages of northern and southern mollusks in the faunas suggest that the Pico is of relatively cold-water aspect and that the Saugus is of somewhat warmer aspect than the fauna living at this latitude today. The Pico is assigned to the Pliocene; the Saugus to the Pleistocene.

Watts, W. L., 1894, The gas and petroleum yielding formations of the central valley of California: California Mining Bur. Bull. 3, 100 p.

Miocene and Pliocene mollusks are listed from localities in the southern and western parts of the San Joaquin basin, California: Kern River area (early and middle Miocene)—33 species; western San Emigdio Mountains

(Pliocene)—three species, (Miocene or Pliocene)—nine species; McKittrick area (Pliocene)—two species; Reef Ridge area—several middle Miocene and Pliocene species; Kettleman Hills are (Pliocene)—13 species; lower Pliocene southwest of Coalinga—17 species; and some upper Miocene and Pliocene mollusks from about 10 miles north of Coalinga.

Watts, W. L., 1897, Oil and gas yielding formations of Los Angeles, Ventura and Santa Barbara Counties [California]: California Mining Bur. Bull. 11, p. 1–94.

Pliocene fossils from downtown Los Angeles area identified by Dr. J. G. Cooper are listed.

Watts, W. L., 1900, Oil and gas yielding formations of California: California Mining Bur. Bull. 19, 236 p.

Pecten peckhami occurs in Neogene shales at Coalinga and *Ostrea titan* and *Lyropecten* in overlying sandstones. Miocene fossils from Santiago Canyon, Piru Creek, and Big Tar Canyon, middle Neogene fossils "(San Pablo Group)" [Pliocene, in part] from Puente Hills, Elsmere Canyon, and Piru Creek, and upper Neogene fossils (Pliocene) from a shallow well near San Juan Capistrano, all identified by J. C. Merriam, are listed.

Weaver, C. E., 1909, Stratigraphy and palaeontology of the San Pablo formation in Middle California: California Univ. Dept. Geology Bull., v. 5, no. 16, p. 243–269.

Sixty-nine species of mollusks are recorded from his San Pablo Formation; their stratigraphic occurrence [lower, middle, and upper San Pablo] as well as their occurrences in the Merced, Purisima and Santa Margarita Formations are indicated. On the basis of percentage of living species, the San Pablo is assigned to the Pliocene.

WEAVER, C. E., 1912, A preliminary report on the Tertiary paleontology of western Washington: Washington Geol. Survey Bull. 15, 80 p., 15 pls.

A review of the Tertiary paleontology and stratigraphy of western Washington with a preliminary geologic map, lists of characteristic mollusks from four Miocene formations, and descriptions of 63 new molluscan taxa of Miocene age [many are from the Montesano Formation, a few of these are from strata now classified as late Oligocene].

Weaver, C. E., 1914, Lower Miocene of Washington [abs.]: Geol. Soc. America Bull., v. 25, p. 153-154.

The nautiloid *Aturia*, formerly regarded as an index to the Oligocene, occurs in the lower Miocene of western Washington.

Weaver, C. E., 1916a, The post-Eocene formations of western Washington: California Acad. Sci. Proc., ser. 4, v. 6, no. 2, p. 19–40.

Five post-Eocene faunal zones including the *Acila gettysburgensis* (late Oligocene-early Miocene), *Arca montereyana* (middle Miocene), and *Yoldia strigata* zones (late Miocene) are defined. Generalized list of molluscan species are presented for each zone.

WEAVER, C. E., 1916b, Tertiary faunal horizons of western Washington: Washington Univ. Pub. Geology, v. 1, no. 1, p. 1–67, pls. 1–5.

Three Miocene "zones" are defined: *Acila gettysburgensis* [in part late Oligocene of modern usage], *Arca montereyana*, and *Yoldia strigata* in

ascending order. Rocks near the mouth of the Quinault River in western Washington may represent a still younger unit than the *Yoldia strigata* "zone." Characteristic species of each zone are listed. Six new species of gastropods and one pelecypod from the *Arca montereyana* "zone" are described and illustrated.

Weaver, C. E., 1916c, The Tertiary formations of western Washington: Washington Geol. Survey Bull. 13, 327 p.

A comprehensive review of the Tertiary geology of western Washington. Included are an annotated bibliography, descriptions of Miocene formations including characteristic mollusks, geologic maps showing fossil localities, locality descriptions, and check lists of (1) Oligocene and Miocene mollusks and (2) upper Miocene mollusks.

Weaver, C. E., 1918, Paleogeography of the Oligocene of Washington [abs.]: Geol. Soc. America Bull., v. 29, p. 165–166.

The Sooke Formation is regarded as a basal Oligocene unit in the more northern of two Oligocene basins of deposition in Washington and southernmost British Columbia. Overlying strata are assigned to the *Molopophorus lincolnensis* zone. The uppermost beds in the northern embayment contain a fauna that has been designated the *Acila gettysburgensis* zone [in part of Miocene age] which is of cooler aspect than the Oligocene *M. lincolnensis* zone which is regarded as subtropical.

Weaver, C. E., 1937, Tertiary stratigraphy of western Washington and northwestern Oregon: Washington Univ. Pub. Geology, v. 4, 266 p.

A stratigraphic résumé of Tertiary formations that furnishes a framework for Weaver's (1942) later catalog of marine larger invertebrates from this region. A few mollusks are referred to in the text but no faunal lists are included.

WEAVER, C. E., 1942, Paleontology of the marine Tertiary formations of Oregon and Washington: Washington Univ. [Seattle] Pubs. Geology, v. 5, pts. 1–3, 789 p., 104 pls.

A comprehensive catalog of larger invertebrate fossils, mostly mollusks, described from Oregon and Washington. Treatment for each species includes original description, type locality, location of type specimen(s), geologic and geographic distribution, supplementary description or comparative notes, and illustration of each species—usually including a figure of the type specimen. Also included is a comprehensive chronologic bibliography of paleontologic reports, a list of University of Washington faunal localities, and a correlation chart. Two new Miocene mollusks are described: *Megasurcula etheringtoni* and *Yoldia clallamensis*.

