Occasional Papers

OF THE

CALIFORNIA ACADEMY OF SCIENCES

XI

SAN FRANCISCO
PUBLISHED BY THE ACADEMY
MARCH 18, 1925

COMMITTEE ON PUBLICATION

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Fauna and Stratigraphic Relations of the Tejon Eocene at the Type Locality in Kern County, California

BY

FRANK M. ANDERSON

AND

G. DALLAS HANNA

Department of Paleontology

SAN FRANCISCO

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MARCH 18, 1925

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Introduction

In 1854 a portion of the Pacific Railroad Survey expedition under Lieutenant R. S. Williamson camped in what is now Kern County, California, in the vicinity of old Fort Tejon. The geologist of the party, W. P. Blake, made numerous excursions in the region during which some paleontologic specimens were collected. In "Cañada de las Uvas", now known as Grapevine Creek, he picked up a float boulder containing fossils and this soon passed into the hands of T. A. Conrad. Several species new to science were detected in the small collection and the age of the formation from which it came was definitely determined as Eocene. Thus was initiated the long series of studies on California paleontology which have followed.

The strata from which the boulder came were located by subsequent workers and were given the name "Tejon." The Group has been found to be a distinct portion of the Eocene Series, demarked both above and below by profound unconformities. For this reason and because of its historical importance the "Tejon" has become the basis of a voluminous literature on west American Eocene.

A large and well preserved fauna has been found in the Group and many species have been first described from there. But a great many others have been listed as occurring in the strata without proper discrimination or through errors of various kinds. No thorough systematic study of the fauna has heretofore been completed, yet a knowledge of the Tejon is essential before studies on other portions of western Eocene can well be attempted. In order to meet this need the senior author in 1913 and 1914 had large collections of fossils made at this and other horizons of possible equivalent age from Seattle, Washington, to San Diego, California. It was then proposed to make a thorough study of the fauna of the Tejon Group at its Type Locality and use this as a basis for correlation elsewhere. Other tasks interfered and the work has been delayed until this time.

In the preparation of the report we have enjoyed the advantages of having very large collections with which to

work. By far the most important is that of the California Academy of Sciences. The University of California also possesses a large collection from the region and this was generously placed at our disposal by Professor Bruce L. Clark. Another large collection of beautifully preserved Tejon material was made by Mr. G. C. Gester. This became the property of the Southern Pacific Company and has recently been deposited in the California Academy of Sciences through the office of Professor E. T. Dumble.

We wish to express our greatest appreciation for the assistance rendered by those above mentioned; also to Mr. Marcus A. Hanna of the University of Washington for the loan of valuable comparative material from San Diego.

MARINE EOCENE DEPOSITS OF CALIFORNIA

Distribution: The marine Eocene deposits of California are known to extend throughout the coast region from below the Mexican border northward for nearly 600 miles to their most northern occurrence in the valley of Clear Lake, Lake County. South of the Tehachapi Mountains in southern California they are extensive and well developed, making up either the whole or considerable parts of several important ranges, such as the Santa Ynez, San Cayatano, Santa Susana and other Coast Ranges, and over wide areas are covered by later Tertiary formations.

North of the Tehachapi Mountains in central California, where these deposits are chiefly of interest in this paper, they not only have a great development, but it is here perhaps that they appear in their most complete and most legible sequence, and where, therefore, they are most advantageously studied. They are found on both borders of the central valley at intervals, and doubtless pass beneath it where they are covered by later sediments. Along the flanks of the Sierra Nevada Mountains from Butte County southward they have been found at several points, as at Table Mountain, Marysville Buttes, Ione, and on the Merced River, and also farther south in the region of the Tehachapi Mountains. On the opposite side of the valley they extend along the Mount Diablo Range as far south as

McKittrick, and they appear also in the outer Coast Ranges farther west bordering the Temblor Basin.

It appears from a closer study of these deposits that during Eocene time, as during later Tertiary periods, the area was normally sensitive to the crustal stresses that affected the margin of the continent, and oscillations of land level have been perhaps more plainly recorded here than elsewhere on the coast. The region seems to have been structurally and otherwise well constituted to respond to such stresses, and to preserve the records of all the more important dynamic events of Tertiary time, even as it is at present.

Volume: It is not claimed that the thickest development of the Eocene deposits of California is in the central valley, although they attain here a stratigraphic volume of over 6,000 feet, according to estimates that have been made. In contrast with the smaller aggregate of the Eocene deposits of the Gulf Coast this estimate for the California Eocene seems large, though it is much less than the estimates for parts of the Rocky Mountains, and less also than that of western Oregon or Washington. Contrasted with the volume of Eocene strata in western Europe, with the exception possibly of England, that of central California is by no means exceptional, or even above average.

In regard to composition there is considerable variety, since there are not only strata of detrital origin, but some more or less organic in character, including calcareous, as well as carbonaceous and lignitic beds, where coal mining has been carried on extensively in the past. The time represented by this accumulation has been very long and the volume serves to emphasize, rather than illustrate the long duration of the Eocene period. It need occasion no surprise, then, that this volume of sediment, situated as it is in a basin, and region, notably subject to crustal disturbances, and representing a correspondingly long interval of geologic time, should be found to contain the records of several distinct epochs of sedimentation. The time has been sufficiently long for the enactment of many diastrophic events. It should be expected, rather, that here, as elsewhere on the continent, and in Europe, warpings, overlaps and uncon-

formities would appear, separating the series into groups, representing as many epochs of deposition. And so they do, though it is not claimed that the record is completely known to us.

The Proper Limits of the Tejon Group

Since the early days of paleontologic study in California the strata of the Eocene period have been subject to misconception and dispute, and accordingly, the literature has become not only voluminous, but also confusing, and during the last decade it has continued to grow in both volume and confusion; unless the source of error can be pointed out and corrected the end of this is not likely to be reached soon. The rich faunas of the Eocene have attracted interest and have been extensively illustrated, but systematic study of the deposits has lagged far behind until within the last few years. Withal it still remains necessary to bring forward for review some of the earlier work, and the formations and localities with which it was concerned, before satisfactory progress can be made in the further study of the Eocene series, or of its groups of deposits.

Among the localities of early geologic interest in California was that near old Fort Tejon, "Cañada de las Uvas", now known as Grapevine Creek in Kern County, at the southern extremity of the central valley. Early interest in this locality led Gabb and Whitney of the old State Survey to adopt the name "Tejon Group" for what they believed to be a unit of California stratigraphy, but strangely enough they were quite unaware of the real significance and value of this collection of strata in the further study of the geologic history of the region, and some later and better informed geologists have not fully appreciated it.

Even at the present time the question as to what properly constitutes the Tejon Group of the California Eocene is far from being settled, and it continues to be a subject that may be fruitful of dispute unless a better understanding of it can be gained. But there is no serious difficulty inherent in the subject itself, and a little care could easily have obviated much of the past confusion and dispute.

Unfortunately for the literature, and for the satisfactory study of the west coast Eocene, the terms "Tejon Eocene", "Tejon Group", "Type Tejon" and even "Tejon Series" have been carried far beyond the type locality without proper understanding, without stratigraphic restriction, and made to include strata of earlier as well as later age, which in fact have not a close relationship to those of the type locality of the Tejon Group. This error has been committed in recent years by nearly every writer upon the west coast Eocene, until the accumulation of unassorted strata under the name *Tejon* has almost buried from sight the group originally denoted, or intended, by this name. The process by which this has been done is simple, and began with the paleontologic efforts of Wm. M. Gabb, the pioneer paleontologist of California, who in his description of species, Tertiary and Cretaceous, attempted to give the geographic, and in some cases the stratigraphic range of each, believing that he had recognized it in other localities remote from that of the type, when in fact he had mistaken its identity.

In addition to this, Gabb's original error in supposing these deposits to be of Cretaceous age led to a prolonged and bitter dispute with T. A. Conrad, who had reported the formations, or fauna, of the Tejon locality as Eocene, comparing them with the Claiborne Group of Alabama.

It is our belief that this dispute induced Gabb, by way of defence, to list many species as belonging to the Tejon Group which are really of Chico-Cretaceous age, and this was probably not his only error. Heilprin in his review of this subject[1] has pointed out in no uncertain terms the untrustworthy character of many of Gabb's statements, made doubtless in the heat of this discussion.

However, the mooted deposits of the Tejon locality, as will be shown later, form a distinct unit of the marine Eocene series of California set off from associated strata by an overlap, and by an unconformity, and as such it deserves careful study, both as to its physical or lithologic characters and as to its faunal contents for reasons that should be obvious. And since the type locality of the Tejon Group does contain a distinct stratigraphic unit, which, as such, may

[1] Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 196-214.

be found to occur elsewhere in the state, or even throughout the west coast, this useful name, already familiar to geologists, should be relieved from much extraneous matter, and preserved to designate as a group its equivalents in such other places, but it should be used with the restrictions which the facts warrant.

Gabb and Whitney applied the name to all the Eocene strata above the group designated by them as the Martinez, which with the Chico they classed as "Division A" of the Cretaceous. Most other writers have followed them in this classification, and it has naturally led to much of the confusion of the existing literature.

As a formational name, *Tejon Group,* should be employed to include only the strata of the type locality or their equivalent, or strata deposited contemporaneously elsewhere, or at most only those that can be shown to belong to the group without expansion of the same beyond the range of the events that determine its limits. On the present evidence in the case the group is delimited, as the result of deposition within a definite epoch of geologic time, which epoch was initiated and closed by crustal movements, the first being the subsidence which brought the sea farther inland in the region of Fort Tejon and at other points within and without the basin. The epoch was closed by the disturbance or uplift which expelled the sea from these areas, and in part at least, exposed them to denudation and waste. The deposition of this epoch should be regarded as constituting the Tejon Group.

As for the term "Tejon Series", it appears to the writers to be unfortunate and inadmissible, as being inapplicable to the facts, and illogical, since the term *Series* is properly applied to the entire collection of strata belonging to a single period of geologic time, such as the Eocene or the Cretaceous. The phrases "Type Tejon", or "Typical Tejon" should be used, as already said, to include only the strata coeval with those of the type locality, and ordinarily no more.

Gabb and Whitney were the first to use the name in any expanded sense, and their example has been usually followed by other writers, down to the present. As an example of such unwarranted use of these terms and of the confusion

that must result from it, attention may be called to the usage of them by Dr. R. E. Dickerson, and to the consequences as illustrated in his interesting paper bearing the title "Stratigraphy and Fauna of the Tejon Eocene of California". It was doubtless following Gabb's and Whitney's misconception of the Tejon Group that this title was employed, but under the caption "Description of Typical Tejon Areas in California", he takes up at once the discussion of sundry localities near Mount Diablo, and includes in his so-called "Typical Tejon" both strata and faunas that have since been shown to be unconformably distinct. That is, he includes in his "Typical Tejon" certain strata that may perhaps be contemporaneous with the Tejon Group at its type locality, and also strata that are unconformably below them, if not also some that are above them. And yet, as may be seen from a comparative study of his lists of species, granting his determinations were correct, he was possessed of faunal data which might have given a clearer insight into the larger stratigraphic facts of this region, and might not have led to some of the discrepancies of this paper.

Had due consideration been given to the fauna properly belonging to the type section of the Tejon Group, particularly if the species that had been reported as such had been checked, the author would have had a still clearer conception of the Tejon Group itself, and could have segregated its equivalents in the region of Mount Diablo.

The fauna strictly belonging to the type locality of the Tejon Group and to its proper equivalents elsewhere has not hitherto been segregated from the lists that have been ascribed to it under the long continued process of landslides, such as those initiated by Gabb, and continued by others even down to the latest writers who made a special study of the marine Eocene deposits of the west coast.

The chief purpose of the present contribution to the Tertiary literature of the west coast is to restore to its potential usefulness, as far as is now possible, the good name of Tejon, and to determine as far as is now practicable the fauna belonging to it, beginning with the type locality of the group near old Fort Tejon. To this end the senior author began the collection of Tejon species several years ago, and it was

under his direction that Bruce G. Martin visited the type locality in 1914 and made extensive collections for the California Academy of Sciences, where the materials are still preserved.

Doubtless other species will subsequently be obtained here, and also found at other localities, to augment the list of Tejon species as properly restricted, but little good can result from hasty and untrustworthy identification of species or faunas.

Historical Notes on California Eocene

The general distribution of the Eocene deposits of California, as described above, has long been known, and their occurrence in the central valley was recognized as early as 1854, although the boundaries have not yet been fully determined in either state or valley.

REVIEW OF EXISTING LITERATURE

Several reviews of the west coast and the California Eocene deposits have been published in the past, all of which naturally were written from the viewpoint of the knowledge or beliefs then current.

In 1891 Wm. B. Clark,[2] and later, T. W. Stanton,[3] reviewed the work that had previously been done.

A distinct gain in our understanding of the California Eocene was made when the work of Stanton and Merriam definitely separated the lowest Eocene from the Chico-Cretaceous Group.[4] This subject was later reviewed by Dr. C. E. Weaver,[5] who, in addition, made some contributions to the subject of the Lower Eocene.

In 1909 Ralph Arnold published some maps and other data[6] showing roughly the areas of marine and fresh water deposits of the several Tertiary periods in California, giving

[2] U. S. Geol. Surv. Bull. 83, pp. 95-106.
[3] U. S. Geol. Surv. 17th Ann. Rept. 1896, pp. 1011-1059.
[4] T. W. Stanton, Op. cit. J. C. Merriam, Jour. Geol. Vol. 4, 1897, pp. 767-775.
[5] Univ. Calif. Publ. Geol. Vol. 4, 1905, pp. 102-104.
[6] Jour. Geol. Vol. 17, pp. 513-529.

references to the papers of Stanton and Merriam just referred to.

Prior to 1912 but little attempt was made at a systematic study of the Eocene of California, most writers being content with a recognition of the groups then known, namely, the Martinez and the Tejon. This was also the attitude of Dr. R. E. Dickerson, who at that time began a study of these deposits which resulted in a succession of contributions, referred to hereafter, for which Dr. Dickerson merits praise, in that he has extended our knowledge of the rich faunas of this period, not only in California, but throughout the west coast.

As these papers, dating from 1913 to 1916, represent a serious study of the Eocene deposits of the west coast, and as Dr. Dickerson has enjoyed in this work some unusual opportunities for such study, his papers will be the subject of more particular attention at this time, though only incidentally, and as the subject seems to require it. He has had at his disposal most of the extensive collections from the west coast Eocene, including those of the University of California, the California Academy of Sciences, the California State Mining Bureau, and collections made by himself and others.

Dr. Dickerson in his treatment of the subject approached it primarily from the viewpoint of paleontology, with comparatively little attention to the larger stratigraphic facts afforded by the field. He recognized only two general divisions of the California Eocene, which he has discussed at length in his several contributions.[7]

But it is to his last two papers that special reference will be made, since they contain the summary of most of his work and of his views concerning the California Eocene, and of the Tejon Group, which is the subject of special interest in the present paper. Concerning the older Eocene, or the Martinez Group, little will be said at this time, except incidentally, and only in order that our subject itself may be clearly defined.

[7] Univ. Calif. Publ. Geol. Vol. 7, 1913, pp. 257-298. Univ. Calif. Publ. Geol. Vol. 8, 1914, pp. 17-25. Univ. Calif. Publ. Geol. Vol. 8, 1914, pp. 61-180. Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 33-98. Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 363-524.

In his later contributions Dickerson divided the "Tejon Group", as understood by him, into four "faunal zones", which he believed were, to a considerable extent, typified by a few genera and species thought to be characteristic of each. His complete scheme of classification for the west coast Eocene deposits may be, therefore, briefly stated as follows:[8]

	g. "Siphonalia sutterensis Zone"
Tejon	f. "Balanophyllia vériabilis Zone"
Group:	e. "Rimella simplex Zone"
	d. "Turbinolia Zone"
Martinez	c. "Solen stantoni Zone"
Group:	b. "Trochocyathus zitteli Zone"
	a. "Meretrix dalli Zone"

Without attempting at this time the discussion of the doubtful utility, or propriety, of such subdivisions of the series before more information had been assembled regarding the range of any of these genera and species, it may be remarked here that few if any of them are either well known, or in any way strongly characterized as species, and most of the genera have a long time range, and are for that reason unsuited for the use to which Dickerson has employed them. Nor are many of the associates of these so-called "characteristic forms" sufficiently well known as to stratigraphic or geographic range, or possessed of the individuality that would entitle them to such distinctive service.

REVIEW OF ALLEGED "FAUNAL ZONES"

As already stated four faunal zones of the "Tejon Group" were proposed by Dickerson as the basis of his subdivisions of the same, and he attempted to carry this scheme of subdivision into western Oregon and Washington.[9]

It requires but little analysis of the matter in his papers to reveal the untrustworthy character of this method of classification, especially in view of the fact that the strati-

[8] Univ. Calif. Publ. Geol. Vol. 8, 1914, pp. 103-104. Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 442 et seq.

[9] Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 409. Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 51 et seq.

graphic range of none of the forms so used, as characteristic of these zones, has yet been definitely ascertained. Most of them are comparatively new to the science. Considering only the "Tejon Group" of Dickerson we would offer the following comments:

"Turbinolia Zone"

According to Zittel the genus *Turbinolia* began in the Tertiary and has representatives still living. As a genus, therefore, its earliest appearance may have been in Middle Eocene time, but it must also have had its species in each of the succeeding epochs down to the present time. The genus, then, could have no diagnostic value in the strata of any single epoch intervening, nor for the earliest epoch at which it had been found, since its ancestors from earlier strata may also have been of the same genus, as far as any one knows.

Almost as vague and disappointing as a basis for correlation would be the use of any one or all of the two or three species of *Turbinolia* listed by Dickerson, if they are rare, as they evidently are. From his list of 23 localities "south of Mount Diablo", all representing what he calls "Basal Tejon strata", he found the genus *Turbinolia* in only five of them;[10] and from a group of 15 such localities north of Coalinga, (p. 430) only three yielded *Turbinolia.* It can be only an assumption, therefore, to suppose that this genus represents any single stage of the Tejon Group, and if so, that it represents it adequately, since it has been found only at rare intervals. Nor is the list of species associated with *Turbinolia* shown to represent anything more than a local fauna of the strata in which it has been found.

Of the 75 forms specifically determined in the list (Op. cit. Op. p. 372) some 30 or more, according to Dickerson's determination, are not found at the type locality of the Tejon Group, or do not appear in such lists. This difference is 40 per cent, or enough to place the faunas in different epochs. Then why call them both "Tejon" horizons?

[10] Univ. Calif. Publ. Geol. Vol. 9, p. op. 372.

"Rimella simplex Zone"

Regarding the zone described as that of *Rimella simplex* the same general observations should be made. The species so employed is in no way strongly characterized, and is certainly not, as such, comparable to *Orthaulax pugnax* of the gulf coast Tertiary, which at least has the merit of being unique. No attempt is made by Dickerson to show that *"Rimella simplex"* has a limited stratigraphic range, and it is not known to have such. As to its geographic range there is still more uncertainty.

The type locality of the species is near San Diego, and it has not certainly been found in the type section of the Tejon Group or at any other point farther north in California. What value can it have then as horizon marker, even in California, not to mention remote places? Obviously it has no value alone, or if it has such it must be over a limited region only. Somewhat analogous species have been found in other districts, but they may well be either older or younger than the so-called "Rimella simplex", and cannot be made to serve in its stead.

"Balanophyllia variabilis Zone"

The same sort of criticism applies to this species and its "zone" as to some of the others proposed by Dickerson. According to Zittel the genus *Balanophyllia* ranges from the Tertiary to Recent, and therefore, as a genus it has no value for marking horizons in the Eocene or any other series. Moreover the species he employs appears to be extremely rare, since in the list of some 268 species accredited to the "Tejon" by Dickerson,[11] from ten or more representative localities of the same in California, *Balanophyllia variabilis* is not mentioned as occurring in any of them. Neither does he mention it as occurring at the type locality of the Tejon Group.

On the other hand he does mention *Turbinolia,* a genus that should characterize the lowermost zone, as occurring with both *"Rimella simplex"* and *Balanophyllia variabilis.*[12]

[11] Univ. Calif. Publ. Geol. Vol. 9, pp. 443-453.
[12] Op. cit. pp. 378, 385, and 443.

What diagnostic value, therefore, can *B. variabilis* have, even within the limits of California? The only logical conclusion that can be drawn from a study of this species is that it affords no better basis for stratigraphic recognition than the others, and is useless as a horizon marker except in the manner of other species. It has no exceptional value as such.

"Siphonalia sutterensis Zone"

Similar observations apply to this zone. The genus *Siphonalia* has persisted from early Tertiary time to the present, and has no more diagnostic value than the preceding. As for the species itself, it is in no way markedly distinguished in form, and in fact is small and lacks distinctive character. It could easily be mistaken for other species.

Dickerson believed that this zone is later in age than all the others, and concerning the fauna of it, associated with *S. sutterensis,* he says:[13]

"That it evolved from the typical Tejon there can be little doubt. . . . In other words, the evidence indicates that the Marysville Buttes fauna represents a later zone or stage of the Eocene than the typical Tejon."

But this zone of *S. sutterensis* contains also *Balanophyllia variabilis* the species supposed to characterize the preceding zone, but which does not occur in the fauna of the type locality of the Tejon Group.

However, Dickerson himself seemed to have modified his views considerably as to the position of this zone in a portion of his paper where he said:[14]

"Many of the forms which were thought to be characteristic [of this zone] have been found at lower horizons, and several more species characteristic of the middle and lower portions of the Tejon Group are now reported from this zone," . . . .

In his list of species,[15] believed to represent his "*S. sutterensis* zone" at five separate localities, there are 87 forms which he has determined specifically, and of this number 54 species, or 62 per cent of the whole, do not occur in his lists of the Type Tejon fauna. This percentage taken from his own lists, nearly as much as distinguishes the Miocene from recent faunas, possibly made him hesitate to class his "*S.*

[13] Op. cit. p. 409.
[14] Op. cit. p. 406.
[15] Op. cit. pp. 406-408.

sutterensis" fauna with the Type Tejon. Comparing the "*Turbinolia"* fauna[16] with 75 species, and the "*S. sutterensis"* fauna of 87, not more than 43 percent are common, and 57 per cent of the former are absent from the latter. Somewhat closer relationship is shown here than in the former case of the "*S. sutterensis"* and the Type Tejon faunas.

Or taking the combined lists of his last two faunas, 130 species in all, there are 32 species common, or 24.6 percent, while 98 species are distinct, or 75 percent of the whole.

In the same manner comparing his "*S. sutterensis"* fauna and his Type Tejon lists, 18.8 percent of the combined number are common, and 81.2 percent are not so.

These figures are enough to show that on the basis of Dickerson's lists, as identified, a closer relationship exists between the faunas of his *S. sutterensis* zone and that of the "basal Tejon strata" near Mount Diablo, than that between the former and the Type Tejon. Therefore the fauna of his *S. sutterensis* zone can hardly be younger than the Type Tejon, as he has concluded.

It can also be shown in the same manner that a closer relationship exists between the *S. sutterensis* fauna and that of the *"Rimella simplex"* zone, since 50 percent of the fauna of the latter is found in the former zone. From these figures it is apparent that the percentage method could not have been followed in the arrangement of the faunal zones.

As for Dr. Dickerson's view that the fauna of his "*Siphonalia sutterensis"* zone evolved from that of the Type Tejon, quite the opposite conclusion can be as logically drawn and with better confirmation in his lists.

It is not to be inferred that the lists referred to furnish a secure basis for calculation of percentages, for as will be shown later, the contrary is true. Many of the determinations of species have been made from incompletely preserved specimens, and in some cases only a small percentage of species listed was based upon material suitable for positive identification. As a consequence, therefore, not all of the interesting lists can be relied upon as bases of comparison.

[16] Op. cit. Op. p. 372.

On another page will be found a revised list of the species gathered from the type locality of the Tejon Group from which quite different percentage results may be calculated for any of the other faunas considered above. But of course this should be done only with authentic lists of such. Only one comparison will be made to illustrate the point.

Of the 87 forms specifically determined in the *"S. sutterensis"* fauna,[17] only 20 are found in the fauna of the type section of the Tejon Group according to the revised lists. This number amounts to 23 percent of the fauna of the *"S. sutterensis"* zone, and only 10 percent of the combined faunas, instead of 38 percent, and 18.8 percent as before calculated. This does not show a close relationship in their respective faunas, nor one that should be the basis of identifying the two groups.

On the other hand, comparing the list of species given in Dickerson's *"Balanophyllia variabilis* zone",[18] with the revised list of Type Tejon species, we find that of the 50 forms specifically determined by him 23 are found in the Type Tejon fauna, or 46 percent, and of the combined fauna, 14.1 percent. These figures clearly suggest a closer relationship between the faunas of the Type Tejon and the "*Balanophyllia variabilis* zone", than between the former and that of the "*Siphonalia sutterensis* zone."

However, other workers have been busy in this field of investigation, and results have appeared that are more satisfactory, since they are based upon large amounts of stratigraphic as well as upon paleontologic data. The major events which are recorded in unconformities have been given their true value in the grouping of the Eocene strata, and this method should be followed everywhere on the west coast.

LATER VIEWS OF CALIFORNIA EOCENE GROUPS

In 1918 Dr. Bruce L. Clark published an account of work done by himself in the region about Mount Diablo, and reached the conclusion that an important group of strata there had been overlooked, which intervened between the

[17] Op. cit. pp. 406-408.
[18] Op. cit. pp. 378-379.

Martinez Group below, and the Tejon Group above, from each of which it is separated by unconformities.[19] The aggregate thickness of the newly discovered group, he stated, is approximately 3000 feet, and he believed it to have a fairly wide distribution over the state. He proposed the name of *Meganos* for this important group, and estimated that of the long list of species found within it over one-half of them were undescribed. The fauna, he believed, contained decided elements of difference from both the Martinez and Tejon Groups.

Later the subject of the Meganos Group was reviewed by Dr. Clark,[19a] and in its distribution it was found by him to extend not only throughout the Temblor Basin of central California, but was recognized also in the southern ranges south of the Tehachapi Mountains. The fauna, he found to be sufficiently distinct to warrant him in formally segregating it from both Martinez and Tejon, and everywhere in California where any two of the three groups of the Eocene strata are present they appeared to be separated by an unconformity. These unconformities therefore are not local, and upon this point Clark remarked:[20]

"As has been pointed out these general uncomformities are not the result of local crustal movements, and surely cannot be classed as being 'at most of secondary order, i.e., such as might separate two formations within a group.'"

With the Meganos Group, Clark correlated not only the two lower zones of the "Tejon Group" of Dickerson, but he included with them also the "*Siphonalia sutterensis* zone" of the sierran foothills, including the localities of Marysville Buttes, Table Mountain, and a part, at least of the Ione formation found farther south. According to Clark only that part of the Mount Diablo section called by Dickerson the "*Balanophyllia variabilis* zone" is properly correlated with the strata of the Type locality of the Tejon.[21]

Considering the stratigraphic volume of the marine Eocene in the central valley, as stated before, it is not strange that several distinct groups have been recognized, due to physiographic changes, nor is it surprising that as many

[19] Geol. Soc. Am. Bull. Vol. 29, 1918, pp. 281-296.
[19a] Jour. Geology, Vol. 29, 1921, pp. 125-165.
[20] Op. cit. p. 160.
[21] Jour. Geology, Vol. 29, 1921, p. 142.

faunal divisions have been recognized, due to the same causes.

Regarding this new classification of the Eocene, Dickerson[21a] has dissented, but it seems at present that the bulk of the evidence is in favor of its adoption. Probably the final judgment cannot be passed until after more is known of the paleontology of the middle group, the Meganos of Clark.

Too little stratigraphic work in the areas of the marine Eocene of the coast has been done to fully established the entire sequence of events which may ultimately be found recorded in unconformities, overlaps, etc.

SUMMARY REVIEW OF DATA

The general facts concerning the magnitude and order of the Lower and Upper Eocene deposits of California brought out by Stanton, Merriam and others soon made it evident that the Eocene period was one of prolonged, though interrupted, subsidence in California, and of transgression by the sea, which brought it into all the larger valleys on the coastal border which had outlets to the west.

Dr. Dickerson has shown this condition of transgression in a diagrammatic manner[22] by lines indicating the landward position of the strand lines of earlier and later Eocene epochs, as he conceived them, though the figures in his later publications are perhaps subject to considerable revision, as the foregoing remarks suggest. He recognized correctly enough the earlier group of the Eocene, but the later sediments are supposed to be sufficiently distinct to be separated in two groups.