Weaver, C. E., 1945, Stratigraphy and paleontology of the Tertiary formations at Coos Bay, Oregon: Washington Univ. [Seattle] Pubs. Geology, v. 6, p. 31–62.

The fauna of the Empire Formation incudes 112 mollusks which are enumerated in a stratigraphic checklist. Localities are listed and are shown on detailed geologic maps of the sea-cliff exposures.

Weaver, C. E., 1949, Geology of the Coast Ranges immediately north of the San Francisco Bay region, California: Geol. Soc. America Mem. 35, 242 p.

Extensive faunal lists from the San Ramon Sandstone, Monterey Group, Briones Sandstone, Cierbo Sandstone, and Neroly Sandstone from the San

Pablo Bay area are presented. The fauna of the San Ramon Formation is assigned to the Oligocene.

Weaver, C. E., 1953, Eocene and Paleocene deposits at Martinez, California: Washington Univ. [Seattle] Pubs. Geology, v. 7, 102 p., pls. 1,2.

Lists of mollusks from the San Ramon Formation (47 species), Sobrante Sandstone (20 species), and Briones Sandstone (54 species) are included.

Weaver, C. E., chm., and others (20), 1944, Correlation of the marine Cenozoic formations of western North America: Geol. Soc. America Bull., v. 55, no. 5, p. 569–598.

The basic scheme for Pacific coast Cenozoic molluscan correlation is set forth in this publication. Here and there a few mollusks characteristic of particular stratigraphic units are indicated in addition to zonal index fossils on the correlation chart. Differences in correlating the microfossil and megafossil chronologies with Europe are shown and discussed. California Neogene "stages" are first defined in this report.

Weaver, D. W., 1965, Summary of Tertiary stratigraphy, western Santa Ynez Mountains [California], *in* Western Santa Ynez Mountains, Santa Barbara County, California, Guidebook, 1965: Coast Geol. Soc., Pacific Sec. Soc. Econ. Paleontologists and Mineralogists, p. 16–30.

Three mollusks from the Vaqueros Formation are recorded. There is a discussion of the relationship between foraminiferal faunas of the Saucesian Stage and the Miocene megafaunal sequence.

WEAVER, D. W., ed., and OTHERS, 1969*, Geology of the Northern Channel Islands [California]: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., 200 p., 34 pls., 18 figs.

Several articles contain data on Miocene and Pliocene molluscan assemblages from San Miguel, Santa Cruz, and Santa Rosa Islands. More than 20 mollusks from formations of early Miocene to Pliocene age are illustrated.

Weaver, D. W., and Doerner, D. P., 1969, Mid-Tertiary stratigraphy, San Miguel Island [California], in Weaver, D. W., ed., Geology of the Northern Channel Islands: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., p. 80–84.

Mollusks identified by Bremner (1933) from the Vaqueros Formation and five mollusks from their Beechers Bay Member of the Monterey Formation, considered to be of middle Miocene age, are listed. The latter assemblage occurs stratigraphically above foraminiferal assemblages referable to the Saucesian Stage and below assemblages referable to the Luisian Stage.

Weaver, D. W., and Frantz, J. D., 1967, Re-evaluation of the type Refugian Stage of the Pacific Coast Tertiary [abs.]: Geol. Soc. America Program Ann. Mtg., Santa Barbara, Calif., Mar. 22–25, 1967, p. 69–70.

The fauna of the Alegria Formation is now regarded as referable to the Oligocene Refugian Stage based on new mapping of the type area of the Refugian Stage in the western part of the Santa Ynez Mountains. It was previously believed to be in part of post-Refugian, Zemorrian age.

Weaver, D. W., Griggs, G., McClure, D. V., and McKey, J. R., 1969, Volcaniclastic sequence, south-central Santa Cruz Island [California], *in* Weaver,

D. W., ed., Geology of the Northern Channel Islands: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., p. 85–90.

Five mollusks are recorded from the middle Miocene San Onofre Breccia; they suggest that this formation was deposited in a shallow-water marine environment and that the formation grades into finer grained sediments containing Saucesian foraminiferal assemblages.

Weaver, D. W., and Kleinpell, R. M., 1963, Mollusca from the *Turritella variata* zone and their chronologic and biogeographic significance, *in* Kleinpell, R. M., and Weaver, D. W., Oligocene biostratigraphy of the Santa Barbara embayment, California: California Univ. Pubs. Geol. Sci., v. 43, pt. 2, p. 81–161, pls. 18–38.

There is a brief discussion of mollusks from the Vaqueros Formation and problems of correlation by mollusks. Early Saucesian foraminiferal assemblages are correlated with Loel and Corey's (1932) "Vaqueros-Temblor Transition Zone," late Saucesian assemblages with the "*Bruclarkia barkeriana* Zone."

Weaver, D. W., and Meyer, G. L., 1969, Stratigraphy of northeastern Santa Cruz Island [California], *in* Weaver, D. W., ed., Geology of the Northern Channel Islands: Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists, Pacific Secs., Spec. Pub., p. 95–104.

Five mollusks first recovered by Rand (1933) from the Monterey Formation and 12 from their newly named Potato Harbor Formation of Pliocene age are listed.

Webster, Arthur, 1906, Geology of the west coast of Vancouver Island [British Columbia, Canada]: Canada Geol. Survey Ann. Rept., new ser., v. 15, 1902–3, p. 54A–76A.

Six feet of sandstone beds with "vast quantities of fossil shells of various species" occur at the mouth of Coal Creek (p. 59A). Fossil shells occur from half a mile west of Muir Creek to the mouth of Coal Creek. Fossils occur in soft bedded sandstone at Point St. Juan.

Weddle, J. R., 1959, Premier and Enas areas of Poso Creek oil field [California]: California Oil Fields, v. 45, no. 2, p. 41–50.

Casts of "*Macoma kerica*, *Arca trilineata* and *Vosella recta*" occur in a 110-ft shale section called the Macoma Claystone Member of the Etchegoin Formation.

Weddle, J. R., 1961, Union Avenue oil field [California]: California Oil Fields, v. 47, no. 1, p. 14–18.