Dickerson believed that he had recognized a distinct faunal horizon in the collections made in Sutter and Butte Counties, and this he termed the "*Siphonalia sutterensis* zone"; his contribution to the fauna of the same is praiseworthy but he believed it to be younger than the Type Tejon instead of older as it appears from later study to be.

[21a] Journ. Geol. Vol. 30, 1922, p. 295-302.

[22] Univ. Calif. Publ. Geol. Vol. 8, 1914, p. 70, etc. Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 469-473.

As pointed out by Clark, this so-called "*Siphonalia sutterensis* zone" extending along the eastern margin of the central valley should be correlated with the middle group of the Eocene found along the western border of the valley in the Mount Diablo Range, and in other parts of California including the southern Coast Ranges.

Unconformities discovered between this group and those above and below, seem to warrant its separation under a distinct name, and *Meganos* has been proposed for it.[23]

Three stratigraphic and faunal groups have therefore been recognized in the California Eocene, and the same may be expected to occur in any or all of the Eocene embayments of the west coast. As proposed by Clark and others, and accepted tentatively[23a] in this report, these groups are as follows:

Eocene Groups	Approximate maximum thickness
The Tejon Group	3000 feet
The Meganos Group	3000 feet
The Martinez Group	1000 feet
Total thickness	7000 feet

This grouping is in accord with the summary table of the geologic time scale for the Pacific Coast given by Dr. Wm. S. W. Kew in 1920 in his paper on the Cretaceous and Cenozoic Echinoidea.[24]

[23a] We believe final judgment should be reserved until more careful faunal studies have been made of some of the reported Meganos localities, particularly at the type locality, than has thus far been published.

[24] Univ. Calif. Publ. Geol. Vol. 12, 1920, p. 26.

[23] Geol. Soc. Amer. Bull. Vol. 29, 1918, pp. 281-296.

EOCENE SUBDIVISIONS BY VARIOUS AUTHORS
IN TABULAR FORM

Gabb and Whitney	White and Becker	Stanton and Merriam	Dickerson	Clark, Kew, Anderson and Hanna
			"Siphonalia sutterensis g, zone"	
			f. "Balanophillia variabilis zone"	Tejon Group 3000 ft.
Tejon Group	"Chico-Tejon Series"	Tejon Group	e, "Rimella simplex zone"	Meganos Group 3000 ft.
			d, "Turbinolia zone"	(Marysville Buttes Table Mtn. etc.)
Martinez Group		Martinez Group	Martinez Group	Martinez Group
Chico Group		Chico Group	Chico Group	Chico Group

Type Locality of the Tejon Group

Geologic Map: The geology of the Tejon area as shown on the map included in this paper is largely a compilation of data taken from various sources. In the area west of Tecuya Creek the map is essentially that of Dr. B. L. Clark,[25] and to the east of this line it is largely the work of the writers, though the geology of the area was roughly sketched by Robt. Anderson.[26] A large part of the area to the west of Grapevine Creek has also been recently mapped by C. M. Wagner and K. H. Schilling,[27] which map is in essential agreement with that of Clark. The topography of the present map is that of the topographic sheets of the United States Geological Survey.

Location and Extent: The type locality of the Tejon Group extends along the northern base of the Tehachapi Mountains to the east and west of Grapevine Creek, and includes the exposures in other canyons for a limited distance, or as far as the strata can be followed areally without confusion, though to the west of Tecuya Creek lower strata appear, the inclusion of which would further complicate the subject. Toward the east the group can be followed beyond the canyon of Pastoria Creek for a mile or more. The situation of this area is within a reentrant valley somewhat cut off from other areas of the Eocene rocks, and as will be shown later derives an advantage from this circumstance which entitles it to particular attention.

The first account of the strata of this locality, later designated as the Tejon Group, was that given by Wm. P. Blake in 1857,[28] whose report also includes that of T. A. Conrad upon the fossils obtained at the exit of Grapevine Canyon.[28a]

Later J. D. Whitney gave a brief account of this locality[29] stating that "about sixty Cretaceous species were found here by Messrs. Brewer, Gabb, and Dr. Horn, who was stationed some time at Fort Tejon".

The species collected here by Dr. Horn and others are now conceded to be Eocene in age, and not Cretaceous as

[25] Jour. Geol. Vol. 29, 1921, p. 151.
[26] U. S. Geol. Surv. Bull. 471, p. opp. 106.
[27] Univ. Calif. Publ. Geol. Vol. 14, 1923, pl. 43.
[28] Pac. R. R. Repts. Vol. 5, 1857, pp. 46, 163, and 164.
[28a] Op. cit. pp. 317-318.
[29] Geol. Surv. Calif. Geol. Vol. 1, 1865, pp. 190-191.

was then believed. These collections do not appear to have been very extensive, though they were important and were much discussed at the time. More than the number of species mentioned by Whitney have since been added from this locality.

The original collection made by Blake was perhaps the first Eocene fossils reported from California, and they chanced also to represent a quite definite unit of the Eocene stratigraphic sequence in California, and possibly of the same throughout the west.

The fuller significance, character and other features of the group found here must be left for further discussion in another place, though it may be stated that the group represents an overlap of the younger Eocene beds upon pre-tertiary rocks, and as such it may well be typical of the Upper Eocene not only in California, but perhaps over the entire coastal region.

In the past the strata of this area have been "Cretaceous", "Cretaceous B", "Eocene", "Upper Eocene", "Tejon", etc., and in the literature of the Eocene of the west coast the name Tejon has been employed in a number of combinations, such as "Chico-Tejon", "Tejon Group", "Tejon Series", etc., and applied even to the greater part of the Eocene deposits, according to the beliefs possessed by the writers who have used the terms.

Whitney's Account: Although much has been written upon the Tejon formation, or the Tejon Group at the type locality, but little improvement has been made by later writers upon the general account of the district and its formations by Whitney. True, the fauna was mistaken by his paleontologists for Cretaceous, but substituting for this the term "Tejon Group", later adopted by him, the following extract from his report[30] will be found instructive:

"The cañadas called "las Uvas" and "los Alisos" are narrow valleys, through which flow streams or "arroyos" of the same names; they both head in the granite and metamorphic rocks of the mountain range to the south, opening out to the north in the valley of Kern Lake, and cutting through a narrow belt of Cretaceous rocks as they enter the plain, being in fact the continuation of the series of strata of this age noticed before as occurring in the San Emidio Cañon. At the Cañada de las Uvas, the Cretaceous beds form a belt from one-third to one-half a mile wide, mostly covered with soil,

[30] Geol. Survey, Calif. Geology Vol. 1, p. 190.

and with many granite boulders, derived from the higher mountains [south], strewn over the surface. The exposures are but few, the fossils being the same as those found in the other cañons east; in the one next to the Cañada de las Uvas the Cretaceous belt is somewhat wider than it is in another one still farther in the same easterly direction; but the best locality for examining the strata is at the Cañada de los Alisos, which debouches into the plain four miles east of the Las Uvas Cañon. Here the Cretaceous belt is over a mile wide, the strata being well exposed, although much broken; they form hills about 1000 feet above the plain, and 2500 feet above the sea, the general level of the base of the range between the Cañada de las Uvas and the Tejon being about 1500 feet above tide-water.

The Cretaceous strata are very much disturbed in this region, both dip and strike being quite variable, the [latter] varying from N. W. and S. E. to N. E. and S. W., while the dip is sometimes to the north and again to the south, and generally at a high angle. The formation consists of sandstones and conglomerates, without any of the shales so characteristic of the Cretaceous in other districts. The conglomerates are very coarse, containing many boulders from three to six inches in diameter, of granite and metamorphic rocks."

The canyon here designated as "Cañada de los Alisos" is that now known as Live Oak, and is situated three or more miles east of Grapevine Creek. The name used by Whitney is shown on some of the older maps of the region; the canyon is that of the "Old Headquarters Camp", and as Whitney stated, is one of the best localities for observing the strata of the Type Tejon Group.

Robert Anderson's Report: This district has been more recently included in a report by Robert Anderson, who also made a somewhat diagrammatic map showing its areal geology,[31] from which we quote the following:

"Locally the lower part of the formation is made up largely of granitic sand interspersed with irregularly aggregated boulders and blocks of granite and other crystalline rocks up to many feet in diameter. A good example of this zone may be seen along Cañada de las Uvas, where there are 100 to 200 feet of beds of this type containing marine fossils. On Tecuya Creek the lower zone contains huge blocks of granite. One of these that is believed to be in place in the formation, though it can not be stated with absolute confidence to be so, is over 50 feet in length and 30 feet in breadth.

Above the lower zone the formation consists chiefly of soft yellowish and grayish brown fine sand and sandy clay, indurated along fossiliferous layers and in irregular patches and nodules. In places true shale beds, intercalated with sand, constitute a considerable part of the formation. The beds throughout possess a marked similarity and give every appearance of representing a period of continuous deposition in one basin. They are therefore to be regarded as making up a formation, and not a larger division of the geologic column."

[31] U. S. Geol. Surv. Bull. No. 471, 1910, pp. 106-121.

This last remark is of importance since it serves to call attention to the fact that this group of the Eocene does not constitute the entire series belonging to this period. Attention is also called to the conglomerates found at the base of the group, though it is by no means evident that the boulders and blocks of granite, etc., at the base in Tecuya Canyon are really a part of the Tejon strata, since landslides and torrential storms have left many such blocks superimposed upon the Eocene and later beds of this district.

After Live Oak Canyon ("Cañada de los Alisos"), the Tecuya Creek Canyon offers the best opportunity for observing the character and thickness of the strata of the Tejon Group, as well as its relation to the succeeding groups of Tertiary strata.

Dickerson's Observation: The latest contribution to the stratigraphy of the Tejon at its type locality is that of Dr. R. E. Dickerson, whose views concerning the sequence of strata in Grapevine Canyon are here quoted from his last paper.[32]

"The Tejon strata in the vicinity of Grapevine Creek rest upon a basement complex consisting of granite rocks and associated schists. The beds in general have a steep north dip of 75° to 85° but are disturbed in places so that the dip is reversed. The basal member, about 250 to 300 feet in thickness, consists of a very coarse conglomerate derived from the granite rocks of the basement complex. This member is overlain by about 1000 to 1200 feet of thin-bedded brown sandstone with subordinate strata of dark gray, clay shale containing limestone nodules. The sandstone is, in places, conglomeratic and in one locality the dark gray pebbles of shale yielded a small pecten. The occurrence of this pecten suggests the deposition of Cretaceous deposits which were completely removed during Upper Eocene time. The uppermost strata, about 1200 feet in thickness, consist chiefly of light tan sandstone with subordinate strata of shale and brown sandstone. The total thickness of the Tejon group along Grapevine Creek (Cañada de las Uvas) is about 2500 feet."

Without questioning the accuracy of Dickerson's observations concerning the strata of the Tejon Group in Grapevine Canyon it should be noted that the overturned structure, faulting and numerous landslides have all conspired to complicate the surface exposures here and to render this locality the least serviceable for stratigraphic observation. As Whitney has stated the best locality for such observations is at

[32] Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 418.

Live Oak Creek, some miles farther to the east, although the canyon of Tecuya also offers an excellent section, where the sequence of strata and the succession of lithologic units may be quite clearly noted. The aggregate thickness of the group has been fairly estimated by Dickerson at 2500 feet, and this estimate is regarded as conservative, since quite as great a thickness of strata is found at both Live Oak and Tecuya Creek Canyons. All of the writers quoted above have noted the basal beds of conglomerate with boulders of granitic and metamorphic rocks, but the finding of an unidentified "small pecten" in pebbles of shale noted by Dickerson may as readily be taken as evidence of the unconformity of the Tejon Group upon older Eocene strata, as a suggestion of "Cretaceous deposits which were completely removed during upper Eocene time". Dickerson himself has mentioned sundry species of small pectens as occurring not only in the Martinez Group,[33] but also in Middle Eocene strata, now classed as the Meganos Group.[34] *Pecten interradiata* occurs in both the Martinez and the Meganos Groups. As will be mentioned later similar facts are pointed out by Clark in his discussion of the relations between the Meganos Group and the Tejon in the region of the San Emigdio Creek, some miles farther to the west.

Local Geology of the Tejon Group

Local Structures: The structure of the Tejon Group within the limits of the type locality is far from simple, being complicated by the various crustal movements that have affected this region in post-Eocene time. In part, the strata lie inclined at a gentle angle dipping away from the basement rocks in a normal manner, but more often they stand at highly inclined angles or are even overturned, and have a steep dip toward the south, or directly against the massif of older rocks. The overturned attitude of the group is most pronounced in Tecuya and Grapevine Canyons, although it is quite prominent also in Live Oak Canyon. In this latter canyon, although the lower one-third of the group dips away from the basement rocks, the overturned attitude

[33] Univ. Calif. Publ. Geol. Vol. 8, p. 108.
[34] Univ. Calif. Publ. Geol. Vol. 9, p. op. 372.

of the major part of the strata is very clear and unmistakeable. The usual degree of inclination of these overturned beds is from 75° to 80°, and the dip is southward.

In Grapevine Canyon this overturn is distinctly noticeable also in a part of the section, although according to Dickerson some of the beds have a normal inclination.

In the vicinity of Pastoria Creek the lower members of the group are well exposed on both sides of the canyon, and have a normal dip of 50° to 75° toward the valley, and a strike of north 70° east.

Faulting of the Tejon Group: One of the striking structural features of the group is the block-faulting, and the horizontal displacements that have resulted in offsetting the steeply inclined beds, thus interrupting the continuity of the strata along their strike, which may be seen at a number of points. Along Tecuya Creek this offsetting of the strata on opposite sides of the canyon amounts to at least 1000 feet, as the result of differential thrust along a north to south line, parallel with the course of the creek. Similar facts were noted about Salt Creek, where the complication is even greater than farther to the east. These thrust movements were similar in character to those noted in a former paper on the San Juan district of San Luis Obispo County.[35]

It may be due to faulting along a north and south line following the western base of the mountains near Kern River, that no Eocene beds are to be found exposed at the surface in this region.

Sequence of Strata: Dr. Dickerson has estimated that at Grapevine Canyon at least 2500 feet of Eocene strata are exposed, and this estimate seems to be conservative. In Live Oak Canyon, which cuts directly across the strike and where the strata are best exposed, the belt of Tejon rocks is nearly a mile in width, and the strata, while somewhat broken, and possibly duplicated in part, clearly have an aggregate thickness of nearly 3000 feet, and perhaps more. In Tecuya Canyon the total thickness is very probably less, but it certainly reaches as much as 2600 feet. Toward the east the group rapidly thins out, and in the vicinity of Pas-

[35] Anderson & Martin Calif. Acad Sci. Proc. 4th Ser., 1914, Vol. 4, pp. 25-29.

toria Creek not more than 1000 feet, and probably less than 900 feet of the strata constituting the lower portion of the group, are exposed, the upper portion being covered by an overlap of younger Tertiary beds.

All of the writers quoted above have mentioned the conglomerates which form the lowest member of the group, and which in most parts of the district directly overlie the crystalline rocks. No complete exposure of this member was discovered by the present writers, although on the west side of Pastoria creek granitic boulders interbedded with coarse sandstones were found near the base of the group. Dickerson stated that this member has a thickness of 250 to 300 feet in Grapevine Canyon, and this is not improbable.

Above the basal beds in Live Oak Canyon there is as much as 1200 feet of soft rusty colored, coarse sandstone, well stratified, the upper part of which includes sandy shales with concretionary layers striking N. 60° E., and dipping to the northwest at an angle of 75°. Above this member there are nearly 650 feet of alternating sands and shales of a dull gray color, and then 300 feet of dark carbonaceous shale, thinly stratified, followed near the top of the section by about 600 feet of sandy shales weathering to a yellowish gray color, and forming smooth rounded slopes.

The upper members of this section all have a steep dip to the southeast, toward the older rocks, at an angle never less than 75°. The sequence of lithologic members of the group at this place is about as follows:

600 feet or more, sandy shales weathering to a yellowish gray color, forming rounded slopes;
300 feet, dark carbonaceous shales, thin bedded;
650 feet, alternating sands and shales, dull gray in color;
1200 feet, rusty colored coarse sands, distinctly bedded, and sandy shales with concretionary layers;
250 feet, basal conglomerates, and coarse sands, not well exposed.

3000 feet, total thickness in Live Oak Canyon.

A gradual lithologic transition from conglomerate and coarse sandstone at the bottom of the section to finer shales and carbonaceous beds near the top is evident, though the uppermost member is also sandy and weathers readily to lower topography along its zone.

In Tecuya Canyon the basal conglomerates noted by Robert Anderson were not found, though coarse sandy beds similar to those of Live Oak are very well exposed. Toward the top of the section there is a preponderance of shales that weather to bare smooth slopes, while the uppermost beds are distinctly sandy. To some extent the lithologic sequence described by Dickerson for Grapevine Canyon agrees with that here described, although he does not mention carbonaceous beds, or the transition from coarse to finer sediments in ascending the section, perhaps for the reason that the strata are not well exposed in the locality studied by him.

It will be noted that throughout the entire belt of the Tejon Group here described, the material of the various members is detrital in character, and with only a small exception, no organic strata have been found such as characterize the later Tertiary groups within the region of the Temblor basin. In contrast with these detrital beds the organic character of some of the older Eocene beds farther north may be mentioned, but their discussion need not be undertaken here.

Stratigraphic Relations: From Tecuya Creek eastward the Tejon Group rests directly upon the crystalline rocks of the basement series which are largely granitic or schistose. Wherever boulders or pebbles were found in the strata of the Tejon they were usually granitic, though boulders of limestone or other crystalline rocks are frequent, and in Live Oak Creek boulders of red andesitic lava inclosed in Tejon sandstone were noticed, showing volcanic activity preceding the epoch of this group.

The materials of the entire group, with small exception, were derived directly from the crystalline areas to the south. It thus appears that the Tejon Group rests upon the basement rocks to the east of Salt Creek in the manner of an overlap, as will be more fully shown later.

Dr. Bruce L. Clark, who has studied the Eocene deposits to the west of Tecuya Creek, has given in his report[36] a map sufficiently detailed for satisfactory field use, which shows clearly a greater thickness of the Eocene strata to the west of Salt Creek than that claimed for the Tejon

[36] Jour. Geol. Vol. 29, 1921, pp. 145-154.

Group. But not only this, he shows an older Eocene Group, which he terms *Meganos,* underlying the Tejon with clear disconformity. Describing the latter group, he said:

"In places lenses of conglomerate are found with the finer sediments, and at one horizon not very far from the base is a heavy layer of conglomerate that can be traced for a considerable distance. It would appear that the Tejon beds at this last general locality may be delta deposits rather than typical marine deposits, such as those to the east in the vicinity of Grapevine Canyon."

These delta deposits with conglomerates resting upon the Meganos strata are taken to be evidence of disconformity, and this is strongly confirmed by Clark in his comparative study of the faunas of the two groups. Moreover, in the canyon of San Emigdio Creek a basal conglomerate of the Tejon was found "containing fossiliferous boulders derived from the beds below".

On the other hand, overlying the Tejon Group throughout the greater part of the distance from Salt Creek east to Pastoria Creek, an extent of 12 miles or more, there are later Tertiary strata of Lower or Middle Miocene age, consisting of marine gravels, sandstones and shales, overlaid by volcanic ejectamenta forming agglomerates and tuffaceous beds interstratified with sands and clays.

R. W. Pack, who studied this section, according to Merriam,[37] stated that these beds

"—are separable on lithologic grounds into a lower division, comprising 800 to 1000 feet of grayish sand and gravel with some indurated calcareous sandstones; and an upper division of somewhat greater thickness consisting of reddish clay, sand and coarse gravel."

Although the estimated thickness of this group, as observed by the writers, was somewhat less than Pack's figures, otherwise it essentially agrees with his statement, and the age determination is the same.

Along Salt Creek, the lower member, 600 to 800 feet in thickness is well exposed, dipping steeply to the northwest and resting unconformably upon older Tertiary beds. It is overlaid by other strata of bluish, gray, or variegated gravels, sands and shales intercalated with volcanic rocks, constituting a suggestion of stratified sediments, agglomer-

[37] Univ. Calif. Publ. Geol. Vol. 8, p. 284.

ates and tuffs 300 to 400 feet in thickness, and presenting a variety of colors.

Farther east, along Tecuya Creek, the variegated beds rest directly and unconformably upon the Tejon strata, and are in turn overlaid by dark volcanic materials followed by beds of gravel of considerable thickness.

At Live Oak Creek, and also at Pastoria Creek, the Tejon Group is covered by a similar sequence of strata including the dark volcanic member, undoubtedly the same as that observed on Salt Creek.

It may be noted here incidently that a flow of similar lava, and associated beds similar in character to those here described was noted by one of the writers near the mouth of Walker Creek, a mile or more north of Bena, involved with beds of Lower Miocene (Temblor) age, and beneath gravel-strata also of Miocene age.[38] Only a small exposure of possible Oligocene strata was seen on Salt Creek beneath the Miocene, while to the east of this stream none was seen in any of the creeks crossing the zone of the Tertiary, and presumably it does not occur there.

A collection of marine species determined as of Temblor age was obtained from the sandy beds beneath the volcanics a little west of Salt Creek, on the SE ¼ of Sec. 29, T. 10 N. R. 20 W. S. B. M., from a locality mapped by Clark[39] as belonging to the "Vaqueros" group, at the base of which he indicated "continental beds", supposed to be of Oligocene age. These continental beds were not observed by the writers, but lying farther to the west is an extensive zone of strata mapped by Clark as belonging to the "San Lorenzo series". The "continental beds" interposed by Clark between the marine Oligocene and the Temblor, sufficiently emphasize the disconformity between the two groups, both of which in their turn, however, are superimposed upon the Tejon Group. The species obtained from these Miocene beds are all such as may be found in the Temblor beds of the Kern River section, and include the following:

Scutaster andersoni Pack
Antigona mathewsonii (Gabb)
Dosinia whitneyi Gabb
Tellina nevadensis Anderson & Martin
Mulinia densata (Conrad)
Agasoma barkerianum Cooper

[38] Calif. Acad. Sci. Proc. 4th Ser., Vol. 3, 1911, p. 92.
[39] Jour. Geol. Vol. 29, p. 151.

Other species only doubtfully identifiable were also found, but as far as can be judged, none that may not be found in the Temblor Group.

A little to the east of Salt Creek these Temblor strata rest directly upon the Tejon with no intervening deposits, and so continue beyond the valley of Pastoria Creek.

Distinctness of the Tejon Group: It appears from what has already been said that there is much convincing evidence of the unity and distinctness of the Tejon Group in the locality of the Type section, and that as a group it forms a part of the Eocene series, but by no means the whole of it.

It is suggested in Whitney's account, and explicitly stated in the report of Robert Anderson that the strata "are to be regarded as making up a formation, and not a larger division of the geologic column".

Anderson described in considerable detail the enclosed lobe of the basin at the southeast extremity of the Great Valley, and styles it a "reentrant". It is in the area of this extreme lobe of the basin where neither Cretaceous nor Lower or Middle Eocene strata are found, that the Tejon Group of the Eocene is exclusively developed, and its stratigraphic distinctness is shown in the manner of an overlap upon rocks of the basement series from which it derived its sediments.

But the distinctness of the Tejon Group from the earlier Eocene rocks is most forcibly shown by the unconformable relations of this group upon earlier Eocene sediments, as pointed out and mapped under the name of Meganos by Clark, and which he showed to underlie the Tejon between San Emigdio Creek and the canyon of Tecuya Creek, already referred to.

If more convincing proof of the distinctness of the Tejon Group is desired it will be found in its faunal aspects as contrasted with those of the older parts of the Eocene in the pages that follow.

Dynamic History: The continental uplift which brought the deposition of Cretaceous sediments to a close along the west coast was one of long duration, extensive denudation, and of removal from extensive areas of the recently deposited sediments.

No doubt the uplift was accompanied by warping and folding of the pre-existing rocks, and doubtless too, the principal ranges and valleys of the present were outlined or foreshadowed by this disturbance, or accentuated by it.

However, this uplift was followed by a subsidence which again brought the sea inland, and resulted in the flooding of the basins and valleys along the continental border, and in the region of central California led the sea eastward to the base of the Sierra Nevada which then occupied a position, if not an elevation, similar to that of the present time. This was the Eocene subsidence.

Oscillations of land-level occurred at intervals during the course of the prolonged subsidence of the Eocene period, but their number, extent, and vertical magnitude have not as yet been fully determined, though at least two events of importance interrupted the course of the general subsidence of the period.

One of these events was the disturbance which marks the interval between the Martinez and the Meganos periods, and the other, that between the Meganos and the Tejon. Both were uplifts of considerable regional extent, followed by subsidences and readjustment of strand lines not altogether coincident with their former positions.

During Tejon time the Eocene sea had its greatest southward advance into the Temblor basin, though apparently not its greatest areal extension, since no Tejon strata are known along the western flanks of the Sierra Nevada, where, in Middle Eocene time the sea had left deposits of considerable thickness. But the overlap of the Tejon sediments beyond the border of the preceding group at the extreme southeastern lobe of this basin, with no such overlap along the sierran margin, indicates a condition of warping as well as of subsidence during the Tejon. The overlap will no doubt be found at other points about the Temblor Basin and elsewhere in central and southern California, but at the present time it has not been very extensively followed.

It is impossible at present to note all of the oscillations that affected this region during succeeding Tertiary times, but the unconformities that followed the Tejon, including

that which separates the Lower Miocene from the earlier groups, were of great magnitude, each indicating uplifts, erosion, and subsequent subsidences with readjustment of strand lines about the Temblor basin.

Among the many disturbances that followed the Tejon epoch only two will be especially noticed in this connection, since they seem to be of importance as affecting the Tejon rocks.

First, all of the Lower Miocene strata exposed in the district of the Type Tejon Group stand at angles of inclination similar to that of the Tejon Group itself. Where the inclination of the Tejon is normal, or away from the basement rocks, that of the Miocene is the same, and where the former is overturned the latter is overturned also. It is evident from this fact that the disturbances which finally resulted in the folding and overturn of the Tejon Group culminated after the epoch of the Lower Miocene, namely the Temblor Group.

Secondly, the block-faulting and offsetting of the Tejon Group, already noted on a former page, such as may be seen along Tecuya and Salt Creeks, involves also the Lower Miocene strata as far as they can be followed, and perhaps even later beds. The exact epoch of this faulting is not clearly indicated, although it probably coincided with that of the folding and overturn just described. From data obtained in other parts of this region the faulting appears to have been initiated with the close of the Temblor epoch, and was probably continued in a progressive manner afterward. The full sequence of the disturbances is of course beyond the scope of this paper, and have already been partly described for the Mount Diablo Range.[40]

Paleontology of the Tejon Group

Rich Fauna of the Group

The Tejon Group at its type locality is exceptionally rich in fossil marine Mollusca, which is perhaps far from being exhausted by the lists included in this paper. Its fauna is

[40] Calif. Acad. Sci. Proc. 4th Ser., Vol. 4, 1914, pp. 23-35.

especially rich in its contents of Gastropoda, some of which are highly ornamented forms that show a considerable degree of advancement in their racial development, but whether this is properly interpreted as indicating a late epoch of the Eocene period, or merely a late epoch in their racial history it is impossible to decide. Some have supposed the former, but it has seemed to us that the preference is involved in the personal factor rather than a result of any truly scientific observation or conception. At all events a better basis for determining the relative age of the group, or its age relative to other groups of the Eocene period, is that of superposition, and its rich faunas with their highly developed forms should properly be regarded only as incidental, or determined by factors that had little relation to stratigraphic position. This conception would neither rob biology of any of its rights nor geology of any of its advantages for the purposes of correlation.

It appears from what has been already said on preceding pages that the fauna described here is likely to have been governed by local conditions, and therefore not fully representative of the group of strata contemporary and equivalent to that of the type section of the Tejon Group. This may be true, and doubtless other localities, as truly representative of the epoch, will furnish many additional species to the aggregate fauna of the Tejon Group, but if as strict a method of sifting is employed for the new localities as the writers have endeavored to use in this case the result should be satisfactory.

Preservation: The greater portion of the fossils obtained from the type locality of the Tejon Group have come from strata of hard calcareous sandstone. The grains of sand are chiefly quartz, though with enough clay and calcareous matter to bind the whole into a very tough rock. A few fossils have come from the basal beds of conglomerate or loose sandstone, but they have been usually poorly preserved and have entered but little into the faunal considerations of this or other papers. On the other hand the fossils in the harder layers are often beautifully preserved and entirely uncrushed, but the hardness and tenacity of the rock has prevented securing perfect specimens and a full representa-

tion of the fauna, although a refined technique of extraction has enabled us to very greatly improve upon the completeness of this work attained in the past by others. It is thus that we have been enabled to expose for illustration many of the more diagnostic parts, such as hinges, etc., and in so doing we have been able also to produce a fauna comparable in many respects to the best from more favored localities and regions.