"Megafossils" occur in the "Santa Margarita sand" (upper Miocene).

Weddle, J. R., 1962, Calders Corner oil field [California]: California Oil Fields, v. 48, no. 1, p. 55–61.

Mulinia [*Pseudocardium*] *densata* occurs in the upper 2,780 ft of the Etchegoin Formation; casts of *Macoma kerica* occur in the lower 4,150 ft of the formation.

Weddle, J. R., 1965, Northeast Area of McKittrick oil field [California]: California Oil Fields, v. 51, no. 2, p. 5–20.

A zone containing abundant *Pecten peckhami* occurs near the top of the upper Miocene Antelope Shale.

Weddle, J. R., 1966, Carneros, Phacoides, and Oceanic pools, McKittrick Front area of Cymric oil field [California]: California Oil Fields, v. 52, no. 2, pt. 2, p. 23–30.

Pyritized megafossils occur in the upper Miocene Antelope Shale.

Wharton, J. B., 1943, Belridge oil field [California]: California Div. Mines Bull. 118, p. 502–504.

Pecten peckhami occurs about 170 ft above the base of the Gould Shale; *Pecten andersoni* and *Turritella ocoyana* occur in hard limy reefs in the underlying Temblor Sand.

WHITE, C. A., 1884*, Fossil Ostreidae of North America: U.S. Geol. Survey Fourth Ann. Rept., p. 273–430, pls. 34–82.

Eight species of *Ostrea* from the California Neogene are listed; four of these are illustrated.

White, C. A., 1889, On invertebrate fossils from the Pacific Coast: U.S. Geol. Survey Bull. 51, 102 p.

Some of the species described by Conrad (1848, 1949) from near Astoria, Oreg. [Astoria Formation, Miocene] are compared with Eocene mollusks from California. Concludes that "Chico-Tejon" strata [Eocene] may be present near Astoria.

White, G. T., 1968, Scientists in conflict, the beginnings of the oil industry in California: Huntington Library, San Marino, Calif., 272 p.

A few of the paleontologists involved in studies pertaining to the early days of exploration for petroleum in California are mentioned in brief historical sketches.

White, R. C., and Buffington, E. C., 1948, Age of the Modelo(?) beds in Haskell and Dry canyons, northern Los Angeles County, California [abs.]: Geol. Soc. America Bull., v. 59, no. 12, pt. 2, p. 1389.

The marine Modelo(?) Formation of the eastern part of the Ventura basin near Saugus contains a large invertebrate fauna assigned to the late Miocene on the basis of echinoids and four mollusks.

White, W. R., 1956, Pliocene and Miocene Foraminifera from the Capistrano Formation, Orange County, California: Jour. Paleontology, v. 30, no. 2, p. 237–260.

Small specimens of *Hyalopecten peckhami* (Gabb) occur in the lower part of the Capistrano Formation of late Miocene age.

Whitney, J. D., 1865, Geological Survey of California, report of progress of the field work from 1860 to 1864: California Geol. Survey, Geology, v. 1, 498 p.

Mollusks identified by W. M. Gabb are recorded from many localities: near the eastern part of Kirker's Pass (19 spp.), the Griswold Hills (10 spp.), Santa Ynez Pass (7 spp.), the northern margin of the Santa Lucia Range (4 spp.), and the Santa Monica Mountains (6 spp.); these probably are of Miocene age. There are scattered references to Neogene mollusks throughout the text.

WIEDEY, L. W., 1928, Notes on the Vaqueros and Temblor formations of the California Miocene with descriptions of a new species: San Diego Soc. Nat. History Trans., v. 5, no. 10, p. 95–182, pls. 9–21.

Included is an extensive review of reports on Vaqueros and Temblor faunas. The upper Oligocene fauna was "predominately cool water"; the

fauna of the Vaqueros "indicates an invasion of many truly tropical genera." The fauna of the middle Miocene "indicates somewhat cooler conditions, more of a warm temperate type, than those of the preceding age, the Vaqueros" (p. 107). Thirty-two new molluscan taxa are described and illustrated.

WIEDEY, L. W., 1929a, New Miocene mollusks from California: Jour. Paleontology, v. 3, no. 3, p. 280–289, pls. 31–33.

Seven new species of mollusks are named and illustrated.

Wiedey, L. W., 1929b, Revision of the Turritellas of the Vaqueros and Temblor Miocene of California [abs.]: Geol. Soc. America Bull., v. 41, no. 1, p. 261.

Turritella variata has been erroneously reported from the Temblor Formation and from the Vaqueros Formation. This discovery necessitates naming of two new species and a new variety of Miocene *Turritella*.

WIEDEY, L. W., 1929c*, Some previously unpublished figures of type mollusks from California: Nautilus, v. 43, no. 1, p. 21–26, pls. 1–3.

Five mollusks of Miocene, and possibly late Oligocene, age originally described by Hall and Ambrose (1916) from the San Francisco Bay area are figured for the first time.

Wiese, J. H., 1950, Geology and mineral resources of the Neenach quadrangle, California: California Div. Mines Bull. 153, 53 p.

Five mollusks collected from exposures of the Santa Margarita Formation in Oso Canyon are listed.

Wilkinson, E. R., 1959, Vallecitos oil field [California]: California Oil Fields, v. 45, no. 2, p. 17–33.

An *Ostrea* reef occurs in the basal part of Pliocene Etchegoin Formation; a "prominent megafossil horizon occurs in the upper part of the Miocene Temblor Formation."

Wilkinson, E. R., 1963, Hollister field [California]: California Oil Fields, v. 49, no. 1, p. 27–37.

Ostrea vespertina occurs in the upper part of the Purisima Formation; "numerous marine megafossils" occur in the lower part of the formation.

Wilkinson, E. R., 1967, Hollister Field [California]: Am. Assoc. Petroleum Geologists, Pacific Sec.-Pacific Sec. Soc. Econ. Paleontologists and Mineralogists, Guidebook, Gabilan Range and adjacent San Andreas fault, p. 95–98.

A further report of *Ostrea* from the Purisima Formation.

Wilkinson, W. D., 1959, Field guidebook [for] College Teachers conferences in geology sponsored by National Science Foundation: Oregon Dept. Geology and Mineral Industries Bull. 50, 148 p.

Includes a correlation chart for Oregon Coast Range Cenozoic sections by D. O. Cochran and lists of characteristic mollusks from a few Neogene formations: the Astoria Formation, Empire Formation, Scappoose Formation, and Nye Mudstone.

Wilkinson, W. D., Lowry, W. D., and Baldwin, E. M., 1946, Geology of the St. Helens quadrangle, Oregon: Oregon Dept. Geology and Mineral Industries Bull. 31, 39 p.

The fauna of the Scappoose Formation is believed to be most similar to the fauna of the Sooke Formation. There are, however, some species in the Scappoose that have been found only in the Astoria Formation suggesting that the fauna may be of intermediate age. Seventeen species of mollusks are recorded from three localities in the Scappoose; most of these were previously listed by Warren and others (1945). The fossil localities are plotted on an index map.

Willett, G., 1946, Additional notes on the Pliocene molluscan fauna of Los Angeles city [California]: Southern California Acad. Sci. Bull., v. 45, pt. 1, p. 28–32.

A list of species of Pliocene mollusks in collection at the Los Angeles County Museum is included.

Wilmarth, M. G., 1938, Lexicon of geologic names of the United States including Alaska: U.S. Geol. Survey Bull. 896, 2396 p.

Geologic names for United States, Mexico, and Canada through 1935 are listed. Citations include designation of type section, current age, geographic area, and original citation with extensive annotations that include some paleontologic data. This treatment is carried through 1960 by Keroher and others (1966).

Wilson, E. C., 1966, Type specimens of fossil invertebrates in the San Diego Natural History Museum: San Diego Soc. Nat. History Trans., v. 14, no. 9, p. 97–132.

Many Miocene and Pliocene mollusks figured in reports of the San Diego Society of Natural History and other publications are listed.

Wilson, E. D., 1931, Marine Tertiary in Arizona: Science, v. 74, no. 1927, p. 567–568.

Corbicula(?) and a cerithid are reported from southern Yuma County (identified by W. P. Woodring) together with a marine barnacle.

Wilson, E. J., 1954, Foraminifera from the Gaviota Formation east of Gaviota Creek, California: California Univ. Pubs. Geol. Sci., v. 30, no. 2, p. 103–170.

Three mollusks are recorded from exposures of the Vaqueros Formation near Gaviota Canyon, Santa Barbara County, Calif.

Wilson, I. F., 1943, Geology of the San Benito quadrangle, California: California Jour. Mines and Geology, v. 39, no. 2, p. 183–270.

Faunas from the lower Temblor Sandstone (22 mollusks). Temblor Shale (1 mollusk), upper Temblor Sandstone (10 mollusks), Santa Margarita Formation (13 mollusks), Etchegoin (63 mollusks) are recorded. A 3,360-ft measured section of Etchegoin is described with brief listing of mollusks found in various units. Both early and middle Pliocene assemblages (of traditional usage) occur in the Etchegoin. The late Pliocene is believed to be represented by a thin interval of oyster beds near San Benito.

Wilson, I. F., 1948, Buried topography, initial structures, and sedimentation in Santa Rosalia area, Baja California, Mexico: Am. Assoc. Petroleum Geologists Bull., v. 32, no. 9, p. 1762–1807.

Lists mollusks from the lower Pliocene Boleo Formation (24 taxa), middle Pliocene Gloria Formation (28 taxa), and upper Pliocene Infierno

Formation (26 taxa). Most of these are pectinids; they were identified by H. E. Vokes.

Wilson, I. F., and Rocha, V. S., 1955, Geology and mineral deposits of the Boleo copper district, Baja California, Mexico: U.S. Geol. Survey Prof. Paper 273, 134 p.

Four mollusks of middle Miocene age are listed from a locality in the Isidro Formation about 5 km west of San Ignacio. Small assemblages of mollusks from the lower Pliocene Boleo Formation are listed. Twenty-nine mollusks are listed from localities in the middle Pliocene Gloria Formation; about 30 from the upper Pliocene Infierno Formation. Identifications are by H. E. Vokes.

Wilson, R. R., 1931, Miocene shales of the Adelaida quadrangle, San Luis Obispo County, California: Micropaleontology Bull., v. 2, no. 5, p. 102–104.

Miocene shales contain abundant *Pecten peckhami* near the base. Dolomitic limestone containing *Bruclarkia barkeriana* is disconformably overlain by rocks containing the middle Miocene foraminifer *Valvulineria californica.*

Wintererer, E. L., 1956, Geology of southeastern Ventura basin, Los Angeles County, California: U.S. Geol. Survey open-file rept.

A preliminary report that includes information presented in Winterer and Durham (1958).

Winterer, E. L., and Durham, D. L., 1958, Geologic map of a part of the Ventura Basin, Los Angeles County, California: U.S. Geol. Survey Oil and Gas Inv. Map OM–196, scale 1:24,000.

The Towsley Formation contains abundant megafossils [mostly mollusks] near Elsmere Canyon and north of the San Gabriel fault. Molluscan fossils are abundant in the Pico Formation.

Winterer, E. L., and Durham, D. L., 1962, Geology of southeastern Ventura Basin, Los Angeles County, California: U.S. Geol. Survey Prof. Paper 334–H, p. 275–366.

Delectopecten occurs in the Miocene Modelo Formation and in shale of the overlying Towsley Formation. Almost 200 molluscan taxa are listed from localities in the Towsley and Pico Formations together with geographic and bathymetric data for those species that are still living. The molluscan assemblages of the Pico Formation are of mixed aspect; deep-water species are of northern aspect whereas shallow-water species suggest somewhat warmer surface temperatures than now occur near Ventura.

Wissler, S. G., 1941, Stratigraphic formations of the producing zones of the Los Angeles Basin oil fields [California]: California Div. Mines Bull. 118, p. 209–234, pl. 5, figs. 88–91, 1 table.