The disassociation of most of the bi-valves of the pelecypods and the presence of considerable numbers of unworn shells and fragments serves to indicate that there were currents at the time of the deposition, but also that they were not swift, since the shells have not been transported far from the point at which the mullusks flourished.

Stratigraphic Range of Species: Except for a small fauna of distinctly strand loving species discovered in the basal beds of the group, there is little evidence of any great change of faunas in ascending the sequence of strata. The differences which can be noticed are such as would naturally follow differences in the character of the sediments, and they are negligible. The basal beds are not very fossiliferous, but contain such forms as *Barbatia, Spondylus,* etc., and numerous fragments and larger pieces of fossilized wood with colonies of teredos. Above this member, which was limited to a few hundred feet, the species found in the lower part of the group ranged generally to the top, and vice versa. In the middle portion of the section, 800 to 2000 feet above the base, fossils are more numerous, particularly the more characteristic gastropods. But many species which characterize the group from the older groups of the Eocene were found not only near the bottom of the section, but ranged through all levels to the top. Some strata, to be sure, were found rich in certain species, such as *Turritella uvasana, Venericardia hornii,* or *Crassatellites uvasanus,* but such conditions were evidently local. There has not been discovered thus far any adequate basis for attempting to recognize faunal zones in the Tejon Group at its type locality, and it seems doubtful to the writers if any warrant will ever be found for doing so.

Collecting Stations in Type Tejon Group

California Academy of Sciences localities:

244. East side of Live Oak Creek, Kern County, California, about three fourths of a mile above where it flows out upon the San Joaquin Valley floor; Bruce G. Martin, Collector. This creek was formerly called Alizos and many species were described from it by Gabb from the collections made by Dr. Horn.

245. Along the east bank of a small gulch about one fourth of a mile east of the pumping plant located near where Grapevine Creek flows out upon the San Joaquin Valley floor, Kern County, California; Bruce G. Martin, Collector.

246. Near the top of a small hill about 300 yards west of Grapevine Creek and one half mile south of where it flows out upon the San Joaquin Valley floor; collections made in coarse sandstone, near the base of the section; Bruce G. Martin, Collector. Grapevine Creek was formerly called Cañada de las Uvas and the original boulder from which Conrad described the first Tejon species came from the bed of the stream.

711. On the east side of Grapevine Creek near the point where the stream flows out upon the valley floor; the fossils were collected near the center of the section; G. Dallas Hanna and Marcus A. Hanna, Collectors; June 1921; locality is very near 245.

792. West side of Tecuya Creek, Kern County, California about one mile south of where the stream flows out upon the valley floor and near the center of the 2,600 feet of exposed strata; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922.

815. West side of Pastoria Creek, Kern County, California, near the base of the Tejon section; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922.

816. East side of Pastoria Creek, Kern County, California, at or below the center of the Tejon section; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922.

823. East side of Tecuya Creek, Kern County, California, about 800 feet above the base of the group; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922.

824. West side of Tecuya Creek, Kern County, California, about 1000 feet above the base of the group; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922.

825. East side of Live Oak Creek, Kern County, California, near the base of the group; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922.

827. East side of Live Oak Creek, Kern County, California, near the center of the group and at stream level; F. M. Anderson and G. Dallas Hanna, Collectors; December, 1922; locality is very near 244.

University of California localities:

A complete list of University of California collecting stations in the Type Locality of the Tejon Group and vicinity was published by Dickerson. (Calif. Acad. Sci. Proc. 4th ser. Vol. V, 1915, pp. 45, 46.) They are num-

bered from 451 to 465 inclusive but the only ones from which material has been described in the present report are 451 and 460, the data for which are as follows:

451. West side of Grapevine Creek, one fourth mile north of base of Tejon Group; Roy E. Dickerson, Collector.

460. Four miles south, 10° West of 1085 bench mark near pumping station on highway; [this would be in or near Tecuya Creek;] Roy E. Dickerson, Collector.

Southern Pacific Rail Road Company Localities:

327. Grapevine Creek, Kern County, California; SW ¼ of SE ¼ of Sec. 20, T. 10 N., R. 19 W., San Bernardino Meridian; G. C. Gester, Collector.

326. West side of Tecuya Creek, Kern County, California; SE ¼ of SE ¼ of Sec. 26, T. 10 N., R. 20 W., S. B. M.; G. C. Gester, Collector.

339. West side of Grapevine Creek, Kern County, California; SW ¼ of SW ¼, Sec. 19, T. 10 N., R. 19 W., S. B. M.; G. C. Gester, Collector.

340. Between Salt and Tecuya Creeks, Kern County, California; SW ¼ of SE ¼ of Sec. 23, T. 10 N., R. 20 W.; S. B. M.; G. C. Gester, Collector.

341. Same locality as 340.

342. Same locality as 340 except NW ¼ of SE ¼ of Sec. 23.

406. Live Oak Creek, Kern County, California; G. C. Gester, Collector.

408. Same locality as 406.

Special Collections: The following lists of species, although at the present time they do not appear to be particularly significant, nevertheless represent some of the earlier horizons of the Tejon Group at its type locality:

Locality 246 (C. A. S. Coll.). Basal beds of the Tejon in Grapevine Canyon, Bruce G. Martin, Collector.

Spondylus carlosensis Anderson
Venericardia hornii (Gabb)
Crassatellites uvasanus (Conrad)
Barbatia sp. undt.
Ostrea sp. undt.
Macrocallista andersoni Dickerson

Locality 815 (C. A. S. Coll.). Basal beds of the Tejon on the west side of Pastoria Creek, east of Grapevine Canyon.

Glycymeris sagittata (Gabb)
Spondylus carlosensis Anderson
Macrocallista andersoni Dickerson
Ostrea sp. undt.
Natica nuciformis (Gabb)
Oliva sp. undt.
Crassatellites uvasanus (Conrad)
Mytilus humerus Conrad
Barbatia sp. cf. *B. morsei* Gabb
Crepidula pileum (Gabb)
Calyptraea excentrica (Gabb)

Locality 816 (C. A. S. Coll.). 600 feet above the base of the Tejon Group, on east side of Pastoria Creek, east of Grapevine Canyon.

Pitaria californiana (Conrad)
Mytilus humerus Conrad
Brachydontes ornatus (Gabb)
Teredo sp. undt. (in fossil wood)
Turritella sargeanti A. & H. n. sp.
Whitneya ficus Gabb
Cardium brewerii Gabb
Spisula bisculpturata A. & H. n. sp.
Venericardia hornii (Gabb)
Crepidula pileum (Gabb)
Amauropsis alveata (Conrad)
Dendrophyllia tejonensis Nomland

Locality 825 (C. A. S. Coll.). 600 feet above the base of the Tejon Group, east side of Live Oak Creek, east of Grapevine Creek.

Glycymeris (2 small sp.)
Amauropsis alveata (Conrad)
Whitneya ficus Gabb
Macrocallista conradiana (Gabb)
Turritella uvasana Conrad
Natica hornii (Gabb)
Surcula sinuata (Gabb)
Cardium brewerii Gabb

Locality 792 (C. A. S. Coll.). 800 feet above the base of the Tejon Group, west side of Tecuya Creek, west of Grapevine Creek.

Pitaria californiana (Conrad)
Tellina tehachapi A. & H. n. sp.
Acila gabbiana Dickerson
Macrocallista andersoni Dickerson
Dentalium stentor A. & H. n. sp.
Exilia fausta A. & H. n. sp.
Worm tubes. sp. undt.
Leda vogdesi A. & H. n. sp.
Pteria pellucida (Gabb)
Macoma viticola A. & H. n. sp.
Solen novacula A. & H. n. sp.
Turritella uvasana Conrad
Sinum coryliforme A. & H. n. sp.

Locality 823 (C. A. S. Coll.). 800 feet above base of the Tejon Group, east side of Tecuya Creek, west of Grapevine Creek.

Crassatellites uvasanus (Conrad)
Antigona hornii (Gabb)
Macrocallista conradiana (Gabb)
Glycymeris sagittata (Gabb)
Olivella mathewsonii Gabb
Turritella uvasana Conrad
Conus hornii Gabb
Natica nuciformis (Gabb)
Pitaria californiana (Conrad)
Cardium brewerii Gabb
Spisula bisculpturata A. & H. n. sp.
Amauropsis alveata (Conrad)
Natica secta Gabb
Calyptraea excentrica (Gabb)
Latirus sinuatus (Gabb)

CHECK LIST OF SPECIES

The following list of species is designed to contain those forms which rightly belong to the Tejon Group at its type locality, such as have either actually been found there by the writers, or collected under their direction, or authentically listed or described from there by others, and in a parallel column, those which have been incorrectly reported. The writers have had access to most of the large collections from the type locality, and have searched them carefully for such confirmation as they afford for the data here offered as authentic. Many species have been referred to this locality by Gabb, and by others since his time but which, in truth, do not properly belong here. Most of these errors have been the result of hasty and mistaken identification of species. The methods of Gabb in attempting to give the

geographic and stratigraphic range of species, while followed doubtless with an earnest desire to advance his science, led him into many errors, the results of which have been inherited by subsequent writers, who have also been heirs to some of his methods.

VALID TEJON SPECIES	SPECIES REPORTED HERETOFORE BUT NOT VALIDATED
Dendrophyllia tejonensis Nomland	*"Turbinolia* sp." Dickerson
	Schizaster lecontei Merriam
	"Callionassa stimpsonii" Gabb
	"Cancer sp. a." Dickerson
	"Cancer sp. b." Dickerson
Aturia kerniana A. & H. n. sp.	*Aturia angustata* Conrad
	Aturia mathewsonii Gabb
	Aturia ziczac (Sowerby)
Acila gabbiana Dickerson	*Acila truncata* Gabb
Antigona hornii Gabb	*"Acila* n. sp." Dickerson
Arca hornii Gabb	*Barbatia morsei* Gabb
Brachydontes ornatus (Gabb)	*Cardium cooperii* Gabb
Cardium brewerii Gabb	*Cardium olequahensis* Weaver
Cardium linteum Conrad	*Corbicula olequahensis* (Weaver)
Corbicula williamsoni A. & H. n. sp.	*Corbula parilis* Gabb
Corbula hornii Gabb	*"Crassatella alta"* Conrad
Crassatellites uvasanus (Conrad)	*Crassatellites grandis* (Gabb)
Divaricella cumulata (Gabb)	*Crassatellites mathewsonii* Gabb
Dosinia elevata Gabb	*Diplodonta polita* (Gabb)
Glycymeris sagittata (Gabb)	*Dosinia alta* Conrad
Glycymeris evermanni A. & H. n. sp.	*Glycymeris instabilis* A. & H. n. sp.
Glycymeris ruckmani Dickerson	*Glycymeris eocenica* (Weaver)
Glycymeris verticordia A. & H. n. sp.	*Isocardia tejonensis* Waring
Glycymeris viticola A. & H. n. sp.	*Leda gabbii* Gabb
Kellia harrisi (Dickerson)	*Leda protexta* Gabb
Kellia uvasana (Dickerson)	*Lucina cretacea* Gabb
Leda parkei A. & H., n. sp.	*Lucina gyrata* (Gabb)
Leda uvasana Dickerson	*Lucina nasuta* Gabb
Leda vogdesi A. & H. n. sp.	*"Lucina (Myrtæa)* n. s." Dickerson
Macoma viticola A. & H., n. sp.	*"Macoma* sp." Dickerson
Macrocallista andersoni Dickerson	*"Marcia quadrata"* Gabb
Macrocallista conradiana (Gabb)	*"Martesia clausa"* Gabb
	"Meretrix ovalis" Gabb
Mytilus ascia Gabb	*Meretrix tularana* Conrad
Mytilus humerus Conrad	*Nucula cooperi* Dickerson
Nucula vitis A. & H., n. sp.	*Ostrea idriænsis* Gabb

VALID TEJON SPECIES

Pitaria californiana (Conrad)
Pitaria tejonensis (Dickerson)
Pitaria uvasana (Conrad)
Psammobia hornii (Gabb)
Pteria pellucida (Gabb)
Septifer dichotomus Gabb
Solen novacula A. & H. n. sp.
Spisula acutirostrata Packard
Spisula bisculpturata A. & H. n. sp.
Spondylus carlosensis Anderson
Tellina castacana A. & H. n. sp.

Tellina howardi Dickerson

Tellina lebecki A. & H. n. sp.

Tellina tehachapi A. & H. n. sp.
Venericardia hornii (Gabb)

Acmæa tejonensis Gabb
Acteon quercus A. & H. n. sp.
Alvania vinosula A. & H. n. sp.
Amauropsis alveata (Conrad)
Architectonica hornii Gabb
Argobuccinum californicum (Gabb)
Argobuccinum tejonense (Gabb)
Bullaria hornii (Gabb)
Bursa hornii (Gabb)
Cadulus gabbi Sharp & Pilsbry
Cancellaria paucivaricata (Gabb)
Calyptræa excentrica Gabb
Chrysodomus ruckmani Dickerson
Clavilithes californicus (Conrad)

Cominella colemani A. & H. n. sp.
Cominella tejonensis (Dickerson)
Conus ægilops A. & H. n. sp.
Conus californianus (Conrad)
Conus hornii Gabb
Conus submonilifer A. & H. n. sp.
Conus ? remondii Gabb
Cowlitzia canalifera (Gabb)
Crepidula pileum (Gabb)

SPECIES REPORTED HERETOFORE BUT NOT VALIDATED

Ostrea sp. Dickerson
Phacoides (Myrtea) taffana Dickerson
Pinna barrowsi Dickerson
Placunanomia inornata Gabb
Psammobia texta (Gabb)
"Psammobia sp." Dickerson
Solen parallelus Gabb
Spisula ashburnerii (Gabb)
Spisula merriami Dickerson
Tellina æqualis Gabb
Tellina californica Gabb
Tellina joaquinensis Arnold
Tellina longa Gabb
Tellina remondii Gabb
Tellina sutterensis Dickerson
"Teredo sp." Dickerson
Venericardia planicosta (Lamarck)
Acteon moodyi Dickerson
Acteon n. sp. Dickerson
Amauropsis alocata Arnold
Ampullina andersoni Dickerson
Ampullina hannibali Dickerson
Ancillaria elongata Gabb
Architectonica cognata Gabb
"Cancellaria marysvillensis" Dickerson

Cancellaria stantoni Dickerson
Cerithiopsis alternata Gabb
Cadulus pusillus (Gabb)
"Chrysodomus supraplicata" (Gabb)
Conus cowlitzensis Weaver

Conus weaveri Dickerson
"Cordiera microptygma" Gabb
Cowlitzia simplex (Gabb)
Crepidula inornata Dickerson
Cymatium cowlitzensis (Weaver)
Cyprœa mathewsonii Gabb
Cyprœa bayerquei Gabb
Epitonium tejonense Dickerson
Epitonium n. sp. Dickerson

VALID TEJON SPECIES	SPECIES REPORTED HERETOFORE BUT NOT VALIDATED
Cylichnella tantilla A. & H. n. sp.	
Cypræa kerniana A. & H. n. sp.	
Dentalium cooperii Gabb	
Dentalium stramineum Gabb	
Dentalium stentor A. & H. n. sp.	*Exilia diaboli* (Gabb)
Exilia fausta A. & H. n. sp.	*Exilia dickersoni* (Weaver)
Exilia novatrix A. & H. n. sp.	*Exilia perkinsiana* Cooper
Exilia waringi Dickerson	*Exilia harrisi* Dickerson
Ficopsis hornii (Gabb)	*Ficopsis cowlitzensis* (Weaver)
Ficopsis remondii (Gabb)	*Ficus modestus* (Conrad)
Ficus mamillatus Gabb	*Fusinus martinez* (Gabb)
Galeodea petrosa (Conrad)	*Fusinus mathewsonii* (Gabb)
Gemmula abacta A. & H. n. sp.	*Fusinus tumidus* (Gabb)
Gemmula encinalis A. & H. n. sp.	*Galeodea tuberculata* (Gabb)
Gyrineum kewi (Dickerson)	*Gyrineum washingtonianum* (Weaver)
Gyrineum uvasalis A. & H. n. sp.	
Helminthoglypta obtusa A. & H. n. sp.	
Latirus sinuatus (Gabb)	*"Hemifusus lewisiana"* Weaver
Latirus whitneyi (Gabb)	*Loxotrema turrita* Gabb
Mangilia fibrata A. & H. n. sp.	*Mitra simplicissima* Cooper
Marginella adumbrata A. & H. n. sp.	*Murex sopenahensis* Weaver
Marginella multifilosa A. &.H. n. sp.	
Melanella acuella A. & H. n. sp.	
Mitra alizalis A. & H. n. sp.	
Mitra murietta A. & H. n. sp.	
Mitra slevini (Dickerson)	
Mitra uvasana Dickerson	
Molopophorus striata Gabb	
Murex beali A. & H. n. sp.	*Nassa cretacea* Gabb
Natica hornii (Gabb)	*Natica fiasco* Hanna
Natica nuciformis (Gabb)	*Natica gibbosa* Lea
	Natica ? oetites Conrad
Natica uvasana Gabb	*Natica semilunata* Lea
Natica secta Gabb	*"Naticina obliqua"* Gabb
Niso pistiliformis A. & H. n. sp.	*Niso polita* Gabb
Odostomia insignifica A. & H. n. sp.	*"Nyctilochus washingtoniana"* (Weaver)
Olivella mathewsonii Gabb	*"Nyctilochus* n. sp. a" Dickerson
Phos blakeanus A. & H. n. sp.	*"Perissolax tricarinatus"* Weaver
Pseudoliva inornata Dickerson	*"Potamides* sp." Dickerson
Pseudoliva volutæformis Gabb	*Pseudoliva lineata* Gabb
Pseudoperissolax blakei (Conrad)	*Pseudoliva tejonensis* Dickerson
Pyramidella slevini A. & H. n. sp.	*"Odostomia packi"* Dickerson
Pyramidella fremonti A. & H. n. sp.	*"Odostomia* sp. a" Dickerson
Pyramidella mucronis A. & H. n. sp.	*"Odostomia* n. sp." Dickerson
Sinum coryliforme A. & H. n. sp.	

VALID TEJON SPECIES	SPECIES REPORTED HERETOFORE BUT NOT VALIDATED
Siphonalia tularensis A. & H. n. sp.	*Scaphander costatus* (Gabb)
Solariella enamellata A. & H. n. sp.	*"Serpula* sp." Dickerson
Surcula alizensis A. & H. n. sp.	*"Siphonalia bicarinata"* Dickerson
Surcula cohni Dickerson	*"Siphonalia sopenahensis"* (Weaver)
	"Spiroglyphus tejonensis" Arnold
Surcula io (Gabb)	*Surcula claytonensis* Gabb
	Surcula cowlitzensis Weaver
Surcula ioformis A. & H. n. sp.	*Surcula fresnoensis* (Arnold)
Surcula sinuata Gabb	*Surcula gesteri* Dickerson
Surcula uvasana Dickerson	*Surcula washingtoniana* (Weaver)
	"Tritonium fusiforme" Gabb
Surcula cœqualis A. & H. n. sp.	*"Turris monilifera"* (Cooper)
Teinostoma exoleta A. & H. n. sp.	*"Turris raricostata"* Gabb
Teinostoma profunda A. & H. n. sp.	*"Turris stocki"* Dickerson
Terebra californica Gabb	*" Turris* sp." Dickerson
Tritonalia volutæformis (Dickerson)	*" Turris* n. sp." Dickerson
	Turritella bicarinata Dickerson
	Turritella buwaldana Dickerson
Turbonilla gesteri A. & H. n. sp.	*Turritella kewi* Dickerson
	Turritella tricarinata Dickerson
Turbonilla kernensis A. & H. n. sp.	*"Turritella* n. sp." Dickerson
Turritella sargeanti A. & H. n. sp.	*Typhis antiquus* Gabb
Turritella uvasana Conrad	*" Voluta* sp." Dickerson
Vitrinella uvasula A. & H. n. sp.	*"Volutilithes* n. sp." Dickerson
Voluta martini Dickerson	
Whitneya ficus Gabb	

TABLE SHOWING NUMBER OF SPECIES REPORTED FROM TYPE SECTION OF THE TEJON GROUP

The following table includes those species which have been properly reported from the Type Tejon; also those which we have been unable to confirm and the new species described in the present paper.

The preceding list contains 22 references to generic names where the species has been left unidentified. For completeness we have included all such found and they are counted in the summary below, but the original authors probably ascribed very little importance to them. Also the table includes certain names found to be synonyms or homonyms which fall into the invalid column although they may be represented by a name in the valid side.

Authors	Accepted Species	Rejected Names	Total Number
Conrad, T. A.	11	10	21
Gabb, Wm. M.	43*	32*	75
Sharp and Pilsbry	1*	....	1
Arnold, Ralph	....	1*	1
Dickerson, R. E.	22*	88*	110
Packard, E. L.	1*	....	1
Anderson & Hanna, new species	53*	....	53
	132	131	262

Description of Species

Introductory Note

In the descriptive notes here offered regarding the different species of the Tejon Group the present authors have endeavored to adhere strictly to scientific methods of paleontologic work; first, by obtaining as exhaustive collections as were practicable of the rich fauna, and secondly, by identifying these species as far as possible with those which had actually been described from this locality, or, where this has not been possible, by comparing them with species from the Eocene elsewhere in California, or finally on the west coast, but always with proper discrimination.

In many cases the original figures and descriptions of species have been poor, and sometimes quite inadequate for identification, especially those of earlier writers who had not the facilities of photography, but in only a few cases, if in any, have the present authors presumed, without satisfactory evidence, to identify such, and then, with the utmost caution. Where the original figures and descriptions have been faulty, and our material has permitted it, new figures and descriptive notes have been added, but only in such cases as the identity appeared to be unquestionable. By this method they have felt compelled to exclude from the list of Type Tejon species many that had been attributed to this locality and group in the past, and on the other hand to add many new forms that had been overlooked, or wrongly identified, but the advantages should be obvious, and have

*The publications are arranged chronologically and the figures given are in addition to any which may have been included in those above. Of course each author after Conrad listed a considerable proportion of both valid and invalid species which had been previously recorded from the formation.

rewarded them abundantly. Errors of stratigraphic correlation may easily arise from hasty and frequently erroneous determination of species, and from the confusion of forms that are only nearly related, and which may come from entirely different stages, or members, or even groups of strata or from different geographic provinces in which there are only analogous species.

The authors have consistently endeavored to avoid such errors, believing that greater gain will result from a careful scrutiny of fossil material, and discrimination between those species which are only analogous, or related genetically, and not truly identical.

But the aim of this contribution has been admittedly geologic rather than biologic, stratigraphic rather than systematic, though the genetic order and relationships have not been overlooked, as it may explain a great many of the difficulties that have been encountered in the work. The accumulation of so great an aggregate of strata has doubtless covered sufficient time to allow specific changes in many of the forms found in the earlier stages of the group, and this fact has been kept in mind though its full effects cannot be followed up at this time as they may be when the fauna becomes better known.

No doubt the Tejon Group, as well as its different members, as found at the type locality, have some geographic continuity and extent, especially within the basin to which the type section belongs. But errors of correlation have been made as a result of hurried determination of the species contained, or obtained from sundry strata, and by assuming a knowledge of stratigraphic conditions which a proper faunal study would have corrected. This error has been often repeated in the past.

The terms Tejon, Tejon formation, and Tejon Group, and even Type Tejon have been applied to members or groups of Eocene strata in the Mount Diablo range, between the type section and Mount Diablo, before any adequate knowledge of the type section itself, or of its fauna, had been gained.

It is with a desire to obtain an authentic faunal basis for correlation that an examination of the faunal contents

of the type section of the Tejon Group was begun, but this has led naturally to a close scrutiny, and then to a review and a revision of the species belonging to it, and to a discrimination between such and those that had been attributed to it by various authors without proper warrant. It has long been known that the fauna strictly belonging to the type section of the Tejon Group had never been segregated from the lists ascribed to it under the long continued action of the landslide methods employed by Gabb, and others.

It was with this problem in view that the senior author, while Curator of the Department of Paleontology of the Academy of Sciences, began the collection of Tejon species, both at the type locality and elsewhere, and under his direction Bruce G. Martin made extensive collections in California, Oregon and Washington during 1913 and 1914.

One of the purposes served by the present contribution, it is hoped, will be the restoration to its potential usefulness of the good name of Tejon, as well as the segregation, as far as is now possible, of the fauna that properly belongs to it. Doubtless other species will subsequently be found to augment the list here approved, either from the type locality of the Tejon itself, or from other localities in which equivalent strata as properly restricted, have been found. This, of course, will be welcome to all students of either stratigraphy or biologic paleontology.

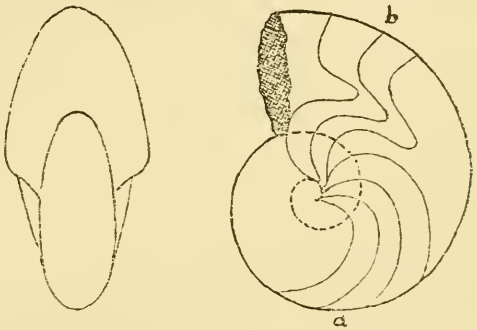
The systematic arrangement of the families and genera of mollusks, follows that of Tryon's Structural and Systematic Conchology[41] as closely as possible. Although that work is known to contain many discrepancies, necessarily resulting from 40 years of research, it is the only readily accessible compilation in English which deals with the entire group of mollusks, living and fossil. There are distinct advantages in following this standard text until a new one is produced which embodies the latest developments of the science.

[41] Three volumes, Philadelphia, 1882-83.

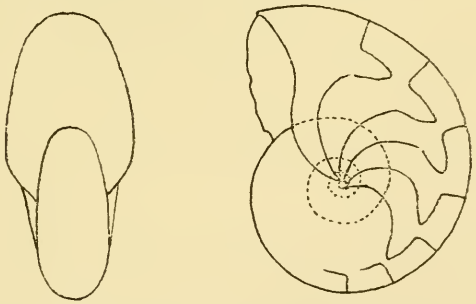
1. Aturia kerniana[42] Anderson & Hanna, new species

Plate 6, figure 8, text figures 1, 2

Aturia mathewsonii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 59, 60 Type Tejon records; (not pl. 17, fig. 31 which was reported from "Division A, Martinez, but apparently came from the Chico Cretaceous. — GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 210, Type Tejon records. — GABB, Calif. Acad. Nat. Sci. Vol. 3, 1867, p. 302, Type Tejon Records.



Figs. 1, 2. *Aturia kerniana,* new species; reconstructed from type No. 881 (C. A. S. Coll.); see pl. 6, fig. 8.



Figs. 3, 4. *Aturia angustata* (Conrad); reconstructed from plesiotype No. 880 (C. A. S. Coll.) and other specimens; see pl. 6, fig. 7.

Shell small, somewhat ovate in section, deeply enveloped; umbilicus very small or covered; sides slightly rounded, sloping rapidly to the dorsum; ratio of height of entire whorl to greatest width, about 2 to 1; surface of shell smooth, marked only by lines of growth which curve strongly forward from the umbilicus, then outward and backward to the dorsum in a regular graceful curve; suture first curving forward, and then back, forming a long angular tongue and

[42] Names printed in bold faced type represent species which have been determined to properly belong to the fauna of the Tejon Group at the type locality. Names printed in ordinary type have been excluded from that fauna for one reason or another.

then bending forward and outward at right angles to the periphery; space between the sutures short, on the dorsum equalling about one-fifth of the diameter of the shell.

Type: No. 881, Mus. Calif. Acad. Sci.; collected at Loc. 711 (C. A. S. Coll.), Grapevine Canyon, Kern County, California, by G. D. Hanna and M. A. Hanna, June, 1921; Type Tejon Eocene.

In its lateral aspect this shell is not unlike the figure of *A. mathewsonii,* and the sutures are similar but differently placed. That species, however, was said to be sub-globose, and to have a form even more regularly rounded than *Nautilus texanus.*[43] Moreover, *A. mathewsonii* is undoubtedly a Chico Cretaceous species because in referring to it later[44] the author listed as associated forms, *Turritella safffordii, Venus varians* and *Pugnellus hamulus,* all of which are undoubtedly Cretaceous forms. Although he listed it from the Martinez Group and was followed in this by Dickerson[45] who also included it as a Tejon species and figured a specimen from an unknown locality, there is considerable uncertainty as to whether it is actually found in the Eocene at all.

The text figures of *A. kerniana* herewith, were drawn from fragmentary material but are true in measurement, proportion and outline.

The species in some respects is not unlike *A. angustata* Conrad[46] from the Astoria Group of northwestern Oregon, but that species is more ovate in section, has differently placed loops in the suture lines, and a smaller umbilicus. It is illustrated herewith for comparison, (pl. 6, fig. 7, text figs. 3, 4.)

2. **Murex beali** Anderson & Hanna, new species

Plate 13, figure 16

Murex sopenahensis WEAVER, DICKERSON, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, pp. 43, 50, 51; Type Tejon records — DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 450; Type Tejon records. Not *Murex sopenahensis* WEAVER, Wash. Geol. Surv. Bull. 15, 1912, p. 48, pl. 1, fig. 8; from Cowlitz Valley, Washington.

[43] Geol. Surv. Calif. Pal. Vol. 1, 1864, pl. 9, fig. 3b.
[44] Gabb, Amer. Journ. Conch. Vol. 2, 1866, pp. 88, 89.
[45] Univ. Calif. Publ. Geol. Vol. 8, 1914, pp. 111, 113.
[46] Wilkes Explor. Exped. 1849, p. 728, pl. 20, figs. 5, 6.

Shell small, inconspicuous, somewhat triangular in outline, though having minor peripheral angles and spines; spire not high, upper slope interrupted, not continuous; canal straight and short, or only moderately produced; spines short, with a tendency to produce double tubercules on the angle of the body whorl; surface ornamented with strong revolving threads, slightly nodose on the peripheral angles.

Type: No. 837, Mus. Calif. Acad. Sci.; collected by Bruce G. Martin at **Locality 244, (C. A. S. Coll.), Live Oak Canyon, Kern County, California**; Type Tejon Eocene.

This species differs from *M. sopenahensis,* and from *M. cowlitzensis* Weaver, in having fewer and more reduced spines, shorter spire and canal, a double keel, and more inflated body whorl. It was mistaken by Dickerson for *M. sopenahensis* Weaver, from the Cowlitz Group of southern Washington.

3. [Typhis antiquus[49] Gabb]

Typhis antiquus GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 82, pl. 18, fig. 31, Div. B, **northeast of Martinez,** not listed from the type Locality of the Tejon Group.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 302.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 214, included as Tejon also. — HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197; Gabb's record copied.

The records of this species from the strata of the Tejon Group at its type locality seem to have been based on an error on the part of Gabb. We are unaware that it has ever been found there, and accordingly omit it from the fauna of this Group.

4. Tritonalia volutæformis (Dickerson)

Hemifusus volutæformis DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 67, pl. 8, figs. 4a and 4b.

This species was described from **Loc. 452 (U. C. Coll.),** of the Type Tejon Group, and the type specimen still remains its solitary representative, as far as we are aware. It falls naturally among the species which have been placed

[49] Names of species printed in small type and enclosed in brackets [ ] have been reported from the Tejon Group at the Type Locality but for some reason or other are herein excluded as a part of that fauna. Names in bold faced type are considered to be valid members of the fauna.

by Dall[50] in the above genus, and no basis is apparent for including it with typical *Hemifusus*. It is obviously allied to living *Ocinebra* of the Pacific Coast.

5. Pseudoliva inornata Dickerson

Plate 12, figure 1

Pseudoliva inornata DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 50, 62, 90, pl. 7, fig. 1a only, not 1b or 1c. (Fig. 1c is stated to be from the same specimen as 1a, but this is obviously an error) — DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 439, Type Tejon record.

Pseudoliva tejonensis Dickerson, Calif. Acad. Sci., Proc. 4th Ser. Vol. 5, 1915, pp. 44, 63, pl. 7, fig. 2, Loc. 245 (C. A. S. Coll.), Tejon locality.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 451, Type Tejon records.

Pseudoliva lineata GABB, DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 451, Type Tejon record.— Not *P. lineata* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 99, pl. 18, fig. 53, from Martinez, California.

Dickerson stated that *P. inornata* was described from Loc. 458 (U. C. Coll.), a Type Tejon station. The type specimen is a young, and somewhat worn example of what he described on a later page as *P. tejonensis* from an adult and more perfect specimen; this latter name is therefore a synonym, and as such must give way to the less fitting name, *P. inornata*. Dickerson's figures 1b and 1c are clearly made from the same specimen, which is without doubt from the Cowlitz group of southern Washington, and it belongs to a distinct species, possibly to a distinct genus, which is at present undescribed. We have no positive evidence to show that *P. lineata* Gabb, has ever been collected from the strata of the Type Tejon locality.

6. Pseudoliva volutæformis Gabb

Pseudoliva volutæformis GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 99, 223, pl. 28, fig. 212, near Fort Tejon. — GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 220, Tejon record. — HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— DICKERSON, Calif. Acad. Sci., Proc. 4th Ser. Vol. 5, 1915, p. 44, pl. 7, figs. 3a and 3b, Loc. 244 (C. A. S. Coll.), Tejon Group.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 439, 452, Type Tejon records.

[50] U. S. Nat. Mus. Bull. 112, 1921, p. 107.

This species was described from the type locality of the Tejon, where it is not abundant; we have seen but few specimens in the collections that have been examined. According to Zittel's Paleontology (Eastman's translation,) *Pseudoliva* is characterized by a small basal tooth, or notch, which corresponds to a groove on the body whorl, as is seen on the outer lip of some living species. In the Tejon form this tooth has not been seen, but the presence of the spiral groove on the body whorl indicates that there may be a projection on the lip as in *Monoceros*. The largest specimen figured by Dickerson measures 28 mm. in altitude; 17 mm. in diameter, and about 13 nodes are to be counted on the periphery of the whorl.

7. Whitneya ficus Gabb

Whitneya ficus GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 104, 224, pl. 28, fig. 216, near Fort Tejon.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 221.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— HARRIS, Science, Vol. 22, Aug. 1893, p. 97; it is stated this species is found in deposits of Claiborne age in Texas.— DICKERSON, Calif. Acad. Sci., Proc. 4th ser., Vol. 5, 1915, pp. 44, 69, pl. 9, figs. 5a, 5b, 5c, and 5d, Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 442, 453, Type Tejon records.

Strepsidura ficus (GABB), HARRIS, Acad. Nat. Sci. Phila. Proc. 1895, p. 71. Listed from Ft. Tejon, Calif. and Alum Creek Bluff, Texas.

This species was originally described from the type locality of the Tejon Group, and has usually been found there and so listed by subsequent collectors. The species is the type of the genus which seems to have several distinguishing features to separate it from its eastern analogues, such as *Bulbifusus* Conrad, *Sycum* Bayle, and others. The bald nuclear whorls, the cancellated sculpture of the young stage and the spiral sculpture in the adult are very constant in the species *ficus* and serve to distinguish the genus *Whitneya*.

8. Argobuccinum californicum (Gabb)

Tritonium californicum GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 154, 218, pl. 26, fig. 33; "rare in Tejon Group, Tejon."— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 294.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.

Nyctilochus californicus (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44, pl. 7, fig. 7; Loc. 458 (U. C. Coll.), Type Tejon section.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 427, 433, 451, Type Tejon records; ? not pl. 40, fig. 8, Loc. 1853 (U. C. Coll.), Marysville Buttes, California.

This species was described from the type locality of the Tejon Group, but is not abundant there. Gabb stated that there are "about two varices to a volution", a character belonging to the genus Gyrineum.[51] However, his figure shows one varix to about one-third of a whorl. The only specimen we have seen of the form came from Loc. 245 (C. A. S. Coll.), and is imperfect. The regularly rounded whorls, high spire, irregularly disposed varices, and roughly cancellated sculpture, without nodes or spines, places the shell in the genus *Argobuccinum*. The presence of nodes and a short spire in *G. kewi*, serve to distinguish it from the present one.

9. Argobuccinum tejonense (Gabb)

Tritonium (Trachytriton) tejonensis Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 154, 218, pl. 26, fig. 34; "Arroyo de los Alizos," Tejon — Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 294.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

Gabb's figure of this species was drawn from a specimen which was largely a cast but to which a small fragment of the shell was adhering, and the specimens which we have obtained are not perfect; altogether they indicate that the species is entirely distinct from any other in the formation from which they came. The irregular varices, short canal, and the anal siphon indicate that the form belongs to the genus *Argobuccinum*.

10. Bursa hornii (Gabb)

Plate 13, figures 3, 4, 8

Tritonium hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 94, 223, pl. 28, fig. 208; Alizos Creek, near Fort Tejon, but recorded also from Cochran's, near Mount Diablo.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Pal. Vol. 2, 1869, p. 218; Tejon Group, Tejon.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 294.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

[51] See Dall, Smiths. Misc. Coll. Vol. 47, 1904, p. 130.

Not *Nyctilochus hornii* (GABB), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, pl. 7, fig. 8, which is *Clavilithes californicus* (CONRAD).

Nyctilochus washingtoniana (WEAVER), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 50, 51; Type Tejon records; not pl. 7, fig. 9, from the Cowlitz Group of Washington.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 451, Type Tejon records.

Not *Cassidaria washingtoniana* WEAVER, Geol. Surv. Wash. Bull. 15, 1912, p. 38, pl. 3, fig. 28.

The figures included herewith are of specimens believed to represent the species Gabb had when he figured *T. hornii*. They agree very well with his description, though not so well with his figure which is quite unsatisfactory. In our specimens the varices are irregularly disposed, sometimes only appearing at the aperture; plications are present on the inner side of the outer border; in the upper angle of the aperture there is a decided anal sulcus, bounded below on the peristome and on the body whorl by a blunt denticle; this last feature places the species in the genus *Bursa* as defined by Dall[52] although the rather long canal seems to exclude it from any of the sub-groups he has indicated. The callus on the body whorl is raised at its outer margin into a sort of flange as in many species of this genus. An analogous species in the Cowlitz Group of Washington was named by Weaver, *Cassidaria washingtoniana,* which Dickerson perhaps confused with Gabb's species when he reported the northern form as occurring in the type section of the Tejon Group.

The species which he figured from Loc. 244 (C. A. S. Coll.) under the name *Nyctilochus hornii* we have determined as *Clavilithes californicus* (Conrad), while he has figured still another species as *hornii* from Loc. 672 (U. C. Coll.), the identity of which we cannot give at this time.[53]

11. [Cymatium cowlitzensis (Weaver)]

Ranella cowlitzensis WEAVER, Wash. Geol. Surv. Bull. 15, 1912, p. 41, pl. II, fig. 15, and pl. 3, figs. 26 and 27.

Not *Bursa cowlitzensis* (WEAVER), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49, 51, Type Tejon records.

Not *Nychtilochus cowlitzensis* (WEAVER), DICKERSON, (Op. cit.,) p. 44; listed from Locs. 244 and 245 (C. A. S. Coll.), and Loc. 452 (U. C. Coll.), Type Tejon records.

[52] Smiths. Misc. Coll. Vol. 47, 1904, p. 118.
[53] Univ. Calif. Publ. Geol. Vol. 9, 1916, pl. 42, fig. 3.

The species described by Weaver was from the **Cowlitz Group of southern Washington,** but it evidently belongs to the Genus *Cymatium,* of the sub-group *Gutturnium,* as Dickerson's figure demonstrates;[53a] it evidently is neither *Bursa* nor *Nychtilochus,* as supposed.

Although Dickerson stated that Weaver's species is a "characteristic and most abundant" form in the "Type Tejon" fauna,[54] we have been unable to find any example of it in any of the collections examined by us. Two small but unidentifiable specimens from Loc. 245 (C. A. S. Coll.) seem to belong to the genus *Cymatium,* but it cannot be shown that they are of Weaver's species, which, in our judgment, has not yet been found at the type locality of the Tejon Group.

12. Gyrineum kewi (Dickerson)

Plate 10, figure 4; plate 13, figure 12

Nyctilochus kewi Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, p. 64, pl. 7, figs. 5a and 5b, **Loc. 458 (U. C. Coll.), Grapevine Creek, Kern County, California.**—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421 and 451, Type Tejon records.

The species was described from immature specimens obtained at the type locality of the Tejon Group. The presence of the two rows of nodes around the body whorl, four between each pair of varices which are oppositely placed, was not mentioned. The nuclear whorls are three in number above the first varix, the earliest two being smooth. The transition from these to the cancellated sculpture of the upper spire is gradual. A full grown specimen, figured herewith, measures 41.5 mm. in altitude, and 26.5 mm. in diameter. The species is much like the living *G. gyrinus,* (L.), which is the type of the genus. It cannot therefore be placed with the giant tritons in the genus *Nychtilochus.* The Tritons were at one time considered by Dall to belong to the genus *Septa* Perry,[55] but Mathews and Iredale[56] showed that this name was preoccupied. Dall then selected *Nychtilochus* as the first available name for these huge living

[53a] Above citation, pl. 9, fig. 4.
[54] Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 51.
[55] Smiths. Misc. Coll. Vol. 47, 1904, p. 134.

shells of the tropics.[57] But this action was unfortunate and Iredale[58] showed the name to be inapplicable; he proposed the name *Charonia* Gistel, for the giant tritons. In 1915 Iredale[59] discussed the much involved subject at some length, adopted the family name Cymatidæ and otherwise disagreed widely with the arrangement of Dall's.

13. **Gyrineum uvasalis** Anderson & Hanna, new species

Plate 6, figure 1; plate 10, figure 5; plate 13, figure 13

Fusus tumidus GABB, DICKERSON, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 43; Type Tejon record.— Not *F. tumidus* GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 145, pl. 26, fig. 22, from the Martinez Group.

Fusinus tumidus GABB, DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 450; Type Tejon records.

Shell large and robust, spire high, and canal long and straight; whorls at least ten in number, including the nucleus; body whorl with nine blunt spines just above the periphery, below which the heavy spiral cords are inclined to be nodose; between these spiral cords, at the periphery of the whorls, there are five spiral threads; toward the upper whorls the spines become axial ribs, extending from one suture to another, while the spiral threads unite into uniform evenly spaced ribs; nucleus consisting of five quite smooth whorls, ending abruptly at the first varix; varices on opposite sides of the whorls, consisting of enlarged modifications of the axial sculpture on other parts of the shell.

Type: No. 829; paratypes, No. 830 and 872; Mus. Calif. Acad. Sci.; collected at Locs. 245 and 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California, by Bruce G. Martin, G. D.Hanna and M. A. Hanna; Type Tejon Eocene.

The specimen selected for the type, although somewhat imperfect, shows the essential characters fairly well, except the nuclear whorls. These are seen, however, on the paratype. The type is the specimen upon which was based the record of *Fusinus tumidus* (and *Fusus tumidus*) in the Tejon Group at its type locality by Dickerson, as it was so labelled

[57] Victorian Naturalist, Vol. 29, 1912, pp. 9-12.
[58] Nautilus, Vol. 26, 1912, pp. 58-59.
[59] Nautilus, Vol. 27, 1913, p. 55.
[59] Trans. New Zealand Institute, Vol. 47, 1915, p. 458.

by him. No other species of *Gyrineum* has been seen with which this one needs careful comparison for separation.

14. ["Tritonium (Trachytriton) fusiforme (Gabb)"]

Tritonium (Trachytriton) fusiformis GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pl. 18, fig. 45; figured without description.— GABB, Pal. Vol. 2, 1869, p. 155, with description. Said to be from the Tejon Group, Tejon.

Triton (Trachytriton) fusiforme GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 219.—COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 294.—ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.

Nyctilochus fusiformis (GABB), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 451, Type Tejon records.

Gabb described this species from the **type locality of the Tejon Group**, and it has been generally so listed in the literature, apparently from his records. We have been unable thus far to recognize the species in any of the large collections studied from there, and we suspect that the name represents a composite of more than one form. The original figure shows an immature varix, which makes the shell difficult to place generically. Until the original material can be studied and the type found, the only safe course seems to be to omit the name from the list of authentic species. Although Dickerson published the name as representing a species occurring at Loc. 245 (C. A. S. Coll.), he seems to have really felt some uncertainty in his identification, since in labelling the single specimen from this point he has written as follows: "*Hemifusus* n. sp. or *Tritonium fusiforme* Gabb? R. E. D." The specimen so labelled is an immature example of the species described herein as *Siphonalia tularensis* n. sp. The name *fusiformis* has been used so many times that it is improbable that it can be applied to the California fossil even if this should be validated.

15. ["Nyctilochus sp. a" and "Nyctilochus n. sp."]

Nychtilochus sp. a, DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44, Type Tejon record.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, and 451, Type Tejon records.

Nychtilochus n. sp. DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44, Type Tejon record.

The above records from the type locality of the Tejon Group are of course meaningless, especially to any one without access to the material so labelled by the author. But since the specimens are really fragmentary and indeterminate specifically, the records have no standing, and are disregarded. It is only for the purpose of completing the record that mention is made of them here.

16. Exilia waringi Dickerson

Exilia waringi Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 68, pl. 9, fig. 3, Loc. 244 (C. A. S. Coll.), Type No. 328, Live Oak Creek, Kern County, Calif.

(?) *E. harrisi* Dickerson, above cit., p. 43, also Loc. 244 (C. A. S. Coll.), *Nomen nudum.*— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 449, *Nomen nudum,* Type Tejon records.

Exilia waringi has several characters which distiguish it from others in west coast Eocene deposits. The apical angle of 25° is as large as in any of the species, and on the body whorl there are no sharply defined zones of spiral sculpture as in *E. fausta,* n. sp., but near the suture the threads are almost as fine as those near the base of the whorl. It differs from *E. dickersoni* in its larger apical angle, which, in the latter is only 21.5°.

The species resembles superficially Gabb's *Cordiera micropygma,* but the plaits on the columella of the latter species no doubt separate it generically from *Exilia.*

No description has appeared of "*Exilia harrisi*" of Dickerson's Type Tejon lists, and it is not possible to conjecture upon what the record was based.

17. Exilia fausta Anderson & Hanna, new species

Plate 8, figures 8, 9

Exilia dickersoni (Weaver), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 50, 51, Type Tejon Records.

Not *Fusus dickersoni* Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 50, pl. 3, fig. 29, and pl. 14, fig. 124, Cowlitz Group, Vader Washington.— Dickerson, above cit., pl. 9, fig. 9, Cowlitz Group, Washington.

Shell small, but robust, spire much less elevated than in *E. dickersoni* Weaver; apical angle 25°; suture impressed,

whorls rounded; body whorl with 19 axial ribs which extend downward slightly beyond the middle of the body whorl; axial ribs sinuous; body whorl having two distinct zones of spiral threads; on the upper portion of the whorl, adjacent to the suture, are six widely spaced threads, somewhat nodose where they cross the axial ribs; below these on the lower part of the body whorl, begins a zone of much finer spiral threads; columella calloused, canal long and straight.

Type: No. 820; paratype No. 821, Mus. Calif. Acad. Sci.; collected at Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California, by Bruce G. Martin; Type Tejon Eocene.

This species differs from *E. dickersoni* in the greater apical angle, shorter spire, and in the much finer spiral threads on the lower part of the body whorl. The apical angle agrees more nearly with that of *E. waringi* Dickerson, but it differs from that species in its coarser ribs, and in the two zones of spiral threads described above. Moreover, even in the young stage of *E. waringi,* the number of ribs is 22, as against 19 in ours. In Dickerson's species the spiral threads are nearly uniform over the entire body whorl, with the exception of three coarse ones near the suture.

18. **Exilia novatrix** Anderson & Hanna, new species
Plate 7, figure 10

Shell small, type composed of three whorls, but originally there were about seven; whorls slightly convex, with suture line sharply impressed and sinuous; apical angle 16.5°; body whorl bearing 14 heavy, slightly oblique axial ribs which extend from suture to suture on the upper whorls, but on the body whorl to only a short distance below the periphery; spiral sculpture consisting of 23 threads on the body whorl, where they are somewhat crowded; interspaces equal in width to the threads, except in the area indicated. Length of type, 8.8 mm., original length, about 12.5 mm.; diameter, 3.5 mm.

Type: No. 961, Mus. Calif. Acad. Sci., collected at Loc. 711 (C. A. S. Coll.) in Grapevine Creek, Kern County, Cali-

fornia, by G. D. Hanna and M. A. Hanna, June, 1921; Type Tejon Eocene.

This slender and graceful species is not closely related to any other in western Eocene deposits. In outline it is almost as slender as *E. perkinsiana,* described by Cooper from Marysville Buttes, but the latter species has the axial sculpture entirely subordinated to the spiral markings.

19. [Exilia perkinsiana (Cooper)]

Plate 9, figure 15

Pleurotoma perkinsiana Cooper, Calif. State Min. Bur. Bull. 4, 1894, p. 40, pl. 2, figs. 23 and 24, Marysville Buttes, California.

(?) *Exilia perkinsiana* (Cooper), Dickerson, Calif. Acad. Sci., Proc. 4th Ser., Vol. V, 1915, p. 94, pl. IX, figs. 2a and 2b.

Not *Exilia perkinsiana* Cooper, Dickerson, above cit., pp. 50, 51, Type Tejon records.— Not *E. perkinsiana,* Dickerson, Univ. Calif. Pub. Geol. Vol. 9, 1916, p. 426, Type Tejon record.

Cooper's species was described from Marysville Buttes, California; it is minute and has characteristic sculpture in which the axial ribs are subordinated to the spirals and the apical angle is only about 15°. Dickerson has figured some specimens from the Cowlitz Group, Washington, Loc. 183 (C. A. S. Coll.) as representing *E. perkinsiana.* We have not compared them sufficiently to affirm that they are identical, although this is possibly true. However, it is not possible for us to determine upon what he based his identification of Cooper's species in the Tejon Group at its type locality. Neither Cooper's species, nor the form from the Cowlitz Group have been found by us in any of the collections from there and we have no basis for including either of them in the fauna of this Group. Dickerson did not include *Exilia perkinsiana* in his formal lists of the Type Tejon species where it should naturally be expected, (pp. 421 and 449 of his latest paper) if he actually considered it to be a valid part of that fauna.

20. [Exilia diaboli (Gabb)]

Fusus diaboli Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 84, pl. 18, fig. 35, Cochran's, east of Mount Diablo.— Gabb, Pal. Vol. 2, 1869, p. 215, found above the coal at Cochran's also recorded from Tejon.— Cooper,

Calif. State Min. 7th Ann. Rept. 1888, p. 282.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

(?) *Exilia diaboli* (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 94, pl. 9, fig. I, Loc. 452 (U. C. Coll.). Dickerson's figure may possibly represent Gabb's species, or it may be a *Cowlitzia*. — (?) Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 449, Type Tejon record.

The type locality of this species is Cochran's, east of Mount Diablo, where it is said to occur above the coal, but in the second volume of California Paleontology Gabb recorded it at Tejon also.

While it cannot be stated positively that this species does not occur at the type locality of the Tejon Group, neither is there any positive evidence that it does so. A careful comparison of Dickerson's figure with that of Gabb shows sufficient differences for separation. The species figured by Gabb is more graceful in outline, and has many more vertical ridges to the whorl than that of Dickerson, which recalls the genus *Cowlitzia* from this locality. That Dickerson himself entertained doubts regarding the identity of his species with Gabb's is indicated, perhaps, by its omission from his formal list of Tejon species from the type locality on page 421, although it is indicated on page 449. On the whole we do not feel warranted in including this species as belonging to the Type Tejon, since we find nothing to positively confirm its occurrence there.

21. [Fusinus martinez (Gabb)]

Fusus martinez Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 82, pl. 18, fig. 32, **Bull's Head Point, northeast of Martinez, Cal.**; not listed from Type Tejon. — Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 302. — Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197.— Gabb, Pal. Vol. 2, 1869, p. 214, recorded from Type Tejon.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 282, recorded from Type Tejon.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15, recorded from Type Tejon.

(?) *Fusus* cf. *martinez* Gabb, Dickerson, Univ. Calif. Publ. Geol. Vol. 8, 1914, pp. 73, 82, 109, 115, recorded only from Martinez.

Not *Fusinus* cf. *martinez* (Gabb), Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 438, Type Tejon record.

This species has been listed from the type locality of the Tejon Group at various times, although it was originally

described from Bull's Head Point near Martinez. It is not now known upon what these records were based; we have seen no specimens from the Type Tejon that can be considered as identical with the one from Martinez. Dickerson recorded it from the Type Tejon only once, and since he did not list it in any of the formal tables where it would especially be expected to appear, this one record should perhaps be regarded as unintentional.

22. [Fusinus mathewsonii (Gabb)]

Fusus mathewsonii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 83, pl. 18, fig. 33, Martinez, California, only. — GABB, Pal. Vol. 2, 1869, p. 215, Martinez Group, Martinez, but no Type Tejon record.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 8, 1914, pp. 75, 77, 82, Martinez Group, Martinez, only.

Not *Fusinus mathewsonii* (GABB), DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 433, 450, Type Tejon records.

We have not been able to learn upon what basis the record of this species in the type locality of the Tejon Group rests. There is no evidence in the material at hand that it is found there, and Gabb did not indicate this locality as one of its habitats. Therefore, it is excluded from the valid list of reported Tejon species.

23. Clavilithes californicus (Conrad)

Plate 13, figures 1, 2

Clavatula ? californica CONRAD, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st Sess. 1855, p. 11, App. to Rep. of W. P. Blake. — CONRAD, Pac. R. R. Repts. Vol. 5, 1857, p. 322, pl. 2, fig. 11; Cañada de las Uvas, California.— *Carpenter,* Rept. Brit. Ass. Ad. Sci. 1864, p. 589. also, Smith. Misc. Coll. 252, 1872, p. 75.

Not *Clavella californica* CLARK, Univ. Calif. Publ. Geol. Vol. 11, 1918, p. 183, pl. 23, fig. 8, from supposed Oligocene strata.

Fusus californicus (CONRAD), GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 85, 222, pl. 28, figs. 205, and 205a. — Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.—GABB, Amer. Jour. Conch. Vol. 2, 1866, p. 89. — GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 302.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 215, Tejon Group, Tejon, etc.— HEILPRIN, Acad. Nat. Sci. Phila, Proc. Vol. 34, 1882, pp. 197, 203.— COOPER, Calif. State Min. 7th Ann. Rept., 1888, p. 282.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

Fusinus californicus (GABB) [err. for CONRAD], DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 368, 442, Type Tejon records.

Nyctilochus hornii (GABB), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 90, pl. 7, fig. 8; Loc. 244 (C. A. S. Coll.).— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 433, 439, 451, Type Tejon records; not p. 516, pl. 42, fig. 3; Loc. 672 (U. C. Coll.), north of Coalinga, California.

Leiorhynus californica (CONRAD), Amer. Journ. Conch. Vol. 1, 1865, p. 30.

Conrad described this species from the Cañada de las Uvas, Type Tejon locality, and it was later redescribed and refigured by Gabb in more recognizable form. Dickerson figured a specimen from Loc. 244 (C. A. S. Coll.) under the name *Nyctilochus hornii,* which is evidently Conrad's species as above indicated.

The nodose sculpture on the upper whorls, becomes obsolete on later whorls; indistinct axial ribs or ridges are irregularly disposed on the larger whorls, and in those characters it agrees with some of the European species of the genus *Clavilithes,* as for example, *C. deformis* (Solander), as figured by Grabau.[60]

The name, *Clavella californica,* given by Clark to a supposed Oligocene species in 1918, probably conflicts with the name of this Eocene species.

24. Latirus sinuatus (Gabb)

Plate 13, figures 14, 15

Fasciolaria sinuata GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 101, 224, and pl. 28, fig. 213, 213a.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 220.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— COOPER, Calif. St. Min. 7th Ann. Rept. 1888, p. 282.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 74, pl. 11, figs. 3a and 3b, Nos. 347 and 348, (C. A. S. Type Coll.) — DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 438, 449, Type Tejon records.

This species was described by Gabb as a *Fasciolaria* from near Fort Tejon, and he listed it from San Diego. It is very abundant in some of the collections from the type locality of the Tejon Group, especially those from Live Oak Canyon. Its outward characters are very constant and sim-

[60] Smiths. Misc. Coll. Vol. 44, p. 120, pl. 14, figs. 1, 3, and 4.

ple. As Dickerson pointed out, the columellar plaits are not visible from the aperture, but we have shown them on a broken specimen. In referring the form to the genus *Latirus* we have followed the example of Pilsbry, who regards those forms with nodose shells and plicate columellas with straight canals as belonging in this group.

25. Latirus whitneyi (Gabb)

Tritonium whitneyi GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 96 and 223, pl. 28, figs. 210 and 210a, Alizos Creek, near Fort Tejon.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 218.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 294.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15. — DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, Type Tejon record only.