Hyalopecten randolphi tillamookensis (Arnold) is common in the middle Pico and *Hyalopecten pedroanus* (Trask) is fairly abundant in the lower half of Miocene Division C.

Wittich, E., 1911, Beiträge zur Geologie der Kapregion von Nieder-Californien: Deutsch Geol. Gesell. Zeitschr., v. 63 B, Monatsberichte, no. 12, p. 578–587.

Ostrea-bearing strata occur in the cape region of Baja California. A few other mollusks including *Donax* and small gastropods occur in Tertiary strata of this region.

Wolfe, E. W., and McKee, E. H., 1968, Geology of the Grays River quadrangle, Wahkiakum and Pacific Counties, Washington: Washington [State] Div. Mines and Geology Geol. Map GM–4, 6 p.

Miocene mollusks occur in the upper part of the Lincoln Creek Formation and in the Astoria Formation.

Woodford, A. O., 1925, The San Onofre breccia, its nature and origin: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 15, no. 7, p. 159–280, pls. 23–35, 11 figs. (incl. maps).

Lists four mollusks from the Vaqueros Formation, 39 from the Temblor Formation, three from blue-schist sandstone at Point Fermin, all of Miocene age. A few others are listed from the Pliocene Capistrano Formation.

Woodford, A. O., 1942, Miocene preferred, *in* Schenck, H. G., and Childs, T. S., Jr., Significance of *Lepidocyclina* (*Lepidocyclina*) *californica*, n. sp., in the Vaqueros Formation (Tertiary), California: Stanford Univ. Pubs., Univ. Ser., Geol. Sci., v. 3, no. 2, p. 32–34.

Lyell's European lower Miocene includes the Aquitainian and Burdigalian; the former is Miocene because of its modern aspect. Recommends use of Miocene age for Vaqueros because of the presence of large pectinids, large ostreids, and other genera which are regarded by A. M. Davies as characteristic of the European Miocene.

Woodford, A. O., and Bailey, T. L., 1928, Northwestern continuation of the San Onofre Breccia: California Univ. Pubs., Dept. Geol. Sci. Bull., v. 17, no. 5, p. 187–191.

Mollusks from sandstone at Point Mugu and from near the head of Sycamore Canyon, Santa Monica Mountains, indicate a "Temblor age."

WOODRING, W. P., 1926a*, American Tertiary mollusks of the genus *Clementia:* U.S. Geol. Survey Prof. Paper 147–C, p. 25–47, pls. 14–17.

Miocene and Pliocene occurrences of *Clementia* are listed; three species are reviewed and illustrated, a fourth, *Venus brioniana* Trask, may be a synonym of one of these. *Clementia* s.s. may have migrated from the eastern Pacific into the Caribbean during the early Miocene via a seaway crossing Costa Rica.

Woodring, W. P., 1926b, Pliocene *Viviparus*-like opercula from California: Nautilus, v. 39, no. 4, p. 109–111.

Scalez petrolia, nonmarine gastropod opercula that occur in a nonmarine tongue in the Etchegoin Formation penetrated by wells in the southwestern part of the San Joaquin basin, most likely represent an extinct group of Viviparidae.

Woodring, W. P., 1928, Miocene mollusks from Bowden, Jamaica, pt. II Gastropods and discussion of results: Carnegie Inst. Washington, 564 p., 40 pls.

Turritella ocoyana from California has no predecessor in the Eastern Pacific; it may have been an Atlantic immigrant derived from the *T. subgrundifera* stock.

Woodring, W. P., 1929, Distribution in tropical America of Turritellas of the phylum of *Turritella ocoyana* [abs.]: Geol. Soc. America Bull., v. 40, p. 256–257.

This group of Turritellas reached California as an invader by way of the Central America seaway from the Atlantic. They have been found from Peru northward to California in the eastern Pacific.

Woodring, W. P., 1930a, Age of Modelo Formation of Santa Monica Mountains [California] [abs.]: Geol. Soc. America Bull., v. 41, p. 155.

Mollusks from the base of the Modelo Formation are of late Miocene age and are correlative with the fauna of the Briones Formation. They represent a rocky substrate association and include the gastropod *Haliotis*.

Woodring, W. P., 1930b, Pliocene deposits north of Simi Valley, California: California Acad. Sci. Proc., ser. 4, v. 19, no. 6, p. 57–64.

Thirty-one mollusks are recorded from Pliocene localities north of Simi Valley, California [Fernando Formation of Kew (1919)]. A small Pliocene assemblage (12 spp.) is also recorded from Temescal Canyon in the northwestern part of Los Angeles basin.

Woodring, W. P., 1930c, Upper Eocene orbitoid Foraminifera from the western Santa Ynez Range, California, and their stratigraphic significance: San Diego Soc. Nat. History Trans., v. 6, no. 4, p. 145–170.

"Pecten" yneziana is compared with *"P." perrini*.

Woodring, W. P., 1931a, Age of the orbitoid-bearing Eocene limestone and *Turritella variata* zone of the western Santa Ynez Range, California: San Diego Soc. Nat. History Trans., v. 6, no. 25, p. 371–388.

Some of the mollusks originally described by Conrad (1856) are compared with Miocene and Pliocene species from California.

Woodring, W. P., 1931b, Distribution and age of the marine Tertiary deposits of the Colorado desert: Carnegie Inst. Washington Pub. 418, p. 1–25.

Mollusks are recorded from six localities in the Imperial Formation of the Colorado Desert, San Diego, Riverside, and Imperial Counties, Calif. The largest assemblages are from Painted Hill near Whitewater River (25 mollusks). This formation is tentatively considered to be of "late lower Miocene age."

WOODRING, W. P., 1931c, A Miocene *Haliotis* from Southern California: Jour. Paleontology, v. 5, no. 1, p. 34–39, pl. 6.

Haliotis palaea n. sp. based on material from the base of the Modelo Formation in the Santa Monica Mountains is described and illustrated. Eight Pliocene records of the genus from California are listed.

WOODRING, W. P., 1932, A Miocene mollusk of the genus *Haliotis* from the Temblor Range, California: U.S. Natl. Mus. Proc., no. 2938, v. 81, art. 15, p. 1–4, pl. 1.