Nychtilochus whitneyi (GABB), DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 427 and 442, and listed as *N. cf. whitneyi* on page 427.

This species was described from the type locality of the Tejon Group and has not certainly been found elsewhere. Dickerson noted it as one of the "characteristic forms of the type locality of the Tejon", (p. 427), but he omitted it from his formal lists of such pp. 421 and 451, without giving a reason. On his pl. 41, fig. 9, is shown a specimen bearing the name of *N. whitneyi,* found at Marysville Buttes, but which may be a distinct species. Gabb's record of it at San Diego on the basis of a cast seems to be of doubtful validity; we have been unable to identify the species with confidence in any of the collections studied from there. Its close resemblance to *Latirus sinuatus* (Gabb) has induced us to place it in this genus, but for reasons already explained it cannot be included with the giant living tritons in the genus *Nychtilochus,* if that name be used for the group as has been proposed.

26. Chrysodomus ruckmani Dickerson

Chrysodomus ruckmani DICKERSON, Calif. Acad. Sci., Proc. 4th ser., Vol. 5, 1915, pp. 43, 65, and 66, pl. 7, fig. 11; Loc. 452 (U. C. Coll.). — *C. ruckmani* DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421 and 449; Type Tejon records.

On page 43 of the first publication cited the species is listed from Locs. 451 and 458 (U. C. Coll.) but in the description of the species the type locality is given as 452 (U. C. Coll.). An examination of the specimen figured showed that an error was made in preparing the list occurring on page 43; Loc. 452 is correct. The species is small and inconspicuous, and while it may not belong to the genus *Chrysodomus,* any other reference at present seems insecure. It was originally described from Grapevine Creek, and is, therefore, a species belonging to the Type Tejon Group.

27. ["Chrysodomus supraplicata (Gabb)", Dickerson]

? *Neptunea supraplicata* Gabb, Geol. Surv. Cal. Pal. Vol. 1, 1864, p. 89, pl. 18, fig. 40, **San Diego, Calif.**

Not *Chrysodomus supraplicata* (Gabb), Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 426, 427, 432 and 438, Type Tejon records.

This species was originally described from imperfect material found at San Diego, and Gabb did not mention its occurrence at the type locality of the Tejon Group. While it may possibly be found there by further search, we have seen no specimens upon which to base a statement that it has been. Dickerson has stated (p. 427) that the species is one of the "characteristic forms at the type locality of the Tejon", but he omitted it without explanation from his formal lists of such species on pages 421 and 449. On the strength of existing evidence the name must be omitted from the list of authentic Tejon species.

Siphonalia A. Adams

This genus has been a receptacle for a great many names of diverse forms of living and fossil shells. The type species is *S. cassidariæformis* Reeve from Japan[61] which has been figured by Tryon[62] and others. Upon comparison of this with the west American Eocene species which have been referred to the genus it seems very doubtful if the latter are congeneric. Thus we have *sutterensis, sopenahensis,*

[61] Adams, Ann. Mag. Nat. Hist. 3rd ser. Vol. 11, 1863, p. 202.
[62] Man. Conch. Vol. 3, 1881, p. 135, pl. 55, figs. 364-369.

bicarinata and *tularensis* forming a natural group. Analagous species are found in the Eocene of the southeastern States and in Europe and it has been customary to refer them all to *Siphonalia.* While we doubt the permanence of this procedure it does not seem that a paper such as the present one is the proper place to make such major changes of nomenclature as would be involved in an attempt to straighten out the irregularities. They more properly belong to the field of the monographer.

28. **Siphonalia tularensis** Anderson & Hanna, new species

Plate 10, figure 1; plate 11, figure 7

Siphonalia bicarinata Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44 and 50, Type Tejon records; not p. 66, pl. 8, figs. 1a, 1b, 1c, 1d.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 450, Type Tejon records.

Shell of moderate size, spire high, having seven or eight whorls, and a relatively short canal; body whorl convex below the upper angle, sloping and straight above; sculptured by two, sometimes by three prominent revolving cords, bearing spines which are also connected by vertical ribs on the body whorl; ornamented also by numerous spiral lines of two orders; those on and near the base of the whorl alternately heavier and finer, but all coarser than those above the base; upper whorls angulated by a single row of spine-like tubercules, passing into vertical ridges that reach the suture below; vertical ribs extending over the body whorl as well, but diminishing on the upper slope; suture undulating above a distinct collar; canal short, slightly recurved, and smooth near the aperture, though not calloused, only slightly notched at the terminus.

Type: No. 854, paratypes, Nos. 855, 856 and 857, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

The nearest analogue of this shell is *S. bicarinata* found in the Cowlitz Group of Washington. The following notes are based upon an examination of more than 60 well preserved specimens of all sizes from there and eight good

but less perfect examples from the type locality of the Tejon Group. The Tejon species is nearly twice the size of the Cowlitz, even for the same number of whorls; it has a more rugged sculpture and outline, and in mature specimens there are as many as three strong revolving cords which cross the vertical ribs forming elevated spines. On the Cowlitz form only two stronger revolving threads are to be seen forming spines on the vertical ribs, and in the majority of specimens there is a single spiral line so developed. The canal is longer in the Tejon species, and is less deeply notched at the terminus; the spines are rounded and tubercle-like but in the Cowlitz form they are flattened and expanded laterally, thus presenting a very different appearance.

29. [Siphonalia sopenahensis (Weaver)]

Tritonium sopenahensis Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 40, pl. 1, fig. 6, **Cowlitz Group, Vader, Washington.**

Hemifusus sopenahensis Weaver, above cit., p. 44, pl. 1, figs. 2 and 3, Cowlitz Group, with the preceding.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser, Vol. 5, 1915, pp. 67, 92, pl. 8, figs. 2a and 2b, apparently also from the Cowlitz Group, Washington.

Not *Nyctilochus sopenahensis* (Weaver), Dickerson, Cal. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 44, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 451, Type Tejon records.

A critical study of 48 well preserved specimens from the Cowlitz Group, near Vader, Wash., (Weaver's type locality), including three cotypes furnished by Dr. Weaver himself, and two plesiotypes figured by Dr. Dickerson, has convinced us that the specimens described and illustrated by Weaver as two distinct species (and genera!) are identical specifically, and the names are therefore synonymous. But the species represented by these specimens appears to belong to the genus *Siphonalia,* as generally used in west American paleontology, and not to either of the genera to which it has been referred. However, no specimens referable to either of the names proposed by Weaver have been found in the locality of the Type Tejon, and at present we find no reason for including it in the fauna of this Group. Two specimens that may represent an analogous species have been found, but the preservation does not permit of their specific determination.

30. Pseudoperissolax blakei (Conrad)

Plate 10, figure 10; plate 12, figure 6

Busycon ? blakei CONRAD, House Doc. 129, proj. Vol. 3, 33d Congress, 1st sess. 1855, p. 11, **near Fort Tejon, California,** unfigured.—*B. ? blakei* CONRAD, Pac. R. R. Repts. Vol. 5, 1857, p. 322, pl. 2, fig. 13, **Cañada de las Uvas, near Fort Tejon.**— CARPENTER, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. No. 252, 1872, p. 75.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 368.

Perissolax blakei (CONRAD), Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 92, 223, Type Tejon records, but not pl. 21, fig. 110, from Div. B, near Martinez.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 149 and 217, Type Tejon records.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 197, 207.=Levifusus.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 289, Type Tejon records.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.— DICKERSON, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, pp. 44, 98, pl. 11, fig. 4, Loc. 244 (C. A. S. Coll.), Tejon locality.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 433, 439, 451, Type Tejon records.

Levifusus blakeyi [Typ. err. ?], (Conrad), Amer. Jour. Conch. Vol. 1, 1865, p. 17; Vol. 2, 1866, p. 99, (stated that the genus is not *Perissolax,* but the species is allied to *Levifusus trabeatus* Conrad, of Alabama Eocene strata.) — HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 207.

Perissolax tricarinatus WEAVER, DICKERSON, Univ. Calif. Publ. Geol. Vol. 8, 1914, p. 113, stated to "occur abundantly in the type section of the Tejon near Fort Tejon."—Not of Weaver, Univ. Calif. Publ. Geol. Vol. 4, 1905, p. 121, pl. 13, fig. 9.

Pseudoperissolax blakei (CONRAD), CLARK, Univ. Calif. Publ. Geol. Vol. 11, 1918, p. 180, Conrad's species named as type of new genus, from Type Tejon locality.

This is one of the species originally described from the boulder of Cañada de las Uvas, now Grapevine Canyon. Conrad was unable to place the species generically to his satisfaction, and Gabb placed it in his genus *Perissolax,* the type of which was *Fusus longirostris* d'Orb. from the Cretaceous of Chile.[63] Conrad, mistaking the generic characters of *Perissolax,* placed in it the species now known as *Ficopsis hornii* (Gabb), etc.,[64] but later he decided that *Perissolax* was a peculiar genus with only one species, and

[63] Proc. Am. Phil. Soc. Vol. 8, 1861, p. 122.
[64] Amer. Journ. Conch. Vol. 1, 1865, p. 363.

that his *Busycon* ? *blakei* belonged to the genus *Levifusus;* this, however, does not appear to be admissible. Dr. B. L. Clark recognized the generic distinction between the Cretaceous type of Gabb's genus, *Perissolax,* and *B.* ? *blakei* of Conrad, and proposed the last as the type of a new genus, *Pseudoperissolax.*

The extraction of perfect specimens from the matrix from Conrad's type locality, including the nuclear and young stages, shows that the essential differences between this Eocene form and the recent species of *Columbarium* Von Martens,[65] as represented by *C. pagoda* (Lesson),[66] are small, but differences in the texture of the shell, the presence of spiral sculpture in the Tejon species, but absent from *Columbarium,* induces us to retain the name proposed by Clark.

A review of the subject, and of the other species which have been referred to *Perissolax* is needed, but cannot be given fully here. Gabb proposed the genus for *Fusus longirostris* d'Orbigny, and included in it *F. trivolvus* Gabb, also from the Chilean Cretaceous. In 1864 he referred his new species *P. brevirostris* to the same genus; it came from strata of the Chico-Cretaceous.[67] At the same time he referred Conrad's species to the same genus, but described and figured a specimen from near Martinez, to represent it.[68] Conrad recognized the difference between this form as described and figured, and his Tejon form, and apparently proposed for the Martinez form the name *Perissolax gabbi.*[69] No further description was given, and no reference made by which it could be identified, as Gabb has pointed out,[70] so that this name stands as a *nomen nudum.*

In 1905 Weaver described and figured a fragmentary specimen from Martinez as *P. tricarinatus,*[71] and Dickerson made the remarkable statement that this species "occurs abundantly in the type section of the Tejon near Fort

[65] Conch. Mitth. 1881, p. 105.

[66] Illust. Zool. 1831, pl. 40.

[67] Geol. Surv. Calif. Pal, Vol. 1, p. 91, pl. 18, fig. 43.

[68] Above cit. p. 92, pl. 21, fig. 110.

[69] Checklist, Eocene and Cretac., Smith. Misc. Coll. No. 200, 1866.

[70] Pal. Vol. 2, p. 150.

[71] Univ. Calif. Publ. Geol. Vol. 4, 1905, p. 121, pl. 13, fig. 9.

Tejon." It might be interpreted that this remark was an unintentional error, or that he alluded to *P. blakei,* were it not for the fact that he included also *Schizaster lecontei* Merriam; this also is a Martinez species, not known at the type locality of the Tejon. He has not subsequently referred to Weaver's species from the Type Tejon, and it is not included in any of his formal lists of Tejon species in his latest paper.[72] However, in this later paper he described from a fragmentary specimen, presumably from the Martinez Group, Loc. 532 (U. C. Coll.), a form for which he proposed the name *P. gabbi,* but does not refer to Conrad's use of this name.[73]

It appears likely, from a comparison of the figures, that the three names, *P. gabbi* Conrad, *P. tricarinatus* Weaver, and *P. gabbi* Dickerson, all denote the same thing, namely, the Martinez form which Gabb erroneously called *P. blakei.* If so, Weaver's name should take precedence.

In 1918 Clark proposed the name *Pseudoperissolax* for the genus of *Busycon* ? *blakei* Conrad, and a new species was added from the San Lorenzo, Oligocene, under the name *P. merriami* Clark. As most of the various figures and descriptions of species referred to *Perissolax* have been made from fragmentary specimens, it is impossible to determine whether they all belong to the same genus or not.

31. **Cominella colemani** Anderson & Hanna, new species

Plate 7, figure 5; plate 9, figure 14

Shell slender and graceful, spire high, consisting of about eight whorls, which are slightly rounded; nucleus consisting of about two smooth and polished whorls; remainder of spire composed of whorls having numerous rounded, slightly oblique axial ribs extending from suture to suture; thus the subsutural collar is beaded, and the depressed groove beneath it is crossed by the vertical ribs which do not, however, show on the bottom of the groove; four rounded spiral grooves are developed on the base of the body whorl, while

[72] Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 449, etc.
[73] Above cit. p. 497, pl. 37, fig. 14.

on the upper part of this whorl spiral markings are to be seen on the ridges forming impressed lines which correspond in position to the major grooves below, were they continued over the whorl; these faint lines are visible only in oblique light; outer lip thickened within, but without teeth, except for a conical denticle opposite the subsutural groove; canal short and not recurved, or only slightly so. Length 20.2 mm.; diameter, 10 mm.; length of aperture, 10 mm.

Type: No. 895; paratype No. 896; Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna, at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

This species is very distinct from all others in the west coast Eocene deposits. The only western member of the genus other than the two listed herein is *Cominella eocenica* (Weaver), from the Cowlitz Group of southern Washington, but it seems to be hardly analogous to either of the Type Tejon forms.

C. colemani is named in honor of Mr. Rufus A. Coleman, of the U. S. Bureau of Fisheries, who made a very considerable collection of Eocene fossils at Rose Canyon, near San Diego, California, which he presented to the California Academy of Sciences.

32. Cominella tejonensis (Dickerson)

Molopophorus tejonensis Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 66, pl. 8, figs. 3a and 3b; **Loc. 245 (C. A. S. Coll.), near Grapevine Creek, Kern County, California.**

Although this species was originally described from the type locality of the Tejon Group it has not been included in any of the lists of Tejon species where it should be expected. In its distinctive characters it is quite unlike *Molopophorus striata* Gabb, which stands as the type of that genus, and is from the same locality. This latter species is more robust, or globose, has much stronger axial ribs, and is without spiral sculpture. Only a few specimens of *C. tejonensis* have thus far been found. The flat sided

whorls and subsutural depression leave little cause for doubt that the species belongs in the genus *Cominella*.

33. **Phos blakianus** Anderson & Hanna, new species

Plate 8, figure 16; plate 11, figures 8, 9

(?) *Hemifusus lewisiana* Weaver, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 450, Type Tejon records.— Not *H. lewisensis* Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 14, *Nomen nudum,* and not *H. lewisana* Weaver, Opt. cit. p. 46, pl. 1, fig. 9, Cowlitz Group, Little Falls, Washington.

Shell composed of about six whorls; spire conical, with lightly impressed suture; sides of whorls slightly convex; canal lengthened so that the shell is almost biconical; sculpture consisting of 16 spiral cords on the body whorl, with interspaces equal in width, crossed by strong lines of growth; nuclear whorls marked by two spiral beaded lines; these followed on the larger whorls by nodose spiral cords, the nodes being stronger and more regular on the upper whorls; nodes not noticably arranged in axial rows on the type, but on the paratype they are so arranged; on the latter also a minor thread between the cords is indicated, but is less prominent on the type; columella bearing a plait above the terminus of the canal; outer lip denticulated with 12 low rounded lamellæ but not greatly thickened; altitude, 16.5 mm.; diameter, 8.3 mm.

Type: No. 844; paratypes, Nos. 845 and 846, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), near Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

The two paratypes here figured formed the basis of the record by Dickerson of *Hemifusus lewisiana* at the type locality of the Tejon Group, but they differ specifically from Weaver's species; it appears also to belong to *Phos,* a "cotype" having been examined in the collections of the Academy of Sciences. It is larger and otherwise distinctly marked.

The species is named for William P. Blake, Geologist of the Williamson contingent of the Pacific Rail Road Survey.

34. ["Nassa cretacea" Gabb]

Nassa cretacea Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 97, 223, pl. 18, fig. 49, near Martinez, not listed from the Tejon.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. III, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 219, listed also from Type Tejon locality for the first time. —Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 287.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.

There appears to be no valid basis whatever for listing this species from the locality of the Type Tejon Group, where it appears not to belong. It was described from the Martinez Group, and is said to be "not rare at Bullshead Point." From the figure and description it is not possible to determine if it has been referred to the correct genus. The form and sculpture contain no very distinctive features, and it may belong to any one of two or three genera.

35. Molopophorus striata Gabb

Plate 8, figure 14

Bullia (Molopophorus) striata Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 157 and 219, pl. 26, fig. 36.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 277.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 14.

Molopophorus striata Gabb, Dall, U. S. Geol. Surv. Prof. Ppr. 59, 1909, p. 45.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 92, pl. 8, fig. 6 (given as fig. 7 in explanation), Loc. 244 (C. A. S. Coll.), Plesiotype, No. 325.

This distinct species was described from the type locality of the Tejon Group, and has not been recorded as occurring elsewhere. Dickerson's plate figure and explanation do not agree, and on p. 67 he refers to it as occurring on Plate 8, fig. 3c; this is an error, as no such number is found on Pl. 8, the correct figure being 6. The species does not seem to have grown to much over six millimeters in length, and is characterized by strong axial ribs and the absence of any spiral sculpture. The specimen Dickerson figured is now in the collections of the Academy of Sciences, and is from Loc. 244 (C. A. S. Coll.), Bruce G. Martin, collector.

36. Voluta martini Dickerson

Voluta martini Dickerson, Calif. Acad. Sci., Proc. 4th Ser, Vol. 5, 1915, pp. 44, 76, pl. 11, figs. 14a and 14b, **Loc. 244 (C. A. S. Coll.), Type Tejon locality.**— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 453, Type Tejon records.

The apex of the type specimen of this species unfortunately is missing, and it is, therefore, not possible to determine positively the genus to which it properly belongs, but it would appear that it is either *Volutilithes* Swainson, *Plejona* Bolten, or *Volutospina* Newton. Regarding the former, Dall has stated[74] that, as represented by the type, *V. muricina* Lamarck, it is not found in the American Tertiaries. In another paper, however, it was stated that the genus is found in the Eocene.[75] The genus *Plejona* was revived by Dall[76] for the group typified by *V. spinosa* Lamarck, but this decision has not always been accepted.[77] Newton proposed the name *Volutospina,* with *V. spinosa* Lamarck, as the type, in order to clear up the tangles of nomenclature. It appears that the only conchological differences in these forms lie in the nuclear whorls, and since these are lost in the type of Dickerson's species it is perhaps best to continue the use of the name *Voluta* for the present. Regarding this genus Dall has stated[78] that the first representatives of the group appeared in the Eocene.[79]

37. ["Volutilithes n. sp." Dickerson]

Volutilithes n. sp. Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, p. 44, listed from Loc. 459 (U. C. Coll.), Type Tejon.

No information has been obtained regarding the above record except what it contains in itself. In the collection from Loc. 459 which is at the University of California we have been unable to find a specimen belonging to the family *Volutidæ.*

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[74] Smith. Misc. Coll. Vol. 48, p. 354, Feb. 4, 1907.

[75] Smith. Misc. Coll. Vol. 50, p. 13, Mar. 7, 1907.

[76] Nautilus, Vol. 19, 1906, p. 143.

[77] R. Bullen-Newton, Proc. Mal. Soc. London, Vol. 7, 1906, pp. 100-103. Burnett Smith, Nautilus, Vol. 20, 1907, pp. 129-131.

[78] Smith. Misc. Coll. Vol. 47, 1907, p. 345.

[79] Above cit. Vol. 50, 1907, p. 13, it is listed first in the Miocene.

38. Mitra alizalis Anderson & Hanna, new species

Voluta sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 76, pl. 11, fig. 15, **Loc. 244 (C. A. S. Coll.) Live Oak Creek, Kern County, Calif.**— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 421, Type Tejon record.

Whorls five, rounded, suture impressed; upper two whorls smooth, the remainder corrugated with rounded axial ribs, of which the last whorl bears 23 extending from the suture in a sinuous course; spiral channels about as far apart as the ribs on that part of the body whorl opposite the columellar plaits; columella bearing four high spiral plaits, only the upper three of which are preserved on the type specimen; the elongated columella shown in Dickerson's figure does not appear in the specimen; altitude, 4.7 mm.; diameter, 3.1 mm.

Type: No. 361, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

This very distinct species has a more elongated analogue in the Eocene of the Paris Basin, in the *M. crebricosta* of Lamarck, figured by Cossman and Pissarro.[80] The type specimen is the only one found, and the canal has been lost so that the true length cannot be given accurately.

39. Mitra murietta Anderson & Hanna, new species

Plate 8, figures 12, 13

Mitra simplicissima Cooper, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 427, 439, Type Tejon records.

Not *Mitra simplicissima,* Cooper, Calif. State Min. Bur. Bull. No. 4 1894, p. 45, pl. 2, fig. 41, Rose Canyon, San Diego County, Cal.— Dickerson, first citation above, pl. 11, fig. 12, also Rose Canyon, San Diego County, California.

Shell short, stout, body whorl inflated; consisting of six convex whorls; spire moderate in height, with apical angle of 40° to 45°; suture deeply impressed; body whorl having an obtuse angulation above, producing a shoulder; canal of

[80] Icon. Eocene, Vol. 2, 1913, pl. 41, fig. 202-5.

medium length, slightly recurved; except for some exceedingly faint striations on the outer part of the canal, the surface is marked only by lines of growth; four strong plications on the columella; outer lip not thickened. Altitude 14.2 mm.; diameter 7.3 mm. Original altitude of type about 17 mm.

Type: No. 834; paratype, No. 835, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

The short spire, relatively wide apical angle, angulated body whorl and recurved canal serve to distinguish this species from *M. simplicissima* Cooper. Besides the two examples of *M. murietta* mentioned in the description, six others are in the collections of the Academy of Sciences from the type locality, all of which lack the characteristic features of Cooper's species, as figured and described by Cooper and Dickerson.

The species is named for Joaquin Murietta, a famous bandit who terrorized the caravans of the Tejon region and the San Joaquin Valley in pioneer days. (See Pac. R. R. Repts. Vol. 5, 1857, p. 192.)

40. **Mitra slevini** (Dickerson)

Voluta slevini Dickerson, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, pp. 34, 44, 75, pl. 11, fig. 16, **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** Type Tejon locality.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 453, Type Tejon records.

A glance at Dickerson's figure of this species is sufficient to show that it does not belong to the genus *Voluta.* Dickerson himself seems to have recognized this fact, since in preparing his table of contents, (p. 34, first reference above) the species is given as *"Mitra slevini"*, but he neglected to make the change in the text. The species is strongly cancellated, not differing greatly from several liv-

ing representatives of the genus. Only one specimen, the type, has thus far been found. The species was named for Joseph R. Slevin, of the California Academy of Sciences.

41. Mitra uvasana Dickerson

Plate 10, figure 6

Mitra uvasana Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 75, 98, pl. 11, figs. 13a and 13b, **Loc. 245 (C. A. S. Coll.)**, Type Tejon Group. [Loc. 244, given with the figures is erroneous.]—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 439, 450, Type Tejon records.

This fine species is not common in the strata of the Tejon Group at the type locality, and only a few specimens have been found there. The specimens figured by Dickerson are defective, and a much better one is given herewith for a more complete representation of the species. It was found at Loc. 711 (C. A. S. Coll.) in Grapevine Canyon, and measures as follows: altitude, 40 mm.; diameter, 13.9 mm.

42. Marginella adumbrata Anderson & Hanna, new species

Plate 9, figure 2; plate 15, figure 6

Shell small but robust; spire short, suture line not impressed; whorls about three, with nucleus round and bead-like; aperture with five heavy plications on the lower columellar wall; canal area bounded by a raised line on the outside of the shell marking the progressive growth; color pattern preserved on the type, and consisting of parallel, zigzag, axial lines which make sharp angles; outer lip on the type broken away, not showing terminal edge. Altitude, 4.3 mm.; diameter, 2.2 mm.

Type: No. 968, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.) in Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

The type specimen of this minute species is unique, and thus far is the only high spired representative of the genus found in the fauna of the Type Tejon Group. The color markings are such as are sometimes seen on certain members of this genus as well as on species of *Olivella,* but the plications of the columella are diagnostic. The specimen was embedded in excessively hard, fine grained sandstone which accounts for the remarkable state of preservation.

43. **Marginella multifilosa** Anderson & Hanna, new species

Plate 7, figures 2, 3

Shell small, robust, spire short, rounded and covered with a glossy and shining testaceous deposit which obscures the suture; apical angle 117°; basal angle, 54°; surface marked by numerous axial lines which appear to be remnants of an original color scheme prior to the deposit of the outer covering; aperture narrowly elongate; outer lip thickened without and within, and having ten rounded tubercle-like teeth on the lower part of the inner surface; canal large and deep; parietal wall bearing six plications entering the aperture, the upper one being smaller, and the lower larger, than the others, the latter continuous outside of the aperture for a short distance around the edge of the canal; an area on the upper part of the parietal wall heavily covered by a callous deposit; between the second and third plications from the canal, a constriction of the shell makes the outline angularly concave at this point; length, 2.7 mm.; diameter, 1.9 mm.

Type: No. 456; paratype No. 957, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

The foregoing is a description of the type specimen. Among a series of 15 individuals very little variation was displayed, except by the one selected for the paratype; it has a somewhat higher spire, and a less pronounced constriction at the base of the shell, but these differences do not seem to warrant specific separation at present. The species is abundant in some of the harder layers of sandstone.

44. **Olivella mathewsonii** Gabb

Plate 8, figure 19

Olivella mathewsonii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 100, pl. 18, fig. 53; described as coming from "northeast of Martinez," but recorded also from **Alizos Creek, near Fort Tejon.**— GABB, Calif. Acad. Nat. Sci. Proc. Vol. III, 1867, p. 303.—GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 220; some additional localities given.—HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— COOPER, Calif. St. Min. 7th. Ann. Rept. 1888, p. 289.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.— DICKERSON, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, pp. 44, 50, 51.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 439, 451.

Ancillaria elongata GABB, DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, listed from Tejon localities.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 432, 438, and 448, Type Tejon records.— Not of GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 100, pl. 18, fig. 54, from San Diego.

Although Gabb mentioned Martinez first in his list of localities for this species, his figure and description of it agree so exactly with some of the specimens from the locality of the Tejon section that we are inclined to believe that his type was actually selected from material brought from Alizos Creek, near Fort Tejon, where he said the species was very abundant.

Length and diameter vary somewhat, and Gabb seems to have figured an immature specimen. Measurements of six individuals give an average altitude of 15.6 mm., and a diameter of 6.1 mm. while Gabb's type was only 9 mm. long, and less than 3 mm. in diameter. Except for its small size this species might well be placed in the genus *Oliva,* some modern forms of which it much resembles.

Dickerson reported *Ancillaria elongata* from the locality of the Type Tejon in all of his more complete lists, but all the specimens so labelled by him in the collections of the Academy of Sciences are indistinguishable from *O. mathewsonii* Gabb. The San Diego form is longer and more slender, has the suture line completely covered by shell substance, and has a narrower aperture. Through the courtesy of

Marcus A. Hanna many well preserved specimens from the type locality at San Diego were sent to us for comparison with the Tejon forms. No species of *Ancillaria* has been collected at the locality of the Type Tejon, so far as known to us.

45. Cancellaria paucivaricata (Gabb)

Plate 8, figures 3, 4

Tritonium paucivaricatum Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 95 and 223, pl. 28, figs. 209 and 209a; described from **Alizos Creek, near Fort Tejon.**—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 218.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 198, 213.=*Cancellaria.*— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 294.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.

Cancellaria stantoni Dickerson, Calif Acad. Sci. Proc. 4th ser., Vol. 5, 1915, pp. 43, 49, 51; Type Tejon records; listed from Locs. 244 and 245 (C. A. S. Coll.), and from Locs. 452 and 458 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 427, 432, 438, and 448; all Type Tejon records; Not p. 510, pl. 39, fig. 9, from Loc. 2225 (U. C. Coll.), **north of Oroville, California.**

Not *Cancellaria stantoni* Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 282, pl. 12, figs. 2a and 2b, locality 1853 (U. C. Coll.), Marysville Buttes, Sutter County, California.