Haliotis lasia is described from the Santa Margarita(?) Formation in the southeast edge of the Temblor Range based on 20 specimens.

Woodring, W. P., 1936a, New Miocene fauna from the California Coast Ranges [abs.]: Geol. Soc. America Proc. for 1935, p. 366.

Shallow-water mollusks of late middle Miocene age at Palos Verdes Hills, California, include a number of tropical genera not previously known from the Coast Ranges. They provide further evidence of the migration of Caribbean mollusks into the Pacific during the Miocene.

Woodring, W. P., 1936b, Pliocene viviparoid calcareous operculum from the Kettleman Hills [California] [abs.]: Geol. Soc. America Proc. for 1935, p. 413.

Scalez petrolia, the operculum of a fresh-water gastropod occurs in two zones in Pliocene strata in the southern part of the San Joaquin basin. The upper zone occurs between probable equivalents of the *Pecten coalingensis* zone and the *Aequipecten eldridgei* zone; the lower zone occurs between the *A. eldridgei* zone and the upper *Pseudocardium* zone.

WOODRING, W. P., 1938, Lower Pliocene mollusks and echinoids from the Los Angeles Basin, California, and their inferred environment: U.S. Geol. Survey Prof. Paper 190, 67 p., 9 pls.

Lists and figures 26 molluscan taxa from outcrops and well cores of the Repetto Formation. The fossils represent depths of 2,000–4,000 ft in the deep-water facies of the Repetto. Thirty species occur in a transition zone between the Repetto and Pico Formations; these are considered to be of intermediate and shallow-water facies. Five new species or varieties and a new genus, *Phreagena*, are described. The systematic section includes extensive discussions of *Lyropecten*, *Delectopecten*, and *Ostrea vespertina* Conrad.

WOODRING, W. P., 1942*, Marine Miocene mollusks from Cajon Pass, California: Jour. Paleontology, v. 16, no. 1, p. 78–83, pls. 13, 14.

Turritella inezana and *Crassatella granti* occur in lower Miocene rocks northeast of the San Andreas fault near Cajon Pass, San Bernardino County, Calif.

Woodring, W. P., 1952, Pliocene-Pleistocene boundary in California Coast Ranges: Am. Jour. Sci., v. 250, no. 6, p. 401–410.

There is a marked faunal discontinuity at the Pliocene-Pleistocene boundary. Important molluscan taxa that become extinct by the end of the Pliocene are *Anadara* s.s., *Lyropecten* s.s., *Opalia varicostata*, *"Nassa" moraniana*, *Strioterebrum martini*, *Mytilus coalingensis*, *Patinopecten healyi*, *Patinopecten dilleri*, *Ostrea erici*, *Clinocardium meekianum*, and *Platyodon colobus*. Lists a few species of mollusks that other workers have cited as criteria for a stratigraphically higher Pliocene-Pleistocene boundary. Includes a brief review of Pleistocene paleoclimatic inferences and correlation with European type Pleistocene. Correlation chart of late Pliocene and Pleistocene formations and a list of various extinct Pliocene and Pleistocene mollusks from California formations.

WOODRING, W. P., 1956*, *Agasoma sinuatum* from the Miocene of Cuyama Valley, California: Jour. Paleontology, v. 30, no. 3, p. 712–713, text figs. 1–5.

Agasoma sinuatum occurs in a late Miocene fauna with species of *Astrodapsis* that have been correlated with the upper Miocene Neroly Formation of the San Francisco Bay area. The stratigraphic range of this species may include all of the stratigraphic interval regarded as upper Miocene in California. The only other known occurrence of this species, and genus, is in the Briones Formation of the San Francisco Bay area. Two specimens are figured.

Woodring, W. P., 1957a, Cenozoic mollusks of California, *in* Ladd, H. S., ed., Paleoecology: Geol. Soc. America Mem. 67, p. 891–892.

A brief listing of some of the more important references to Tertiary and Quaternary mollusks of California.

WOODRING, W. P., 1957b, Geology and paleontology of Canal Zone and adjoining parts of Panama, geology and descriptions of Tertiary mollusks (Gastropods: Trochidae to Turritellidae): U.S. Geol. Survey Prof. Paper 306–A, p. 1–145, pls. 1–23.

California Miocene records of *Trochita costellata* Conrad, "*Calyptraea*" *diabloensis* Clark, and "*C.*" *martini* Clark are probably of *T. trochiformis* (Born), a late Oligocene to Holocene species. There is a brief discussion of *Turritella ocoyana* and *T. inezana* from the California Miocene.

WOODRING, W. P., 1959, Geology and paleontology of Canal Zone and adjoining parts of Panama, description of Tertiary mollusks (Gastropods: Vermetidae to Thaididae): U.S. Geol. Survey Prof. Paper 306–B, p. 147–239, pls. 24–37.

Includes a reference to *Trophosycon kernianum* from California middle Miocene.

WOODRING, W. P., 1964, Geology and paleontology of Canal Zone and adjoining parts of Panama, description of Tertiary mollusks (Gastropods: Columbellidae to Volutidae): [U.S. Geol. Survey Prof. Paper 306–C, p. 241–297, pls. 39–47.

A useful systematic report on tropical Neogene molluscan faunas of Panama with extended discussions of certain lineages that have persisted into the Holocene fauna of the tropical western Pacific.

Woodring, W. P., 1965, Endemism in middle Miocene Caribbean molluscan faunas: Science, v. 148, p. 961–963.

The middle Miocene Caribbean province includes faunas of the modern Caribbean and from the west coast of the Americas as far north as about lat 10° N. Much of the endemism suggested by analysis of several local faunas is more apparent than real.

Woodring, W. P., 1966, The Panama land bridge as a sea barrier: Am. Philos. Soc. Proc., v. 110, no. 6, p. 425–433.