Cancellaria marysvillensis Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 442; Type Tejon record; *nomen nudum.*

This species is very common in the collections made at Loc. 244 (C. A. S. Coll.), in Live Oak Canyon, by Bruce G. Martin. Gabb's reference of it to the genus *Tritonium* is not surprising in view of the hard character of the matrix rock. Dickerson followed Heilprin correctly in referring it to *Cancellaria,* though we cannot agree that it is identical with the species listed and described by the former from Table Mountain and Marysville Buttes as *C. stantoni.* If this were true then Gabb's name would have precedence. The name listed by Dickerson, *C. marysvillensis,* is a *nomen nudum.*

46. Terebra californica Gabb

Plate 8, figure 18

Terebra californica Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 162, 223, pl. 27, fig. 41, **Tejon Group, Martinez.**— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 211.— Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, p. 44, Loc. 244 (C. A. S. Coll.), Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 427, 434, 453, Type Tejon records.

This species was said to have been described from the Tejon Group at Martinez, and was not listed from the Type Tejon locality until 1915. The specimens found in the collections of the Academy, labelled "*Terebra californica*", by Dickerson, from Loc. 244 (C. A. S. Coll.) prove to belong to another genus (see *Turbonilla gesteri*) and we have seen but one specimen of the species, from the type locality of the Tejon Group. It came from Grapevine Creek, Loc. 711 (C. A. S. Coll.). Except for the slightly greater obliquity of the axial ribs the specimen does not seem to differ in any way from Gabb's figure; the form and number of whorls are the same; apical angle 10°; sides of spire straight; spiral sculpture absent; sub-sutural depression distinct, forming a sort of collar, as Gabb's showed; shell slightly longer than that of Gabb.

Surcula H. and A. Adams

This genus-name has long been used in west American paleontology for certain species which were formerly referred to *Pleurotoma* or other names. The orginal use of *Surcula*[81] was to replace *Turricula* Schumacher[82] in the belief that this was preoccupied by a non-binomial writer, Klein. It has recently been shown by Iredale[83] that this action was unwarranted and Schumacher's name must stand. *Turricula* was based upon figures of *Murex tornatus* Dillwyn[84] which show a shell of usual *Surcula-Pleurotoma* shape but without nodes, beads or spines. *Surcula,* on the other hand, has a

[81] H. & A. Adams, Gen. Rec. Moll. Vol. 1, 1853, p. 88.
[82] Essai Nouv. Syst. Vers. Test. 1817, p. 217.
[83] Proc. Malac. Soc. London, Vol. 12, 1917, p. 324.
[84] Chemnitz, Conch. Cab. Vol. 4, pl. 143, figs. 1337, 1338.

nodose species, *Murex javanus* Linnæus as type. It has been claimed that both species are congeneric and the name *Surcula* must be relegated to a rank of no greater importance than a minor section of *Turricula*. This action has already been taken by such well known authorities as Iredale, Dall[85] and Hedley.[86]

Nevertheless, we have continued to use the name *Surcula* in its usual generic sense although it seems likely that it will soon be entirely displaced. Our reason for so doing has been the fact that the Eocene strata of western America contain a group of species which have been referred to *Surcula* in the past for want of a better place to put them. These are represented by such as *Surcula io* (Gabb). They obviously do not belong to the same genus as *Surcula cohni* Dickerson, for instance. Gabb stated in 1876[87] that there was no suitable name for the group but it seems unlikely that this has remained true to the present time. It would seem that some investigator would have discovered the distinctness of the group and named it but if so we have been unable to discover the name. We do not wish to transfer these species to *Turricula* where they obviously do not belong, nor do we wish to give them a new generic name until we have determined that there is not already one available for them; to do this will require considerably more time for consultation of literature than is at present available. Therefore the name *Surcula* has been retained herein and is used in a broader sense than is usual in modern nomenclature. It is noted that Pilsbry has likewise retained the name in a late monograph on Santo Domingo fossils.[88]

It is possible that Conrad's name, *Surculites,* might be used, at least for the Tejon species, *sinuata*. The name was based upon *S. annosa*[89] from the Eocene of Shark River, New Jersey. Dall[90] has stated that the shell is a doubtful one and many of the essential characters remain unknown. Whitfield refigured the type of *S. annosa* and described two

[85] U. S. Nat. Mus. Proc. Vol. 54, 1919, pp. 315, 316, 332.
[86] Records Aust. Mus. Vol. 13, No. 6, 1922, p. 253.
[87] Acad. Nat. Sci. Phil. Proc. 1876, p. 280.
[88] Acad. Nat. Sci. Phila. Proc. 1922, p. 317.
[89] Amer. Journ. Conch. Vol. 1, 1865, p. 213, pl. 20, fig. 9.
[90] U. S. Nat. Mus. Proc. 1919, Vol. 54, p. 332.

additional species, all under *Surculites* used as a genus; but he stated that there was little to distinguish them from *Surcula* proper.[91]

47. Surcula cohni Dickerson

Plate 10, figures 12, 13, 14; Plate 11, figures 3, 4

Su[r]cula (Typ. err.) *cohni,* Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, p. 70, pl. 10, fig. 1, **Loc. 245 (C. A. S. Coll.).** See references under *S. cowlitzensis* Weaver.

This species is abundant at its type locality, and attains a larger size than Dickerson's type specimen. The most perfect specimen measures 38.4 mm. in altitude after having lost the apex and the tip of the canal. Another specimen when complete must have been considerably larger. Dickerson's type specimen is pathologic and defective, having been broken and mended by the animal. Better specimens from the same locality are here figured for further illustration of the characters of the species.

This species is closely related to *S. cowlitzensis* Weaver, but with a good series of both forms at hand it is not difficult to find differences sufficient for specific discrimination. In *S. cohni* the apical angle is about 27°, and the number of nodes on a complete whorl is 16. In the Cowlitz species the apical angle is 35°, and the number of peripheral nodes is only 12. There are also differences in the finer sculpture of the latter form, both above and below the angle. The body whorl of the Type Tejon specimens is more inflated and longer below the line of nodes than in the Cowlitz specimens. On the other hand there is a tendency in both, as specimens reach maturity, for the nodes to assume an oblique, receding direction, parallel to the lines of growth. The form, the sinuous growth lines and corrugated character of the shell place *cohni* in the genus *Surcula,* the type of which appears to be *Murex javanus* Linnæus.[92] As previously stated the genus-name will probably be displaced.

[91] U. S. Geol. Surv. Monog. 18, 1892, p. 218, etc.

[92] Tryon, Man. Conch. Vol. 6, 1884, p. 237, pl. 5, figs. 63-65.— Dall, U. S. Nat. Mus. Proc. Vol. 54, 1919, pp. 315, 332.

48. [Surcula cowlitzensis Weaver]

Surcula cowlitzensis Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 57, pl. 3, figs. 30 and 36, pl. 11, fig. 86; **Cowlitz River, Vader, Washington;** Eocene.—Not *S. cowlitzensis* Weaver, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 50, 51, Type Tejon records;=? *S. cohni* Dickerson. Not *S. cowlitzensis,* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 439, 452, Type Tejon records; = ? *S. cohni* Dickerson.

Although Dickerson stated that this species "is abundant in Washington and at the type locality of the Tejon," only one specimen has been found by us in the collections from any place within the locality of the Type Tejon Group which approaches it closely. This one agrees in some respects with Cowlitz fossils and was found at Loc. 244 (C. A. S. Coll.). The close relationship between several species from the type locality of the Tejon and their analogues in the Cowlitz Group at Vader, Washington, is well illustrated in the Turritidæ. This relationship rarely amounts to identity of species, or even a close approach to intergradation. A superficial inspection of these analgous species has often led to their confusion and to their determination as being identical. In this case it appears that the specimen in question is only a variation of *Surcula cohni;* it is figured on plate 11, figure 3.

49. **Surcula coæqualis** Anderson & Hanna, new species

Plate 11, figure 2

? *Drillia ullreyana* Cooper, Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, p. 43.— Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 449, 512. Type Tejon records.—Not *D. ullreyana* Cooper, Calif. St. Min. Bur. Bull. 4, p. 41, pl. 2, figs. 25, 26, 1894; described from Marysville Buttes.

Shell fusiform, turrited, spire high, apical angle about 32°; last whorl with eleven axially lengthened nodes, extending up from the suture nearly to that on the whorl above; upper half of each whorl slightly concave, lower half convex; the former sculptured only with distinct lines of growth, the latter with five heavy spiral threads with finer lines between; lines of growth deeply sinuous and rough, even on the parts containing the spiral sculpture.

Type: No. 866, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

In size and general form this species is similar to *S. cowlitzensis* (Weaver), but it is more symmetrical, lacks spiral sculpture on the upper slope of the whorl, the nodes are more lengthened axially, and are not inclined on the body whorl, as in Weaver's species. The canal of the type specimen is not complete. This species differs from *S. cohni* Dickerson in the less elongated body whorl, and in the above mentioned features which distinguish it from *S. cowlitzensis* (Weaver).

Dickerson's records of *D. ullreyana* from the Type Tejon are based, so far as we have been able to determine, upon four specimens from Loc. 245 (C. A. S. Coll.). Two of these are very young and the others mere fragments but they appear to be the same as has been described above as *S. coæqualis*. We have compared them with Cooper's original specimens (No. 11, C. A. S. Type Coll.) of *ullreyana*, the spiral lines of which have a characteristic wave, not possessed by any we have seen from the Type Tejon.

50. Surcula uvasana Dickerson

Surcula uvasana Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 71, pl. 10, fig. 10, Locality 458 (U. C. Coll.). Type Tejon Eocene.

(?) *Turris uvasana* Dickerson, same Vol. p. 44, listed from Loc. 245 (C. A. S. Coll.), and from Locs. 451 and 452 (U. C. Coll.).— *T. uvasana* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, (listed as n. sp.), and 453, Type Tejon records.

Surcula uvasensis, Zool. Record, 1915, Moll. p. 28.

This species was described from the type locality of the Tejon and listed as one of the species of this horizon by the author. The name appeared in all of his formal lists as "*Turris uvasana*" and it is not possible to determine from the context if the two names are intended to apply to the same species but that interpretation is made herein.

Surcula uvasana seems to be a rare form, since we have failed to detect it in any of the collections from this locality, the type being thus far the only specimen of the species we have seen. It is said to have come from near the base of the formation, or "about 400 feet (stratigraphic) above the "Basement-Complex-Tejon-Contact".

51. [Surcula fresnoensis (Arnold)]

Turris fresnoensis (Arnold), Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 439, Type Tejon record.

Not *Pleurotoma fresnoensis* Arnold, U. S. Geol. Surv. Bull. 396, 1909, p. 53, pl. 4, fig. 23, from 15 miles north of Coalinga, California.

We have no means of determining the species upon which Dickerson based his record of *fresnoensis* at the type locality of the Tejon Group. *Surcula coæqualis* resembles Arnold's figure and description, but it has more nodes on the body whorl, and no spiral striations on the shoulder above the node line. But as Dickerson has not included *S. fresnoensis* in any of his formal lists of Type Tejon species it must be assumed that his record, given above, was an error.

52. [Surcula gesteri Dickerson]

Surcula gesteri Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 499, pl. 42, fig. 4, locality 672 (U. C. Coll.), Parson's Peak, north of Coalinga, California; not p. 516, Type Tejon record.

This species was listed from the type locality of the Tejon by its author, (above citation p. 516,) who stated that "it occurs at the type locality of the Tejon group and in the Cowlitz phase of the Washington Tejon". After searching the collections of the University of California and the California Academy of Sciences for specimens of it from either place we are at a loss to know upon what the statement was based. No specimens from either locality among the collections examined have been labelled by Dickerson as *S. gesteri,* nor have we found any that should be so labelled. Neither does Dickerson give it in his formal list of Type Tejon species on page 421, although he seems to have indicated it on page 434. In view of such evidence it appears necessary for us to omit the form from a list of the valid species of the Type Tejon until further evidence proves its occurrence there.

53. [Surcula claytonensis (Gabb)]

Turris claytonensis Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 92, pl. 18, fig. 46, **Clayton, California;** not listed from the type locality of the Tejon Group.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303. — Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197.

Surcula claytonensis Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 217, listed from the locality of the Type Tejon as well as Clayton.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 292, Type Tejon record.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15, Type Tejon record.

All of the records of this species from the Type Tejon Group are based upon the statement by Gabb. Since the species was not found there by Dickerson, and is absent from all of his lists of Tejon species, and has not been found in any of the collections from this locality by ourselves, it is excluded from the list of authentic species from there.

54. Surcula io (Gabb)

Plate 10, figure 11

? *Fasciolaria io* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 101, 224, pl. 28, fig. 214.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 220.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 281.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.

Surcula (Surculites) io Gabb, Acad. Nat. Sci. Phila. Proc. 1876, p. 280. Stated that generic relationship is doubtful and that there is no name for the group.

Surcula io (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44, Type Tejon record; not p. 72, pl. 10, fig. 11, which is *Surcula alizensis,* new species,— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 427, 452, Type Tejon records.

Gabb described this species from the **type locality of the Tejon Group,** and it properly forms a part of the fauna of the same. But in the collections studied we have found only one specimen which we can satisfactorily identify with his figure and description, and that is the one here figured on plate 10. The nearest approach to the *S. io* of Gabb is the form described herein as *S. ioformis,* apparently a new species.

55. Surcula ioformis Anderson & Hanna, new species

Plate 12, figures 3, 7

Bursa washingtoniana (Weaver), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49, 51, and pl. 7, fig. 4; not fig. 6.

Not *Ranella washingtoniana* Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 41, pl. 2, fig. 14;

Shell robust, spire high, turrited, consisting of about eight whorls when complete, though the type has only two and a half entire whorls preserved; apical angle 46°; last whorl with 11 nodes, or blunt spines, which are somewhat flattened axially, producing ridges below the angle; shoulder concave, and upper slope rising in a thick collar on the preceding whorl; upper slope sculptured with 13 spiral threads, slightly heavier than the growth lines which cross them; canal slightly recurved; columella calloused. Altitude, 43.5 mm.; originally about 50 mm.; diameter, 21.3 mm.

Type: No. 311; paratype, No. 865, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

The specimen selected for the type of this species is the same as that figured by Dickerson as *Bursa washingtoniana* (Weaver) cited above. It has no varices, and, therefore, does not belong to the family Bursidae. The species has a near relationship to *Surcula io* (Gabb), which is figured for comparison. In the new species the sculpture is much coarser, the nodes much larger and differently formed, and the upper slope is less uniform.

56. Surcula alizensis Anderson & Hanna, new species

Plate 12, figures 2, 3, 4

Surcula io (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 72, pl. 10, fig. 11. Loc. 244 (C. A. S. Coll.)

Not *Fasciolaria io* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 101, pl. 28, fig. 214, etc.

Shell bi-conical, outline rhomboidal with the left side of the spire nearly parallel with the lower outer margin of the aperture; apical angle about 47°; last whorl with 11 rounded

conical nodes; upper slope slightly concave near the suture, but elsewhere straight; sculptured with rugose, deeply sinuous growth lines crossed by minute spiral lines; lower part of body whorl bearing coarse spiral threads about two mm. apart, and having a single finer thread between each of the former; these are also crossed by heavier growth lines; altitude of type, 36 mm.; diameter 24 mm.; both apex and canal are missing on the type, but the apex is shown on the paratype, fig. 3.

Type: No. 344, Mus. Calif. Acad. Sci.; collected at Loc. 244 (C. A. S. Coll.), Live Oak Creek, formerly known as Cañada de los Alizos, Kern County, California, by Bruce G. Martin; paratype No. 858, was obtained from Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California; Type Tejon Eocene.

This species is closely related to *Surcula io* (Gabb), and is about the same size and form, but the suture line is so high on the preceding whorl that it is made sinuous by the nodes; moreover, on Gabb's species the upper slope is sculptured by spiral lines as heavy or heavier than the growth lines, while on this they are very minute, or absent.

57. Surcula sinuata Gabb

Plate 12, figure 5

Conus sinuatus GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 123, 226, pl. 29, fig. 227, near Fort Tejon, Tejon Group.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.

Surcula (Surculites) sinuata GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 150, pl. 26, fig. 28— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 292.—ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44 and 70, pl. 10, figs. 2a, 2b, and 2c, Loc. 458 (U. C. Coll.)— DICKERSON, Univ. Calif. Publ. Geol. Vol. IX, 1916, pp. 421, 433, 439, 442, and 452.

This species was originally described from specimens collected at the type locality of the Tejon Group where it occurs frequently. It is a rather large robust species with fine spiral sculpture on the upper surface of the whorls, and much coarser threads on the lower part of the body whorl.

Nodes are present in the younger stages, but are not prominent on full grown shells. In this character we have a well marked group into which the species falls, as pointed out by Gabb. *Surculites* was given by Conrad as a sub-genus of *Surcula*.[93]

58. [Surcula washingtoniana (Weaver)]

Fasciolaria washingtoniana Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 52, pl. 1, fig. 5; Cowlitz River Eocene, Vader, Washington.

Not *Surcula washingtoniana* (Weaver), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 50, 51, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421 and 452, Type Tejon records.

In his first paper cited above, Dickerson figured a specimen which he called *Surcula washingtoniana* (Weaver), from the Cowlitz Group; (p. 72, pl. 10, figs. 7a, 7b) this was called a "cotype", and is now preserved in the Calif. Acad. Sci. collections as No. 341. A search through Weaver's publications discloses the species reviewed here, which can be clearly identified with Dickerson's figure, and this gave the clue for co-ordination of the two names. Both authors' specimens are from the Cowlitz Group of Washington, near Vader. The often repeated specific name, *washingtoniana*, for nearly related forms has proved very confusing. Weaver used it with *Fasciolaria, Fusus, Pleurotoma, Hemifusus,* and *Turris.*

The nearest ally of Weaver's species in the type locality of the Tejon Group is Gabb's so-called *"Fasciolaria io"*, of which he questioned the genus.

59. ["Turris sp. Turris n. sp." Dickerson]

Turris sp., Dickerson, Calif. Acad. Sci., Proc. 5th Ser., Vol. 5, 1915, p. 44, listed from Loc. 458 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 421.

Turris n. sp., Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, pp. 44, 50, 51; Type Tejon records; not p. 96, pl. 10, fig. 5.

Although records of this sort are of no value in faunal lists, since subsequent students find it impossible to determine

[93] Am. Jour. Conch. Vol. 1, 1865, p. 213, pl. 20, fig. 9.

what species the author had in view, yet there is ground for believing that the last citation above was intended as a record of what was afterward named "*Turris stocki*" by Dickerson. At any rate the specimen which was figured by him on pl. 10, fig. 5, from the Cowlitz group of Vader, Washington, was so-labelled in the collection. A comparison of the figure of the Cowlitz species with the figure and type of "*T. stocki*" affords convincing evidence that the two are distinct, and in fact they do not belong to the same genus.

60. Gemmula abacta Anderson & Hanna, new species

Plate 7, figures 6, 7; plate 8, figure 11

Drillia raricostata (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 449, Type Tejon records.

Not *Turris varicostata* [Typ. err.] Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 93, pl. 18, fig. 47; near Clayton, Contra Costa County, above the coal. (In Pal. Vol. 2, 1869, p. 217, this species bears the name of *Surcula raricostata.*)

Turris stocki Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 434, 453; Type Tejon records; not p. 499, pl. 42, fig. 5, Loc. 672 (U. C. Coll.), north of Coalinga, California.

Shell turrited, composed of about eight whorls, the upper four smooth, or marked by axial growth lines without beads; remaining whorls having a spiral line of rounded beads on the periphery, marking the progressive location of the anal fasciole, where the growth lines are deeply sinuous; paratype No. 962 has 17 of these beads on the body whorl; above and below the bead lines are concave zones which are unmarked above the last whorl, except by faint spiral threads and growth lines; on the last whorl these zones may, or may not bear one or more spiral threads; suture deeply impressed, and bordered below by a spiral cord; below the bead line on the body whorl are five or six distant, strong spiral threads; canal straight but not long; altitude of type specimen 8 mm., original length about 10 mm.; diameter about 3.9 mm. Altitude of largest paratype 7 mm.; diameter, 2.8 mm.

Type: No. 826; paratypes, Nos. 962, 963, Mus. Calif. Acad. Sci., collected at **Loc. 711 (C. A. S. Coll.), Grapevine**

Creek, Kern County, California, by G. D. Hanna and M. A. Hanna; Type Tejon Eocene.

This species differs from *G. encinalis,* an associated form, in the rounded, instead of elongated beads, and in the fewer spiral threads on the body whorl. It differs, on the other hand, from *G. stocki* (Dickerson), and from *G. wattsi,* n. n., in its fewer spiral threads on the body whorl, and in its fewer beads. It appears to be, however, more closely related to *G. stocki* than to any other species, and, while Dickerson may have had this form in view when he recorded *"Turris stocki"* as occurring in the Type Tejon section, we believe, rather, that his record of *D. raricostata* in the fauna of this group was so based, since four specimens from Loc. 245 (C. A. S. Coll.), bearing this latter name in his handwriting, evidently belong to *G. abacta.*

61. **Gemmula encinalis** Anderson & Hanna, new species

Plate 8, figure 10

Turris monolifera (COOPER) DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44, Type Tejon records, Loc. 451, (U. C. Coll.); not p. 96, pl. 10, figs. 6 and 9, Cowlitz Group, Vader, Washington.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 427, 453, Type Tejon records; not p. 514, pl. 41, figs. 3a and 3b, near Oroville, California, which appear to be near but not the same as *Gemmula wattsi,* new name.

Not *Surcula monilifera* COOPER, Calif. State Min. Bull. No. 4, 1894, p. 39, pl. 2, figs. 28 and 29, Marysville Buttes, Sutter County, California.

Not *Surcula monilifera* Melleville, COSSMAN & PISSARO, Icon. Comp. Eocene, Paris, pl. 50, figs. 223 bis 5, 1907-1913. (Ann. d. Soc. Geol. 1847, p. 65, pl. 8, figs. 21-23.)

Not *Pleurotoma monilifera* PEASE, Zool. Soc. Lond. Proc. 1860, p. 398.—PEASE, Am. Jour. Conch. Vol. 5, 1870, p. 68.—Tryon, Man. Conch. Vol. 6, p. 358, 1884, a species which Hedley has placed in the genus *Gemmula.* (Rec. Aust. Mus. Vol. 13, 1922, p. 218.)

Shell turrited, with five whorls remaining intact in the type; 15 nodes, or slightly elongated beads around the periphery of the body whorl; above this row of nodes there is a concave tabulation, and between this and the suture a double spiral thread, beaded in accordance with the ornamentation of the periphery of the whorl; body whorl marked by 12 strong spiral threads below the keel; canal not complete, but

evidently short and straight; lines of growth deeply sinuous at the bead line. Altitude, 10.2 mm.; diameter, 4.4 mm.; apical angle 30°.

Type: No. 825, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

This species was identified by Dickerson as *Surcula monilifera,* (now *G. wattsi* n. n.), but the name was constantly misspelled. It differs from Cooper's species in several important characters; his two cotypes, (No. 17, C. A. S. Coll.), from Marysville Buttes contain 30 beads on the periphery of the body whorl; more than 30 spiral threads below this line of nodes; the tabulated shoulder above the nodes is not concave, but flat, containing seven raised spiral threads, (in *G. encinalis* the same area is sculptured by two spiral channels impressed in the shell) ; the ridge between the tabulation and the suture is imperfectly nodose.

62. [Gemmula wattsi Anderson & Hanna, new name]

Surcula monilifera Cooper, Calif. State Min. Bull. No. 4, 1894, pp. 39-40, pl. 2, figs. 28 and 29. **Locality, Marysville Buttes, Sutter County, California.**

Not *Turris monilifera* Pease, Zool. Soc. Lond. Proc. 1860, p. 398.

Not *Pleurotoma monilifera* Pease, Am. Jour. Conch. Vol. 5, 1870, p. 68.—Tryon, Man. Conch. Vol. 6, 1884, p. 358.

Turris monolifera (Cooper), Dickerson, Univ. Calif. Publ. Vol. 7, 1913, p. 275, pl. 11, figs. 1a and 1b, Marysville Buttes, Sutter County, California. —Not Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pl. 10, figs. 6 and 9, Cowlitz Group, Washington.—Not Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pl. 41, figs. 3a and 3b.

Turris inconstans (Cooper), Dickerson, same plate, (Op. cit.) fig. 2, north of Oroville, California.

The name applied to this species by Cooper had already been used by Pease for a recent species from the Hawaiian Islands which is probably congeneric. Although Dickerson listed the Marysville Buttes species from the locality of the Type Tejon Group,[94] the specimens upon which the identification was made differ so much that we have considered them

[94] Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 453.

as belonging to a distinct species, *G. encinalis*. Dickerson's figure of *T. inconstans* (Cooper), was evidently made from a large specimen of the species here referred to *G. wattsi*.

The reference of these species to the genus *Gemmula* is in accord with the latest revision of the Turritidæ by Dr. Dall.[95] The type of the genus is *Pleurotoma gemmata* Reeve.[96]

The type specimens of *G. wattsi* are from Marysville Buttes and were obtained there by Mr. W. L. Watts, of Los Angeles, in whose honor the species is named.

63. **Mangilia fibrata** Anderson & Hanna, new species

Plate 14, figure 7; plate 15, figure 7

Shell small, but long and slender, with tapering spire composed of seven slightly rounded whorls; the upper two whorls smooth; suture but little impressed; body whorl with nine vertical, rounded ribs, extending from the sutural band to slightly below the periphery on the body whorl; body whorl with ten spiral threads, one above the anal fasciole, and nine below it; two small spiral threads occur on the zone just below the sutural cord, with a single one between each two of the others, except the second and third, counting from above; lines of growth rather coarse and deeply sinuous; columella with the lowermost external threads extending within as low plaits; outer lip of type slightly broken, but apparently somewhat thickened, and bearing a single denticle at the lower boundary of the anal sulcus; altitude of type 7.6 mm.; (+1.5 mm. ?); diameter, 2.5 mm.

Type: No. 967, Mus. Calif. Acad. Sci.; collected at **Loc. 711 (C. A. S. Coll.), in Grapevine Creek, Kern County, California,** by G. D. Hanna and M. A. Hanna, June, 1921; Type Tejon Eocene.

This species is related to "*Mitramorpha parsoni*" Dickerson, but is more slender, and contains a greater number of vertical ribs to each whorl; that species, however, apparently belongs to the genus *Mangilia*. It was described from

[95] U. S. Nat. Mus. Proc. Vol. 54, 1918, pp. 313-334.

[96] See Tryon, Man. Conch. Vol. 6, 1884, p. 173, pl. 4, figs. 51 and 54.

the Eocene deposits north of Coalinga, California.[97] In the classification of the small Turritidæ we have followed the late works of W. H. Dall[98] as closely as possible. A somewhat similar species, though larger, occurs in the Cowlitz Group of southern Washington, and has been named by Dickerson "*Drillia ornata*".[99] This specific name had been used several times previously, for similar turritids, as for example, *Pleurotoma ornata,* Hinds,[100] *Pleurotoma ornata* d'Orbigny,[101] and *Filodrillia ornata* Hedley,[102] etc. *Surcula polyappellatia* Hanna was recently proposed for the Cowlitz fossil but it apparently should fall under the genus-name *Mangilia.*[103]

64. ["Cordiera microptygma" Gabb]

Cordiera microptygma GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 93, 223, pl. 28, fig. 203, **Tejon Group, near Fort Tejon.**— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 218.—HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 279.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 449, Type Tejon record.

This name was used by Gabb in a description and for a figure published in 1864, the type of which was said to have come from near Fort Tejon. We have seen no specimens referable to it and venture the suggestion that the basis may have been an assemblage of specimens, not all belonging to the same species.

The spire and sculpture of the figure are like those of the species here described as *Exilia fausta,* but the columellar plaits may be those of *Fasciolaria* or *Latirus.* The difficult task of excavating specimens showing the aperture from the material of this locality makes such a mistake easy. Until the subject can be more satisfactorily cleared up by better material it seems best to withhold the name from a valid list of the Type Tejon fauna.

[97] Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 495, pl. 38, fig. 11.
[98] U. S. Nat. Mus. Proc. Vol. 54, 1918, pp. 313 etc.; Vol. 56, 1919, pp. 1-86.
[99] Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 71, pl. 10, fig. 3.
[100] Voy. Sulphur, Moll. 1844, p. 25, pl. 7, fig. 21.
[101] Ramon de la Sagra's Cuba, 1853, Vol. 2, p. 171, pl. 23, figs. 26-28.
[102] Rec. Aust. Mus. Vol. 13, 1922, p. 223,
[103] Proc. Calif. Acad. Sci. 4th Ser. Vol. 13, 1924, p. 182.