Paciphile molluscan genera (genera that once lived in the western Atlantic but are now extinct there and are still living in the eastern Pacific) are enumerated. Forty-three paciphile genera and subgenera are listed; their stratigraphic ranges in the western Atlantic and in the eastern Pacific are recorded. The generalized distribution of Miocene and Pliocene marine strata along the Pacific coast of Central America is indicated on an index map.

WOODRING, W. P., and BRAMLETTE, M. N., 1950, Geology and paleontology of the Santa Maria district, California: U.S. Geol. Survey Prof. Paper 222, 185 p., 23 pls. [1951].

The definitive stratigraphic and paleontologic study of the Santa Maria basin including figures, brief descriptions, and stratigraphic lists of the large Pliocene molluscan fauna. Four new species or varieties of mollusks are named. Four mollusks are listed from conglomerate in the middle Miocene Monterey Shale. Pliocene rocks are divided into basin facies and marginal facies. There are sections on paleoecology and faunal correlation.

WOODRING, W. P., BRAMLETTE, M. N., and KEW, W. S. W., 1946*, Geology and paleontology of the Palos Verdes Hills, California: U.S. Geol. Survey Prof. Paper 207, 145 p., 37 pls.

Mollusks of middle Miocene age occur in the Altamira Shale Member of the Monterey Shale; 19 of these are illustrated. Many of the genera are tropical migrants recorded for the first time from the California Coast Ranges. The fauna is correlated with the Temblor ["Stage"] of California. A few mollusks occur in the upper part of the Altamira. *Lima hamlini* occurs in the Repetto Siltstone. There is a comprehensive annotated bibliography of previous geological reports on this area.

Woodring, W. P., Bramlette, M. N., and Kleinpell, R. M., 1935, Miocene stratigraphy and paleontology of the Palos Verdes Hills [California] [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 19, no. 12, p. 1842.

A molluscan assemblage from the late middle Miocene on the north side of Palos Verdes Hills includes many warm-water genera not previously recorded from California.

Woodring, W. P., Bramlette, M. N., and Kleinpell, R. M., 1936, Miocene stratigraphy and paleontology of Palos Verdes Hills, California: Am. Assoc. Petroleum Geologists Bull., v. 20, no. 2, p. 125–149.

List 52 mollusks from the middle part of the Altamira Shale (loc. 13 in George F Canyon, 40 ft above the top of the schist). Many species previously unrecorded from California are of tropical aspect being allied to species living in the Gulf of California and Mazatlanic region. The middle Miocene assemblage indicates shallow water conditions close to the littoral zone. *Delectopecten pedroanus* is the only mollusk known from the upper Miocene Valmonte Diatomite.

Woodring, W. P., Bramlette, M. N., and Lohman, K. E., 1945, Stratigraphy and paleontology of Santa Maria district, California: Am. Assoc. Petroleum Geologists Bull., v. 27, no. 10, p. 1335–1360.

A few mollusks occur in a breccia-conglomerate in exposures of the Monterey Shale near Point Sal. Many mollusks of Pliocene age are listed in the text; these are from the Sisquoc Formation, the Foxen Mudstone, and the Careaga Sandstone.

Woodring, W. P., and Kew, W. S. W., 1932, Tertiary and Pleistocene deposits of the San Pedro Hills, California [abs.]: Washington Acad. Sci. Jour., v. 22, no. 2, p. 39–40.

Temblor mollusks occur in middle Miocene strata in the San Pedro Hills.

Woodring, W. P., Roundy, P. V., and Farnsworth, H. R., 1932, Geology and oil resources of the Elk Hills, California, including Naval Petroleum Reserve No. 1: U.S. Geol. Survey Bull. 835, 82 p.

Three molluscan genera are reported from cores of the Pliocene Etchegoin Formation. The "*Mulinia*" zone is recognized in cores of the Etchegoin Formation.

WOODRING, W. P., STEWART, RALPH, and RICHARDS, R. W., 1940, Geology of the Kettleman Hills oil field, California: U.S. Geol. Survey Prof. Paper 195, 170 p., pls. [1941].

The classic biostratigraphic report on Neogene rocks of the Coalinga-Kettleman Hills area of the San Joaquin basin. Nine Pliocene faunal zones based on shallow-water marine mollusks are defined and are used in making a detailed biostratigraphic-geologic map of the North Dome of

Kettleman Hills. Somewhat fewer zones are recognizable in the Middle and South Dome areas. The faunas of each zone are listed; in the San Joaquin Formation the faunas of strata between the named zones are also listed. Nearly all of the Pliocene mollusks are illustrated and are discussed in a section including taxonomic notes. Eight new mollusks are described. A comprehensive discussion of Pliocene correlation in California is included, as is an annotated bibliography of reports on the Kettleman Hills-Coalinga area. There are several measured sections of the Temblor Formation along the west side of the San Joaquin Valley including mollusk occurrences. Middle Miocene mollusks from localities on Reef Ridge and Coalinga Anticline are listed. Molluscan paleontology is by Woodring and by Stewart.

Woodward, W. T., 1945, Southeastern part of Midway-Sunset oil field, Kern County, California: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 30, scale 1:24,000 [1947].

A few mollusks from the Pliocene San Joaquin and Etchegoin Formations are listed. Five zones bearing the names of Pliocene marine mollusks are indicated on an electric log correlation section.

Wright, L. A., 1948, Age of the basal Modelo(?) Formation in Reynier Canyon [California] [abs.]: Geol. Soc. America Bull., v. 59, no. 12, pt. 2, p. 1390.

The basal sandstone of the Modelo? Formation in the southeastern part of the Ventura basin contains many late Miocene species, six of which are listed. Eleven species are listed from the Elsmere Canyon fauna [Pliocene]. About half of the species in the late Miocene fauna also occur in the Pliocene fauna.

Yates, L. G., 1890, Stray notes on the geology of the Channel Islands [California]: California Mining Bur. Ninth Ann. Rept. State Mineralogist, p. 171–178.

Seven molluscan taxa of Miocene age are recorded from Santa Rosa Island.

Yeats, R. S., 1965, Pliocene seaknoll at South Mountain, Ventura Basin, California: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 5, p. 526–546.

Thyasira disjuncta occurs in the basal glauconitic sandstone of the Pico Formation.