65. **Conus ægilops** Anderson & Hanna, new species

Plate 13, figures 5, 6

Shell of medium size, spire high, turrited, general form biconical; sides of body whorl almost straight, marked by faint revolving striæ above, but with stronger raised threads near the base; angle of whorls having a distinct beaded ridge, bordered below by an impressed groove at the top of body whorl; nodes or beads 24 or more in number on a complete whorl; shoulder concave above, slope rising in a collar on the preceding whorl; lines of growth almost straight, but curving gently forward. The raised beaded cord on the angle of the last whorl gives the shell somewhat the form and appearance of an acorn of the large oaks (*Quercus lobata*), growing at the type locality of the species; hence the name. The length of the largest specimen found is 32 mm.; diameter, 13 mm.; height of spire, when complete, about equal to diameter.

Type: No. 809, Mus. Calif. Acad. Sci.; collected by Bruce G. Martin at **Loc. 245, (C. A. S. Coll.), Grapevine Creek, Kern County, California.** Cast of paratype, No. 810, Mus. Calif. Acad. Sci., from Loc. 452 (U. C. Coll.) in Grapevine Canyon; Type Tejon Eocene.

This species has a general similarity to *C. cowlitzensis* Weaver and it is possible that Dickerson may have had one of the specimens here described when he reported that form from the type locality of the Tejon Group.

66. **Conus californianus** (Conrad)

Plate 8, figure 5

Volutatithes californiana Conrad, House Doc. 129, Proj. Vol. 3, 33 Cong. 1st Sess. 1855, p. 11, App. to Rep. of W. P. Blake.—Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 322, pl. 2, fig. 9, locality **Cañada de las Uvas, California.**—Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.

(?) *Conus remondii* Gabb, (in part,) Geol. Surv. Calif. Pal. Vol. 1, p. 122, Type Tejon records, but not pl. 20, fig. 79, from Cochran's, east of Mount Diablo, etc., and not *C. remondii* Gabb, Pal. Vol. 2, 1869, p. 225.

C. californiana (Conrad) Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record, and p. 74, pl. 11, fig. 6.—Dickerson,

Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 438, 449, Type Tejon records.

Volutilithes californiana Conrad, Amer. Journ. Conch. Vol. 1, 1865, p. 23.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 368.

Conrad's description of this species was from a specimen found at Grapevine Canyon by W. P. Blake; his figure is defective, and his description incomplete, but still the species can be recognized among the forms obtained at the type locality. Gabb's criticism of the specific name employed by Conrad is not well founded, since he misquoted it, (as *Volutilithes californica*); as Conrad wrote it it seems to be entirely permissible. Furthermore the specimen figured and described by Gabb for Conrad's species was from Cochran's, east of Mount Diablo, and represents a distinct form, related to, but not identical with Conrad's type. The names are, therefore, not synonymous, and both may be used for their respective species. A small form, quite similar to Gabb's species, occurs in the Tejon Group at the type locality, but it is easily distinguishable from Conrad's; it may be identical with *C. remondii* Gabb. It is still doubtful whether this species should be included in the list of valid species from the Type Tejon locality.

Dickerson recognized the distinctness of Gabb's species, as well as the validity of the name used by Conrad, since he has listed both from this locality.

67. [Conus cowlitzensis Weaver]

Conus cowlitzensis Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 54, pl. 2, fig. 20, **Cowlitz Group, Vader, Washington.**

Not *C. cowlitzensis* Weaver, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 49, 51, Type Tejon records, and not pl. 11, fig. 8, "cotype No. 352."—Not *C. cowlitzensis* Weaver, Dickerson, Univ. Calif. Publ. Geol. Vol. 9, pp. 421, 449, Type Tejon records.

The species described by Weaver under this name is abundant in the Cowlitz Group near Vader, Washington, where the senior author and Mr. Martin obtained a number of good specimens at Loc. 182 (C. A. S. Coll.). Dickerson figured a specimen from there as *C. cowlitzensis,* but his "cotype No. 352" differs from Weaver's species in a number of important details; the apical angle of Weaver's figured

specimen is 60°, the number of nodes is 16 to 18, on the body whorl which contains 40 revolving lines below the angle; while the specimen figured by Dickerson has an apical angle of only 45°, only 12 nodes on the angle of the body whorl and the latter is quite smooth, or only faintly marked by a few spiral lines near the base. In other words it is evidently a distinct species, and does not represent Weaver's species, as Dickerson supposed. Moreover, his so-called "cotype" was merely a plesiotype. No specimen of Weaver's species has yet been recognized in any of the collections from the type locality of the Tejon Group studied by us, and no confirmation has been found of its occurring there.

68. **Conus hornii** Gabb

Conus hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 122, pl. 29, fig. 226, **Alizos Creek, (Live Oak), near old Fort Tejon.**— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 225, said to come from the Type Tejon Group.—Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 278, listed as Tejon.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 98, pl. 11, figs. 9a, 9b, 9c; Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 427, 432, 438, 449, Type Tejon records.

This species was first described from the type locality of the Tejon Group, and has been found plentifully at Loc. 244 (C. A. S. Coll.), Live Oak Canyon, by Mr. Bruce G. Martin. Several good examples are in the collections of the California Academy of Sciences, three of which were figured by Dickerson. The complete absence of nodes or beads on the periphery and the slightly concave shoulder are the chief distinguishing features of the species.

69. **Conus submonilifer** Anderson & Hanna, new species

Plate 8, figure 6

Shell small, smooth, spire relatively high, biconical, with nine, heavy, impressed spiral lines on the lower half of the body whorl and finer ones extending to the periphery;

whorls eight, rising into a high spire with almost straight sides; periphery sharply angled the ridge being quite smooth, or only faintly crenulated on the body, but with more distinct crenulations on the younger whorls; shoulder slightly concave above the angle; lines of growth sinuous on the body whorl, bending obliquely forward below the angle; apical angle 68°; basal angle 32°. Altitude of largest shell, 18 mm.; diameter, 13 mm.; spire one-third of the total length; altitude of type, 9.9 mm.; diameter, 5.2 mm.

Type: No. 812, Mus. Calif. Acad. Sci.; collected at **Loc. 244, (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

This species appears to be related to the small form called *C. remondii* (?) herein, found with it at the type locality of the Tejon Group, but is distinguished from it by the absence of beads, or even crenulations on the more mature whorls, and fewer spiral lines on the same. Numerous specimens of both species were obtained at Live Oak Canyon by Mr. Martin and the writers.

The species is related to *C. hornii* but has a higher spire, traces of beads on the periphery, and for the same number of whorls is uniformly smaller.

70. ? Conus remondii Gabb

Plate 8, figure 7

Conus remondii, GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 122, pl. 20, fig. 79, **Cochran's, east of Mount Diablo,** and other localities including Type Tejon.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. III, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 225.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— COOPER, Calif. State Min. 7th Ann. Rep. 1888, p. 278.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

Not *Volutatithes caniforniana* CONRAD, Pac. R. R. Repts. Vol. 5, 1857, p. 322.

Not *Conus californianus* (CONRAD) GABB, Pal. Vol. 1, p. 122, Type Tejon records.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, pp. 43, 49, 51, Type Tejon records, but not p. 74, pl. 11, fig. 7, Cowlitz Group, Washington.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 438, 449, Type Tejon records.

As stated by Gabb, Remond obtained a specimen of *Conus* from Cochran's, east of Mount Diablo, which was taken

for the species found by Blake at Grapevine Creek, and named by Conrad *Volutatithes* (Typ. err.) *californiana*. Gabb confused this name with *C. californicus* Hinds, objected to its use, and sought to replace it with the name *C. remondii*. Conrad's name appears to be valid, notwithstanding its resemblance to that used by Hinds for a recent species, and since Gabb actually used *C. remondii* for a distinct, even though related species, both names may be retained, but used for their respective species only.

Dickerson figured a specimen (pl. 11, fig. 7,), from Loc. 183 (C. A. S. Coll.), near Vader, Washington, as *C. remondii* Gabb, but which, from a direct comparison with Gabb's figure, and with Tejon material appears to be a questionable determination. A form similar to Gabb's, but smaller, occurs in the Tejon Group of the type locality. The number of nodes varies in the series we have and they do not have the axially flattened appearance of the figure of *C. remondii*. We have been unable to secure any authentic specimens of the latter from Cochran's to check the work of Gabb and until this is done it would seem premature to separate the Tejon form specifically. The identification is made, however, with the belief that eventually the separation will have to be made.

71. [Conus weaveri Dickerson]

Conus weaveri Dickerson, Calif. Acad. Sci., Proc. 4th Ser. Vol. 5, 1915, p. 74, pl. 11, fig. 10, Cowlitz Group, Vader, Washington, Loc. 182 (C. A. S. Coll.); not pp. 43, 49, 51, Type Tejon records.— Not *C. weaveri* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 429, Type Tejon records.

This species was described from a single specimen obtained from the Cowlitz Group by the senior author and Mr. Martin at Loc. 182 (C. A. S. Coll.), near Vader, Washington. Dickerson's record of the species from the type locality of the Tejon Group, is apparently based upon a single worn and fragmentary specimen, Loc. 244 (C. A. S. Coll.), which shows none of the diagnostic characters of his *C. weaveri*. On the other hand it bears a closer resemblance to *C. hornii* Gabb, a common form in the type local-

ity of the Tejon Group. We do not regard the evidence as sufficient to warrant including this species as a member of that fauna.

72. Cowlitzia canalifera (Gabb)

Plate 9, figures 6, 9, 13

Rostellaria (Rimella) canalifera Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 123, 226, pl. 29, fig. 228; Martinez and near Fort Tejon.

Rimella canalifera Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1868, p. 303.— Gabb, Amer. Journ. Conch. Vol. 5, 1868, p. 142.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 225.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 291.—Stanton, U. S. Geol. Surv. 17th Ann. Rept. 1897, p. 1027.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

? *Rimella macilenta* White, Stanton, U. S. Geol. Surv. 17th Ann. Rept. 1897, p. 1027, not of White.

Rimella simplex Gabb, Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, pp. 44, 50, 51, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 427, 439, 452, Type Tejon records.— Not *R. simplex* of Gabb.

Cowlitzia canalifera (Gabb), Clark & Palmer, Univ. Calif. Publ. Geol. Vol. 14, 1923, p. 284, pl. 51, figs. 15-20.

In Gabb's description of this species the first locality mentioned was Martinez, but he added, "and near Fort Tejon". Our collections from the type section of the Tejon Group contain numerous specimens that agree so well with the original figure and description that we are disposed to believe that the type came from the Tejon locality. This surmise is borne out by the fact that we have found no mention of the species occurring at Martinez by any of the later writers who have studied this section, where it should have been found if the type had really come from there. To Gabb's meager description we add the following supplementary notes:

Shell with about seven whorls, regularly rounded, and with suture well impressed between them; upper two and a half whorls smooth, the rest strongly sculptured but with gradual transition; posterior canal extending up the spire to the lowest nuclear whorl where it bends to the right around the spire; last whorl sculptured with nine axial ribs,

the last six diminishing in length; penultimate whorl sculptured with 13 spiral cords which pass over the ribs and which are separated by interspaces of equal width to the cords; cords and interspaces squarish or flattened, not sharply cut; aperture heavily calloused on columella and peristome; anterior canal slightly recurved; lower portion of peristome somewhat angulated at its juncture with outer margin, and denticulated with about seven conical projections at the terminations of the spiral cords; stromboid notch very slight or absent. The number of axial ribs on the body whorl varies from nine to thirteen; number of spiral cords on the penultimate whorl varies from nine to sixteen, due to splitting in some specimens.

Measurements

Altitude	Diameter
12.6 mm	5.9 mm
16.0	7.2
18.9	8.0
20.5	9.1
23.7	10.0

The great variation in size of fully adult individuals, as shown by the above, is possibly due to sexual dimorphism; a similar condition has been seen to exist in the other species of the genus. The descriptive notes above are drawn chiefly from the three specimens figured. Varicies may or may not be developed in the immature shell as shown in figs. 9 and 10.

C. canilifera is the smallest species of the genus. Other related forms are *C. simplex* from San Diego, California, and *C. washingtonensis* from southern Washington. Prof. Bruce L. Clark and Mrs. D. K. Palmer have recently worked over the group and separated the west American forms generically from those of European Eocene deposits.[104]

73. [Cowlitzia simplex (Gabb)]

Rostellaria (Rimella) simplex GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 124, pl. 20, fig. 80; **Rose Canyon, San Diego,** and above the coal at Clayton.

Rimella simplex GABB, Amer. Journ. Conch. Vol. 5, 1868, p. 142.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 225,— COOPER, Calif. State Min.

[104] See Clark & Palmer, Univ. Calif. Publ. Geol. Vol. 14, No. 7, 1923, pp. 277-288, pl. 51.

7th Ann. Rept. 1888, p. 291.— Cooper, Calif. State Min. Bur., Bull. No. 4, 1894, pp. 37, 38, and 62.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.

Not *Rimella simplex* Gabb, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 50, 51, Type Tejon records.— Not *R. simplex,* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 427, 439, 452, Type Tejon Records. (See *Cowlitzia canalifera* Gabb.)

The type of this species was obtained at Rose Canyon, near San Diego, by Dr. J. G. Cooper, as he himself has stated. Dickerson has listed it as occurring at Loc. 245 (C. A. S. Coll.), Type Tejon. An examination of the specimens from there, labelled *R. simplex,* by him shows them not to be this, but they are undoubtedly large *C. canilifera. C. simplex* (Gabb) is a distinctly robust form, having more axial ribs on the penultimate than on the body whorl. We have not found it in the type section of the Tejon Group.

74. ["Loxotrema turrita" Gabb]

Loxotrema turrita Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 168, 229, pl. 28, fig. 49, from 10 miles west of Griswold's ranch, between San Juan and New Idria; not listed from the type locality of the Tejon Group.

Not *Loxotrema turrita,* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 439, Type Tejon record.

The listing of this species from the Type Tejon locality by Dickerson was probably unintentional, as there is no other record to show its occurrence there. He has not included the species in any of his more formal lists of that fauna, nor is there known to us any evidence whatever that it does occur there.

75. Cypræa kerniana Anderson & Hanna, new species

Plate 13, figures 9, 10, 11

Cypræa mathewsonii Gabb, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 60, and pl. 6, fig. 5.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 438, and 448, Type Tejon records. (Not *C. mathewsonii* of Gabb.)

Shell smooth, short and greatly inflated; outer lip rounded, ornamented with nine denticulations; columellar side of the

aperture sculptured with plaits, the center ones of which are longest, and toward the exterior, wavy. The shell is slightly more globose toward the anterior end than the smaller *C. mathewsonii* from Martinez. Moreover in our species the outer lip has only nine denticulations, though it is larger, while the Martinez species has 15. The sculpture of *kerniana* is finer on the body whorl and some variation in size is shown in the series which we have studied, the largest being 17.7 mm. in length, and the smallest 13.6 mm.

Type: No. 816; paratypes No. 817 and 818, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), one-fourth mile east of Grapevine Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

76. [Cypræa bayerquei Gabb]

? *Cypræa bayerquei* GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 129, including three text figures; **Clayton, Contra Costa County, California.** (? Not of GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 163, 225, pl. 27, figs. 43, 43a, 43b, and 43c; "Tejon Group," at Martinez, reported also from Tejon.)— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 280; Gabb's record copied.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15; Gabb's record copied.— ? DICKERSON, Univ. Calif. Publ. Geol. Vol. 8, 1913, pl. 15, fig. 1, Martinez Group, locality not given.

? Not *Cypræa bayerquei,* DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43; reported from Loc. 452 (U. C. Coll.) and a specimen figured, pl. 6, figs. 4a and 4b.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 448, Type Tejon records.

In an endeavor to ascertain the proper status of this species, and of its stratigraphic and geographic occurrence, some interesting facts have been disclosed. Gabb's original drawings, (Pal. Vol. 1, pp. 129 and 130,) were made from a cast obtained near Clayton. The figures shown in the attempted revision,[105] were made from a "perfect specimen" from near Martinez. The young form, (pl. 27, fig. 43c,) is probably one of the two sent by Dr. Horn from the Tejon locality, as per Gabb's note, (p. 164). In this view of the case it appears probable that Gabb's revision and re-illustration of the species were based upon two distinct species,

[105] Pal. Vol. 2, pl. 27, figs. 43, 43a, and 43b.

neither of which represented his original form obtained from Clayton. This surmise is borne out by his figures.

A single well preserved specimen of *Cypræa* in the Academy of Sciences, obtained at Big Tar Canyon, southern Fresno County, California, agrees very well with Gabb's original figures and description of *C. bayerquei* from near Clayton and it comes from strata very near if not exactly equivalent to those found at the latter place.

Dickerson figured a specimen in his Martinez paper (Op. cit. 1, pl. 15, fig. 1,) as *C. bayerquei,* without giving any direct information as to its occurrence, except that on p. 109 it is included in the "Meretrix dalli zone", while his complete list of species from this zone (pp. 71-74, et seq.) contains no mention of it. His "Meretrix dalli zone", however, is said to be in the lower part of the Martinez Group, while Gabb's types are from what he considered the Tejon Group. Nevertheless, Dickerson's figure in this paper comes nearest agreeing with those of Gabb's original description. Dickerson, in his second paper, reported *C. bayerquei* from Loc. 452 (U. C. Coll.) in Grapevine Canyon, Kern County, and figured a specimen from there under this name, but with no better warrant than Gabb had. The figures in this paper (pl. 6, figs. 4a and 4b) do not agree with those of his first.

A critical study of the foregoing data reveals the fact that at least three species have been confused under this name, which should apply only to the first, namely that from Clayton, first considered by Gabb. The species figured by Dickerson from the Martinez Group seems to resemble it, but its identity requires to be proved. Dickerson's later figures from Loc. 452 (U. C. Coll.) Grapevine Canyon, resemble somewhat Gabb's specimen from the "Tejon Group" near Martinez,[106] but we cannot affirm its identity. Dickerson's specimen is at the University of California, and measures 12.5 mm. in length, and 7.5 mm. in width. His figures show it, therefore, nearly three times enlarged, instead of twice, as he reported. The specimen is, moreover, defective, in that the preservation is poor, the apertural teeth have suffered from the operation of cleaning,

[106] Pal. Vol. 2, pl. 27, figs. 44, 44a, and 44b.

and the shape is distorted from crushing. On the whole it is not at all certain that it is not an abnormal specimen of *C. kerniana,* described herein.

Neither of Gabb's forms have been recognized by us in the type section of the Tejon Group, although it is possible that his last one may be found there.

77. [Cypræa mathewsonii Gabb]

Cypræa (Epona) mathewsonii Gabb, Geol. Surv. Calif. Pal. Vol. II, 1869, pp. 164, 225, pl. 27, figs. 44, 44a and 44b; **Tejon Group, Martinez.**

Not *Cypræa mathewsonii,* Dickerson, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, p. 43; Loc. 245 (C. A. S. Coll.), near Grapevine Creek, nor p. 60, pl. 6, fig. 5 (or 5a).—Not *C. mathewsonii,* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 438, 448, Type Tejon records, all of which=*C. kerniana.*

This species was originally described from the "Tejon Group" at Martinez, which, as Gabb conceived it, was not necessarily equivalent to the Tejon Group at its type locality. Dickerson reported it from the type section of the Tejon Group, Loc. 245 (C. A. S. Coll.), based upon a specimen from the Martin collection. An examination of the specimen figured by him, referred to above, shows it to be specifically distinct from *mathewsonii* and is *C. kerniana.* A comparison of Dickerson's figure with Gabb's shows a decided difference in form and in the aperture. Gabb's figure, moreover, shows the outer lip to have 15 denticles, a simple crescent shaped aperture, and a narrower and semi-ovate body whorl. On the other hand, *C. kerniana* has only nine denticles on the outer lip, is shorter in proportion to the width, and has a body whorl considerably more globose toward the anterior end. We have seen no specimens of *Cypræa* in any of the collections from the type locality of the Tejon Group referable to *C. mathewsonii.*

Galeodea Link

In the use of the genus-name *Galeodea* Link we are in accord with Dall, who believed the name is not preoccupied by *Galeodes* Bolten.[107] The type of the genus is the living

[107] U. S. Geol. Surv. Prof. Paper 59, 1909, p. 64.

species *Galeodea echinophora* (Linn.), which does not appear to differ generically from the Eocene forms on the west coast. That there are several species of *Galeodea* in the western Eocene deposits can hardly be doubted. Each group, and each sub-province appears to have its form, distinguishable from the others by constant characters of specific value. They may, however, be regarded as analogous species, in part, particularly in the groups which are synchronous, though their specific identity is difficult to show.

The nearest analogue of the Tejon species described in this report is that from the Cowlitz Group of Washington, described by Weaver as *Morio tuberculatus* Gabb, var. *trituberculatus*.[108] This form was also figured by Weaver and Palmer from the same group of southern Washington.[109] The Cowlitz species is smaller, has three rows of spines nearly equal in size, which are elongated axially, and the spiral threads are not uniformly alternated large and small, as in the Tejon species.

G. petrosa (Conrad) also has its analogue in the Eocene of western Washington, which has been described as a subspecies by Weaver and Palmer.[110]

The Eocene strata of Marysville Buttes furnishes a species with strong spines.

78. Galeodea petrosa (Conrad)

Plate 10, figures 2, 3

Stramonita petrosa Conrad, House Doc. 129, Proj. Vol. 3, 33rd Cong. 1st. Sess. 1855, p. 17; App. to Prelim. Geol. Rept. by W. P. Blake.— Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 327, pl. 6, figs. 47, 47a; also Blake, p. 42; Type Tejon Eocene.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 590; also Smith. Misc. Coll. 252, 1872, p. 76.

Purpura petrosa Conrad, Meek, Smith. Misc. Coll. Checklist Sp. No. 663.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 112.

Galeodea petrosa Conrad, Smith. Misc. Coll. 200, Checklist, Eocene Fossils, 1866, Species No. 471.

Morio (Sconsia) tuberculata Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 223, in part, Type Tejon records, only. (Not *M. (S.) tuberculata* Gabb, Pal. Vol. 1, 1864, p. 104, pl. 19, fig. 57, Bull's Head Point, near Martinez.) — Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 287, Type

[108] Wash. Geol. Surv. Bull. No. 15, 1912, p. 39, pl. 3, fig. 35.
[109] Univ. Wash. Publ. Geol. Vol. 1, No. 3, 1922, pl. 11, figs. 23 and 27.
[110] Op. cit. p. 37, pl. 11, figs. 18 and 20.

Tejon records.— Arnold, U. S. Geol. Surv. Prof. Ppr, 47, 1906, p. 15, Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.

Galeodea tuberculata (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 50, 51, Type Tejon records. (Not p. 88, pl. 6, figs. 3a and 3b, Cowlitz Group, Washington, = *G. tri-tuberculata* (Weaver.)—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 438, 450, Type Tejon records. (Not p. 516, pl. 42, fig. 2, locality not given.)

Shell robust, spire moderately elevated, suture slightly channelled; body whorl with nine conical, bluntly pointed spines in the upper row, smaller spines below on the periphery, equal in number, and below these a third row of still smaller spines, or tubercules; almost five whorls visible on the type specimen, the upper two being smooth; the spines of the upper row increase in size gradually to the aperture; surface of body whorl marked by spiral threads of variable strength; canal sharply recurved, outer lip greatly thickened and expanded outwardly, apparently denticulated within; upper margin of the peristome continuous with the heavy callous deposit on the columellar wall. Altitude of plesiotype No. 823, 33 mm.; diameter, 30 mm.

This species differs from *G. tuberculata* (Gabb) (=*G. tuberculiformis* Hanna) in its larger size and more robust form, in its turrited spire which is not one of continuous slope, and in its three rows of spines instead of two as in Gabb's species. It differs from *G. tri-tuberculata* (Weaver) also in its larger size, more robust form, and in having the spines appressed vertically. Examples of the Cowlitz species in the collections of the Academy show it to be a very distinct form, not easily confounded with ours.

The type specimen of this species was obtained by Blake from a block of sandstone found on the trail less than eight miles west of Grapevine Creek, perhaps in the drainage areas either of Tecuya or Salt Creek and was doubtless derived from the Tejon strata of that section. His description and figures are poor but characteristic and were included by him under the species referred to the Miocene in his report.

It does not seem that the use of the name *Galeodea petrosa* (Conrad) should be invalidated by his use of "*Gal-*

odea petrosa" in 1866.[111] He listed it from "Lower Eocene" of Oregon but gave no reference to where the species was described; the name therefore has no more standing than a *nomen nudum.* Gabb in 1869[112] stated that he did not know what the name signified unless it be *"Semicassis ? biliratus"* or *"Semicassis ? petrosus"* listed by Conrad as Nos. 472 and 474. The latter was described as *"Dolium petrosum"*[113] by Conrad and afterwards referred to *Doliopsis* and *Semicassis;* it is now placed in *Eudolium*[114] and occurs in Miocene strata at Astoria, Oregon.

79. [Galeodea tuberculiformis Hanna]

Morio (Sconsia) tuberculata Gabb, Geol. Surv. Calif. Pal. Vol. I, 1864, p. 104, pl. 19, fig. 57, **Bull's Head Point, Martinez.**—*M. (S.) tuberculata* Gabb, Pal. Vol. II, 1869, p. 223, in part, but not Type Tejon records.

Galeodea tuberculata (Gabb), Dickerson, Univ. Calif. Publ. Geol. Vol. IX, 1916, p. 421, etc., not Type Tejon records, but possibly p. 516, pl. 42, fig. 2, locality not given.

Galeodea tuberculiformis Hanna, Calif. Acad. Sci. Proc. 4th ser. Vol. 13, 1924, p. 167.

Not *Cassidaria tuberculata* Risso, Hist. Nat. Eur. Mer. Vol. IV, 1826, p. 186.

This species was described from near Martinez, and from strata not yet proved to be the equivalent of the Type Tejon. Gabb stated that there are two, rarely three, rows of tubercules on the body whorl, and this character is well shown in his figure, as it is also in that of Dickerson, referred to above. In this form the spire is low, with nearly straight smooth slopes on which the several whorls show no vertical rise, and no tubercules. It has not been seen in any of the collections from the type locality of the Tejon Group.

Unfortunately, the original name of the Martinez species is in conflict with an earlier one and the rules of nomenclature required its replacement.

[111] Smith. Misc. Coll. No. 200, Check List Inv. Foss. N. A. Eocene and Oligocene, 1866, p. 15, No. 471.

[112] Geol. Surv. Calif. Vol. 2, 1869, p. 112.

[113] Geol. U. S. Expl. Exp. App. 1, 1849, p. 727, pl. 19, figs. 3, 4.

[114] Dall, U. S. Geol. Surv. Prop. Papr. 59, 1909, p. 71.

80. Ficus mamillatus Gabb

Ficus mamillatus Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 211, pl. 32, fig. 276; **near Fort Tejon.**— Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363; said to be the same as *Sycotypus modestus* of Oregon Tertiary.— Gabb, Amer. Jour. Conch. Vol. 2, 1866, p. 91.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 221; Tejon Group, Tejon.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— English, Univ. Calif. Publ. Geol. Vol. 8, 1914, p. 245.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 50, pl. 6, fig. 12; Loc. 244 (C. A. S. Coll.), Live Oak Canyon.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 449, Type Tejon record.

? *Sycotypus modestus* Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363; (*Ficus mamillatus* Gabb is stated to be identical.)

Ficopsis mamillatus (Gabb), Conrad, Amer. Jour. Conch. Vol. 2, 1866, p. 100; (included in new genus proposed by Conrad.)

This species, which was first described from the type locality of the Tejon Group has not, to our knowledge, been found anywhere else, although Dickerson has listed it from the Cowlitz Group of southern Washington, and from the vicinity of Mount Diablo. It is a rare species at the type locality, only three specimens having been seen by us among the large collections studied from this section.

81. Ficopsis hornii (Gabb)

Plate 12, figure 8

Fusus (Hemifusus) hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 86, pl. 28, figs. 206 and 206a; **near Fort Tejon.**— Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.— Gabb, Amer. Jour. Conch. Vol. 2, 1866, p. 90.— Gabb, Calif. Acad. Nat. Sci., Prov. Vol. 3, 1867, p. 302.

Ficopsis hornii (Gabb), Conrad, Amer. Jour. Conch. Vol. 2, 1866, p. 100.— (Gabb), Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 158, 221.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 282.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record, and p. 61, pl. 6, fig. 9; Loc. 244 (C. A. S. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 449, Type Tejon records.

Perissolax hornii (Gabb), Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.