Yeats, R. S., McLaughlin, W. A., and Edwards, George, 1966, Potassium-argon mineral age of an ash bed in the Pico Formation, Ventura basin, California [abs.]: Geol. Soc. America, Program 1966 Cordilleran Section Meeting, p. 79–80.

A potassium-argon age of 8.7 m.y. is reported for thin volcanic ash bed in Pliocene Pico Formation. Warm-water mollusks are associated with the ash layer; 200–1,750 ft higher in the section the molluscan assemblages resemble those living in the Pacific Northwest.

Yeats, R. S., McLaughlin, W. A., and Edwards, George, 1967, K-Ar mineral age of ash bed in Pico Formation, Ventura basin, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, pt. 1, p. 486.

The base of a cold-water molluscan faunal zone occurs just below an ash bed at South Mountain, Ventura County, that has K-Ar dates of 8.4±1.3 to 10.2±2.1 m.y. A warm-water molluscan faunal zone occurs

directly below the cold-water zone. The cooling evidenced by molluscan fossils is attributed to shifting oceanic current patterns superimposed upon a general late Tertiary cooling trend.

Yeats, R. S., Meade, R. F., Gouty, J. J., and Ingle, J. C., 1967, Field Trip-Pliocene seaknoll, South Mountain, Ventura County, California: Am. Assoc. Petroleum Geologists Ann. Mtg., Field Trip No. 2, 12 p., illus., appendix.

Mollusks from upper part of Fernando Formation represent depths of 15–50 fathoms but are displaced into deeper water deposits; they are of similar composition to modern fauna of this latitude. Early Pleistocene mollusks of the overlying Santa Barbara zone are of cooler water aspect, similar to the Puget Sound area or to the southwest part of Canada. Stratigraphically higher assemblages that may be early Pleistocene are again similar to modern fauna of this latitude. Includes a radiometric determination on an ash bed of Pliocene age (8.7 m.y.).

Yerkes, R. F., 1960, Geologic map of the Whittier and La Habra quadrangles, western Puente Hills, Los Angeles basin, California: U.S. Geol. Survey open-file rept.

Marine mollusks of Pliocene age occur in the Fernando Formation.

Yerkes, R. F., Campbell, R. H., Schoellhamer, J. E., and Wentworth, C. M., 1964, Preliminary geologic map and sections of southwestern part of the Topanga quadrangle, Los Angeles County, California: U.S. Geol. Survey open-file map.

Turritella inezana santana occurs in the Vaqueros Formation. Middle Miocene mollusks including *Vertipecten* cf. *V. nevadanus* occur in the lower part of the Topanga Formation. *Melongena* occurs in their Unit D.

Yerkes, R. F., McCulloh, T. H., Schoellhamer, J. E., and Vedder, J. G., 1965, Geology of the Los Angeles basin, California—an introduction: U.S. Geol. Survey Prof. Paper 420–A, 57 p.

Brief mention is made of mollusk evidence of age of some divisions of the Miocene and Pliocene. Mollusks have been used to divide lower Pliocene rocks into three bathymetric facies varying from shoreline to 4,000-ft depths. An annotated bibliography includes reference to some paleontological reports dealing with the Los Angeles basin.

Youngquist, Walter, 1961, Annotated lexicon of names applied to Tertiary stratigraphic units in Oregon and Washington west of the Cascade Mountains, with bibliography: Eugene, Oreg., Oregon Univ. Bookstore, 92 p.

A very useful source for stratigraphic data which includes correlation charts of western Oregon and western Washington Tertiary formations. The age, type section, original description, and geographic distribution of Tertiary formations are listed. A few molluscan genera and species are listed for some of the Neogene formations.

Zimmerman, John Jr., 1944, Tumey Sandstone (Tertiary), Fresno County, California: Am. Assoc. Petroleum Geologists Bull, v. 28, no. 7, p. 953–976.

Sixteen Miocene mollusks are recorded from exposures of the Temblor Formation on Monocline Ridge, Fresno County, Calif.

Zulberti, J. L., 1956, McKittrick oil field [California]: California Oil Fields, v. 42, no. 1, p. 49–59.

Pecten eldridgei occurs in the basal part of San Joaquin Clay; also *Mya* occurs in thin sand bed in this formation. The Etchegoin Formation

(0–800 ft thick in wells) is "very fossiliferous." *Pecten estrellanus* occurs in the Olig Formation (upper Miocene).

Zulberti, J. L., 1957, Republic sands of Midway-Sunset field [California]: California Oil Fields, v. 43, no. 2, p. 21–33.

Pecten peckhami occurs in the upper Miocene Antelope Shale.

Zulberti, J. L., 1958, Santiago area of Midway-Sunset oil field [California]: California Oil Fields, v. 44, no. 1, p. 65–73.

Nassarius and *Bittium* are reported from cores of Etchegoin Formation (0–400 ft thick) in the Santiago pool.

Zulberti, J. L., 1959, Thirty-Five anticline of Midway-Sunset oil field [California]: California Oil Fields, v. 45, no. 1, p. 37–43.

The contact between the San Joaquin Clay and the underlying Etchegoin Formation is determined by the first occurrence of *Mulinia densata* Conrad.

Zulberti, J. L., 1961, Lakeview pool of Midway-Sunset oil field [California]: California Oil Fields, v. 47, no. 1, p. 29–38.

Pecten oweni [*Patinopecten lohri*] and "other fossil fragments" occur in the Calitroleum sand, a productive oil sand (0–30 ft thick) near the base of the Etchegoin Formation.

Zullo, V. A., 1961, "Pliocene" of northern California and southern Oregon [abs.]: California Univ., Los Angeles, Dept. Geology, Graduate Symposium: current research in the geological sciences, p. 8.

An assemblage of about 100 species from Moonstone Beach near Arcata, Calif., includes mollusks that suggest correlation with the upper part of the Etchegoin Formation. A younger fauna of about 80 species near Cape Blanco, Oreg., includes the extinct pelecypod *Clinocardium meekianum* suggesting a late Pliocene age and correlation with the lower part of the San Joaquin Formation.

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