This species was originally described from the type locality of the Tejon Group, and has usually been so listed by most of the writers who have dealt with this formation down to the present. Dickerson enumerated it as one of the

"characteristic" forms. It has been collected at Locs. 244 and 245 (C. A. S. Coll.), and at Locs. 451 and 452 (U. C. Coll.). In the large series of specimens which we have studied considerable variation has been seen in the strength of the three rows of spines which encircle the whorls. In senile individuals the two lower ones are usually lost and in one case even the upper row was missing but the shell was distinctly angulated at the place where the row would be, the angle being just a little more than 90°.

82. Ficopsis remondii (Gabb)

Fusus (Hemifusus) remondii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 87, pl. 18, fig. 36; Cochran's, east of Mount Diablo, and Alizos Creek, near Fort Tejon.— Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.— Gabb, Amer. Jour. Conch. Vol. 2, 1866, p. 90.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 302.

Ficopsis remondii (Gabb), Conrad, Amer. Jour. Conch. Vol. 2, 1866, p. 100. — Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 158 and 221; reported from Martinez, Clayton, and Fort Tejon.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 197 and 212.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 282.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, Tejon record.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record, and pp. 61, 88, and pl. 6, fig. 8; Loc. 244 (C. A. S. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 433, 449, Type Tejon records.

Perissolax remondii (Gabb), Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.

This species was originally described from Cochran's, near Mount Diablo, but Gabb reported it also from Alizos Creek, near Fort Tejon, where it does occur plentifully, along with the preceding species. There are several good specimens in the collections of the Academy of Sciences from this place.

The slender form and complete absence of nodes or spines at all ages will serve to distinguish the species from *F. hornii,* with which there appears to be no intergradation. Dickerson has figured a typical example of *remondii.*

83. [Ficopsis cowlitzensis (Weaver)]

Hemifusus cowlitzensis Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 45, pl. 1, figs. 1, and 4, (*Hamifusus* by err.), Cowlitz Group, near Sopenah, Washington.

Ficopsis cowlitzensis (Weaver), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. V, 1915, pp. 61, 62, 88, pl. 6, fig. 10, Loc. 182, (C. A. S. Coll.), Cowlitz Group, Vader, Washington. (Not pp. 43, 50 and 51, Type Tejon records.) — Not *F. cowlitzensis,* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 449, Type Tejon records.

This species is abundant in the Cowlitz Group near Vader, Washington, from which locality there are numerous specimens in the collections of the Academy of Sciences. Dickerson listed it also from the type locality of the Tejon Group, but does not specify the points at which he has obtained it. In his earlier publication he listed it (p. 51) as one of the "characteristic and most abundant species" of both the Cowlitz Group and the "Type Tejon". We do not know upon what he based the statement of its occurrence in the Type Tejon Group, nor upon what he relied for his statement that it is a "characteristic and most abundant species" there. We have not found a single specimen of it in any of the large collections which we have examined from there. It is true that some variations of *F. hornii* Gabb, resemble the Cowlitz species in a general way, but this resemblance does not amount to specific identity, without an expansion of the Tejon species to include the other entirely, which we do not believe is justifiable.

Naticidæ

The members of the family Naticidæ which have been found or reported as occurring in the strata of the Tejon Group at the type locality have been placed here in the following genera: *Ampullina, Amauropsis, Natica, Neverita* and *Sinum*. In order to avoid confusion we should state the basis of our use of these names.

The type of the genus *Ampullina* is given by Dall as *Ampullaria depressus* Lamarck,[115] and there can be no doubt that the western Eocene forms, such as *Natica hannibali* Dickerson, belong to this genus. No representatives of the group, however, have been found by us in the strata of the Type Tejon Group.[116]

[115] U. S. Geol. Surv. Prof. Ppr. 59, 1909, p. 89.

[116] *Ampullina depressus* (Lam.) has been figured by Cossman and Pissaro. Icon. Eocene Paris, pl. 10, fig. 64-7.

The type species of *Amauropsis* has been given as *Natica helicoides* Johnston, a living species of the north Atlantic.[117] The western analogue is *A. purpurea* Dall. The species has a channeled suture and is probably generically distinct from Conrad's, *A. alveata.*

The two largest groups of living *Naticidæ* are *Natica* and *Polinices,* but the presence of a calcareous operculum in the first, and one of horny character in the second, furnish the only reliable means of distinguishing them,[118] but this is usually missing in fossil species. Therefore the generic identification of fossil species as one or the other must be largely upon resemblance to living forms. The unsatisfactory nature of this method is shown by the many changes in the nomenclature in paleontologic literature. The only consistent escape from this elusive method is that of referring all the naticoid fossil species to the earliest name for the group, and therefore *Natica* has been adopted for this report.[118a] Of this group there are certain well marked species in the Type Tejon strata. *Natica hornii* Gabb has a low spire, shallow sutures, and an umbilicus completely filled with callus. *Natica uvasana* is smaller in size, has an open umbilicus only partly filled by a calcareous pillar on the side next to the aperture. *Natica nuciformis* has an open umbilicus with no calcareous deposit within it whatsoever.

The group *Neverita,* as used by conchologists, has usually been included as a sub-genus under *Polinices,* because the species have a horny operculum; but western paleontologists generally use it in a generic sense for naticoid shells having relatively high spires, somewhat flattened sides, and base, and with an umbilicus open or partly filled by a callous deposit. On these characters it is usually possible to distinguish the fossil species from *Natica* at a glance, but there appears to be abundant intergrades when large numbers of species are studied. Under such circumstances the only

[117] Dall, opt. cit. p. 89; figured by Tryon, Man. Conch. Vol. 8, 1886, p. 53, pl. 22, fig. 31.

[118] Dall, opt. cit. p. 87, and Trans. Wag. Free Inst. Vol. 3, pt. 2, p. 362, etc.

[118a] In late reports by Hedley, (Rec. Aust. Mus. Vol. 14, No. 3, 1924;) and Marwick, (Trans. New Zealand Institute, Vol. 55, 1924, p. 559;) it has been shown that the genus-name *Polinices* Montfort, 1810, is ante-dated by *Uber* Humphreys, 1797, and the former name has been discarded as a group of the Naticidæ. This further serves to illustrate the unsatisfactory results which would be obtained if attempts be made to place fossils of the group into so unstable a system as that in present use with living forms.

logical course would seem to be to use *Natica* for the genus and *Neverita* as a sub-genus.

No difficulty is experienced in recognizing the members of the genus *Sinum* which the acceptance of Bolten's names compels us to use instead of the well known *Sigaretus* of Lamarck.

84. Natica hornii (Gabb)

Plate 10, figure 7

Natica ?oetites Conrad, House Doc. 129, Proj. Vol. 3, 33d Cong. 1st Sess. 1855, p. 10, App. to Rep. W. P. Blake,— Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 321, pl. 2, fig. 7.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.— Not *N. oetites* Conrad, Foss. Sh. Tert. Form. 1833, from the Claiborne Group.

Natica aetites ? Dickerson, Univ. Calif. Publ. Geol. Vol. IX, 1916, p. 368.

Lunatia hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 106, pl. 29, fig. 217, **Alizos Creek, near Fort Tejon**; listed on p. 224 from San Luis Gonzaga Ranch, probably by error, the star being placed in the wrong column.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303. — Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 222.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 285.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, Type Tejon record.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record, and pl. IV, fig. 11, Loc. 245, (C. A. S. Coll.), near Grapevine Creek, Kern County, Calif.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 438, 442, 450, Type Tejon records.

This species was first described from the type locality of the Tejon Group, and the above records are from there only. The species has been variously listed from many other places, but no attempt has been made here to check its occurrence elsewhere than at the Tejon locality.

Gabb's description and figure do not entirely agree, probably due to inaccuracy of the artist. However, it seems to be generally conceded that he had the low spired, heavily calloused form which is abundant in the strata of the Type Tejon Group. Conrad's figure is entirely unrecognizable. Occasion is here taken to represent the species photographically.

85. Natica nuciformis (Gabb)

Plate 10, figure 8

Lunatia nuciformis Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 107, pl. 28, fig. 218.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, p. 222, **Alizos Creek, near Fort Tejon.**—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 285.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 50, 51.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 427, 432, 438, 450, Type Tejon records. (Not p. 510, pl. 39, fig. 4, from Loc. 2225 (U. C. Coll.)).

This species was originally described from Alizos Creek, now known as Live Oak Creek, at the locality of the Tejon Group. All of the records given above refer to the Type Tejon only. The occurrence of the species is not confirmed from other localities. Dr. B. L. Clark has also recorded the species from the strata of the Type Tejon.[119]

86. Natica uvasana Gabb

Plate 9, figures 3, 4

(?) *Natica gibbosa,* and *N. semilunata* Lea, Conrad, House Doc. 129, Proj. Vol. 3, 33d Cong. 1st Sess. 1855, p. 10, App. to Rep. W. P. Blake; not the species described by Lea, in Contr. to Geol. 1833, from Eocene of Alabama.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 368.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.

Natica uvasana Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 212, pl. 32, fig. 277, **near Fort Tejon.**— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 221.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 287.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 44, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 433, 439, 451, Type Tejon records, ? p. 508, pl. 38, fig. 8.

This species was originally described from the type locality of the Tejon Group, where it occurs abundantly. It is surmised that it was this that Conrad mistook for the species of Lea from the Eocene of Alabama. At any rate this seems to be the most plasuible interpretation of the

[119] Jour. Geol. Vol. 29, 1921, p. 159, Tejon record.

record. The species is fairly constant in form, and in the possession of the peculiar callus described by Gabb. We have selected a specimen for photographic illustration which agrees with that of Gabb as nearly as possible.

87. Natica secta Gabb

Plate 10, figure 9

Neverita secta Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 108, 225, pl. 29, fig. 220, Alizos Creek, near Fort Tejon.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. III, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 222.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— Cooper, Calif. State Min. 7th Ann. Rept., 1888, p. 288.— Harris, Science, Vol. 22, Aug. 18, 1893, p. 97. = *Natica oetithes* Conrad. — Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44, 50, 51, Type Tejon records, (Not (?) p. 84, pl. 4, fig. 9, Cowlitz Group, Wash.) — Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 433, 451, Type Tejon records, but not p. 510, pl. 39, fig. 6, the locality of which is not given.

This species was first described from the locality of the Type Tejon, and the above records pertain only to its occurrence there. It is a very well marked form which need not be mistaken upon careful comparison of specimens.

88. [Natica fiasco Hanna]

Natica fiasco Hanna, Calif. Acady. Sci. Proc. 4th ser. Vol. 13, 1924, p. 173; new name for *Neverita globosa* Gabb.

Neverita globosa Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 161, 222, pl. 27, fig. 39, from 10 miles west of Griswold's ranch on the road from San Juan to New Idria, California; not listed from the Type Tejon.

Not *Neverita globosa* Gabb, Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 422, Type Tejon record nor p. 510, pl. 39, figs. 5a, 5b, from near Oroville, California.

Not *Natica globosa* King, Zool. Journ. Vol. 5, 1830-1831, p. 344.

Not *Natica globosa* Jeffreys, Proc. Zool. Soc. London, 1885, p. 33.

Dickerson probably did not intend to record this species from the type locality of the Tejon Group, since he has not listed it in any of his formal tables of this fauna. Specimens in the collections of the Academy of Sciences from Loc. 244 (C. A. S. Coll.) labelled *N. globosa* in his hand-

writing, are clearly *Natica hornii.* Nevertheless, on p. 442 he included *globosa* as a species that is "entirely typical of the Tejon", and says that it "has been reported from the Type Tejon of Grapevine Creek". He has not stated where it is so reported, nor have we found any specimens of the species in any of the collections from there.

89. [Ampullina andersoni (Dickerson)]

Amauropsis andersoni Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 4, 1914, p. 120, pl. 12, figs. 2a and 2b; Glide, **Douglas County, Oregon, Loc. 25 (C. A. S. Coll.).**— Not of Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43; Loc. 245 (C. A. S. Coll.) and Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 448, Type Tejon records.

This species was described from the Eocene deposits of the Roseburg Quadrangle, Oregon, and an inspection of the type and other specimens of the same species in the collections of the Academy of Sciences shows that it belongs to the genus *Ampullina,* and not that to which it was referred by Dickerson. It does not seem to have been found in the Tejon Group at the type locality, although Dickerson recorded it from there in three separate places, as above cited. We have been unable to find any specimen from there that even resembles generically the very distinct Oregon species. Specimens in the Academy of Sciences collections from Loc. 245 (C. A. S. Coll.) labelled *Amauropsis andersoni* Dickerson, are unmistakably referable to *A. alveata* (Conrad), under which name the subject is more fully treated.

90. [Ampullina hannibali (Dickerson)]

Natica hannibali Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 4, 1914, p. 119, pl. 12, figs. 5a and 5b, **Loc. 25 (C. A. S. Coll.), near Glide, Douglas County, Oregon.**— Not of Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, p. 44, and Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 433, 439, 451, Type Tejon records.

The type of this species came from the Umpqua River, near Glide, Oregon, and was obtained by the senior author in 1904, along with many other specimens of the same. It is clearly an *Ampullina,* and not a *Natica.* Dickerson has listed the species in the fauna of the Type Tejon Group on

the basis of its supposed occurrence on Salt Creek, Kern County, but we have been unable to find any specimens of it in the collections from this place, which are numbered. He did not figure a specimen from there, but selected instead one from near Salt Creek, Fresno County, and this is a distinct species with which we are not now concerned.[120] However, the possible occurrence of older Eocene strata, unconformably below the Type Tejon, on Salt Creek in Kern County, should not be overlooked, and these beds could contain species not found in the Tejon itself. As Dickerson has furnished no evidence that this species belongs to the Type Tejon Group, we do not feel inclined to admit that it should be so listed, and therefore have omitted it from our list of the fauna.

91. Amauropsis alveata (Conrad)

Plate 6, figure 2; plate 7, figure 1; plate 15, figure 17

Natica alveata Conrad, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st. Sess. 1855, p. 10, App. to Rep. W. P. Blake,— *Natica alveata* Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 321, pl. 2, figs. 8 and 8a; **Cañada de las Uvas, Type Tejon.**— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.

Amauropsis alveata (Conrad), Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 110, 225, pl. 19, fig. 59; not pl. 21, fig. 111, from northeast of Martinez.— Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.— Gabb, Amer. Jour. Conch. Vol. 2, 1866, p. 90.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 49, 51; Type Tejon records; (not pl. V, fig. 9.) — Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 368, 421, 432, 438, 448; Type Tejon records; (not p. 508, pl. 38, fig. 7, from Loc. 672 (U. C. Coll.), northwest of Coalinga.)

Lunatia ? alveata (Conrad), Amer. Journ. Conch. Vol. 1, 1865, p. 26.

Globularia alveata Conrad, Amer. Jour. Conch. Vol. 1, 1865, p. 363.

Euspira alveata (Conrad), Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 160, Type Tejon records.— Cooper Calif. State Min. 7th Ann. Rept. 1888, p. 281, Type Tejon records.— Arnold, (*Enspira* by err.) U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15, Type Tejon records.

Amauropsis alocata (Gabb), Arnold, Op. cit. p. 14, (probably typ. err.)

Ampullina alveata Conrad, Amer. Jour. Conch. Vol. 2, 1866, p. 100.

Amauropsis andersoni Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43; Loc. 245 (C. A. S. Coll.), Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 448, Type Tejon records.

[120] Opt. cit. p. 508, pl. 38, figs. 9a and 9b.

This species is very abundant at the type locality of the Tejon Group and is well illustrated by both Conrad and Gabb. Dickerson has figured a specimen without comment or statement of locality, which, if it is properly referred to this species, is at least not true to form.[121] Our figures are here introduced to show the aperture and young stages of the shell, in specimens obtained from Loc. 711 (C. A. S. Coll.) in Grapevine Canyon, Kern County, California. These features have not been previously illustrated. In this species the two nuclear whorls are smooth; those following are usually striated spirally, the sculpture consisting of broad flat threads with narrow channels between. In older shells this feature is variable, but is finally entirely lost, perhaps by being eroded away, due to the burrowing habits of the animal. From the same cause also the sharply angulated shoulder, developed after the sixth whorl, becomes rounded, and the nuclear whorls are worn away. In the younger shells the umbilicus is partly open.

92. **Sinum coryliforme** Anderson & Hanna, new species

Plate 9, figure 10; plate 10, figure 15; plate 15, figure 8

Naticina obliqua GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 109, and 225, Type Tejon records; not pl. 21, fig. 112.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 223, Type Tejon records.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 198, 208, 213. = Sigaretus.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 287.— ARNOLD, U. S. Geol. Surv. Prof. Ppr, No. 47, 1906, p. 15.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 44, 50, 51, Type Tejon records, but not pl. 5, figs. 5a and 5b, from the Cowlitz Group, Washington.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 427, 433, 439, 442, 450, Type Tejon records.

Sigaretus obliqua GABB, DALL, Trans. Wag. Free Inst. Sci. Vol. 3, Pt. 2, 1892, p. 380.

Sinum (Genus) Bolten, DALL, U. S. Geol. Surv. Prof. Ppr. No. 59, 1909, p. 91.

Shell depressed, thin, whorls about four; two or more nuclear whorls smooth, changing abruptly to spiral striations; spiral sculpture consisting of flat-topped, wavy threads, separated by interspaces almost equal to their width; each

[121] Op. cit. pl. V, fig. 9.

interspace containing one to three minute intermediary lines; suture linear, depressed near the aperture; body whorl swollen a little below the suture; umbilicus small, partially covered by the expanded callus of the inner lip; aperture ovate, narrow above, rounded below.

Type: No. 851; paratypes, Nos. 852, 853 and 971, Mus. Calif. Acad. Sci., collected at **Loc. 244 (C. A. S. Coll.), Live Oak Canyon, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

In Gabb's species the outline of the body whorl is straight, or concave, near the suture, while in ours the outline is decidedly convex, this character being constant in a large series of specimens. Moreover, Gabb's species is higher, with a less enveloped spire, has a more rounded aperture and a wider umbilicus. In all the specimens of our species the spiral sculpture is much finer than that shown by Gabb's figures; these appear to have been made from a distinct species, probably from near Martinez, and of which no specimens have been seen in the collections from the type locality of the Tejon Group.

We follow Dall in placing these shells in the genus *Sinum,* rather than in *Naticina* or *Sigaretus* where they have usually appeared heretofore.

93. Calyptræa excentrica (Gabb)

Galerus excentricus Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 136, pl. 20, fig. 95, and pl. 29, figs. 232 and 232a; five localities are listed for this species, including Martinez and the type locality of the Tejon.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 228.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 198, 203.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.

Calyptræa excentrica (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, pp. 43, 51, and 49; Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 432, 438, 449; Type Tejon records.

In the original description of this species the first locality mentioned was northeast of Martinez, and the figure on plate 20 looks as if the specimen had come from that place;

the drawing seems to have been made from a cast. The figures on plate 29 are better, and the fossils may have come from the locality of the Type Tejon; they correspond well with examples obtained there by ourselves. At any rate we have 40 specimens of the species from Live Oak Canyon, where it is very abundant, and the variation among them is sufficient to include all the forms figured by Gabb. It seems likely that this species may occur in both the Martinez and Tejon Groups at their type localities.

94. [Crepidula inornata Dickerson]

Crepidula inornata Dickerson, Univ. Calif. Publ. Geol. Vol. IX, 1916, p. 489, pl. 38, figs. 5a and 5b, **Loc. 672 (U. C. Coll.), north of Coalinga;** (not p. 432, Type Tejon record.)

The type locality of this minute species is not that of the Type Tejon Group, but in beds that are probably older. We have not found it in any of the Tejon collections and since the author did not include it in his formal lists from there on pp. 421 and 448, we must suppose that the record of it at the place above cited was unintentional.

95. Crepidula pileum (Gabb)

Plate 13, figure 7

Crypta (Spirocrypta) pileum Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 137, 228, pl. 29, figs. 233, 233a and 233b.

Spirocrypta pileum Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— *S. pileum* Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 228.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 198, 203.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 291.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.

Crepidula pileum (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 49, 51, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 438, Type Tejon records.

This species was described from the type locality of the Tejon Group and was made the type of the subgenus *Spirocrypta*. Tryon, however, has considered the group of little systematic value,[122] and in this view we concur. Dickerson

[122] Man. Conch. Vol. 8, 1886, p. 104.

recorded the species from Locs. 244 and 245 (C. A. S. Coll.), of the Type Tejon, and we have many good examples from the same places; among them a considerable amount of variation is shown, as might be expected in the genus. A specimen from Loc. 245 is 50 mm. long, and of decidedly different form from any of the others. It may be a distinct species, but is too imperfect for description. *C. pileum* rarely has a length of more than 19 mm., and smaller ones are more abundant.

96. Architectonica hornii Gabb

Plate 8, figure 2; plate 9, figure 1

Architectonica hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 117, pl. 29, figs. 224 and 224a; **Type Tejon locality.**— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. III, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 224.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 275.— Harris, Science, Vol. 22, Aug. 18, 1893, p. 97; = *Solarium amœnum* Conrad of Claiborne age.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 14.—Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, p. 43; listed from Loc. 244 (C. A. S. Coll.), Type Tejon.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426 (as *A.* cf. *hornii*,), 427, 432, and 448; all Type Tejon records.

Architectonica cognata Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 224.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Heilprin, Acad. Nat. Sci. Phila. Vol. 34, 1882, p. 193.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 275.— Harris, Science, Vol. 22, Aug. 18, 1893, p. 97; stated the species is *Solarium alveatum* Conrad.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 14.— Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, p. 43.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 448. All of the above pertain to records of the species from the Type Tejon Group. (Not of Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 117, pl. 20, figs. 72, 72a, b, c, from Bull's Head Point, Martinez.)

This species was described by Gabb from the type locality of the Tejon Group, where it occurs frequently. Mr. Bruce G. Martin obtained several good specimens of it at Loc. 244 (C. A. S. Coll.). The largest one is 15.4 mm. in diameter, and although its spire is broken it is 10 mm. in altitude. The spire is slightly dome-shaped, and has an apical angle of

98°. Gabb's figure shows a larger angle than this, and may be taken as showing the extremes of variation in this respect, though his specimen was undoubtedly younger and less mature than ours.

Although *Architectonica cognata* has been repeatedly listed from the Type Tejon we have seen no undoubted specimens of it from there. It is believed that casts of *A. hornii* may have been mistaken for it originally and the remaining records are repetition.

97. [Epitonium tejonense Dickerson]

Epitonium tejonensis Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 491, pl. 38, fig. 4, **Loc. 672 (U. C. Coll.), Parson's Peak, Fresno County, Calif.**

(?) Not *Epitonium* n. sp., Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record.

(?) Not *Epitonium tejonensis* Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 433, 449, Type Tejon records.

Dickerson stated that his record (and description) is the "first time this genus has been reported from the Eocene of the Pacific slope". It may be pointed out, however, that neither his figure nor his description of the specimen referred to this genus afford a very satisfactory basis for a generic determination. The record of the form, whatever the genus, occurring in the Tejon Group at the type locality is based apparently upon two imperfect specimens from Loc. 244 (C. A. S. Coll.) which are not generically identifiable, although they have a general resemblance to Dickerson's figure and type. The data at present available is too meager to warrant including the species, as named, in the fauna of the Type Tejon with which we are now dealing. As to the locality of "Parson's Peak", Loc. 672 (U. C. Coll.), these beds have not yet been proved to belong to the horizon of the Tejon at its type locality, and they may be older. It is therefore regrettable that this name has been used for any species not actually obtained from the type locality of the group or its equivalent, since it is likely to be misleading. Such usage is of course based only upon an assumption that may not prove to be correct upon further study.

98. Turritella sargeanti Anderson & Hanna, new name

Turritella uvasana Conrad, Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, pl. V, figs. 1b, 1c, and 3, Loc. 244 (C. A. S. Coll.), Live Oak Canyon, Kern County, Calif.

Turritella uvasana bicarinata Dickerson, above cit. pp. 44, 58, pl. 5, fig. 2, Loc. 244, (C. A. S. Coll.), same as above.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 452; Type Tejon records.

Not *T. bicarinata* Eichwald, 1830; Pusch, 1836 or Andrz., 1837; see Bronn & Röemer, Lethæa Geognostica, Vol. III, 1853-56, p. 490.

Turritella uvasana tricarinata Dickerson, Calif. Acad. Sci. 4th ser., Vol. 5, 1915, pp. 44, 58, pl. 5, fig. 4, Loc. 244, (C. A. S. Coll.) same as above.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 453, Type Tejon records.

Not *T. tricarinata* King, Zool. Jour. Vol. 5, 1830-31, p. 346, Valparaiso, Chile; see Tryon, Man. Conch. Vol. 8, 1886, p. 254.

The usual form of *Turritella* in the type locality of the Tejon Group is angulated on the whorls, the spiral threads of which number five to seven; this number decreases as the whorls increase in size, which is not the case in *T. uvasana* Conrad. In *T. sargeanti* the threads are higher and sharper, as well as coarser than in *T. uvasana,* and less uniformly spaced. Dickerson's varietal forms, *T. bicarinata,* and *T. tricarinata,* intergrade, and represent the same species, as described above. Conrad's name cannot be applied to this species, and both of Dickerson's are preoccupied. We have therefore named the species for Mr. W. W. Sargeant, Secretary of the California Academy of Sciences. Dickerson's varieties can not be distinguished, since some specimens have been found with both forms of sculpture on a single individual.

Type: No. 284, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin. The specimen was figured by Dickerson, (first citation above, fig. 1c.).

99. [Turritella buwaldana Dickerson]

Turritella buwaldana Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 500, pl. 42, figs. 7a and 7b, **Loc. 672 (U. C. Coll.) north of Coalinga, Calif.**; not pp. 421, 434, 439, 453; Type Tejon records.

Although this species has been listed as occurring in the strata of the Tejon Group at its type locality, it was not described from there, and no specimens have been found which enable us to corroborate its occurrence.

100. [Turritella kewi Dickerson]

Turritella kewi Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 501, pl. 42, fig. 8a; not pp. 421, 434, 453; Type Tejon records. (The text and explanation refer to fig. 8, which is an error, fig. 8a being intended.)

This species was described from **Loc. 672 (U. C. Coll.) north of Coalinga,** and the same remarks apply to it as to the preceding species. Two specimens bearing the number 452 have been found in the collections of the University of California, but the matrix rock is that of Loc. 672 (U. C. Coll.); a note on the label in Dickerson's handwriting refers to Loc. 672 (U. C. Coll.), and the specimens probably came from this latter place. This fact naturally throws doubt upon their occurrence at the Tejon locality. But among all the collections examined by us from the strata of the Type Tejon of Kern County not a single specimen corresponds to the species described as *T. kewi.*

101. Turritella uvasana Conrad

Plate 11, figures 5, 6; plate 12, figure 9

Turritella uvasana Conrad, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st. Sess. 1855, p. 10, App. to Rep. W. P. Blake.— Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 321, pl. 2, fig. 12.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.— Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 134, 227; Type Tejon records; perhaps not pl. 21, fig. 92, Bull's Head Point, near Martinez; Vol. 2, 1869, p. 228; Type Tejon record.— Conrad, Am. Jour. Conch. Vol. 1, 1865, pp. 32, 363.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 295.— Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, pp. 44, 50, 51; Type Tejon records; not pl. 5, figs. 1a, 1b, 1c, nor 3.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 434, 439, 452; Type Tejon records; not pl. 42, fig. 6; Loc. 672 (U. C. Coll.), north of Coalinga, California.

Our discovery of a large number of specimens at the type locality of the Tejon Group, and at Conrad's type locality of this species, which agree with his meager description and

poor figure better than any others heretofore collected there or elsewhere, has enabled us to offer a better figure and description of the same. Of the two species which occur there, it now appears that Conrad had the rarer one, with rounded whorls, with finer, more numerous, and regular spiral threads ornamenting the whorls, and with a long and very tapering spire. The specimen figured by Gabb, while it resembles Conrad's in some respects, came from near Martinez, and has a smaller number of spiral threads on the whorls. No specimens agreeing with Gabb's figure have been found by us in any of the collections, from the type locality of the Tejon Group. The more usual forms are the ones Dickerson has referred to Conrad's species as subspecies, but an inspection of Conrad's figure and description makes it evident that the strongly bicarinate or tricarinate forms do not represent his form.

The largest pleisotype of *T. uvasana* Conrad, as here described, is 81 mm. in altitude, with about 17 mm. missing from the apex; diameter, 20 mm. The total number of whorls in the complete shell is about 20; the upper ones are sharply threaded with only two or three lines, but about the eighth whorl below, these increase in number until there are eight or more on each whorl, alternating greater and smaller as stated by Conrad. The aperture is rounded and not axially elongated as in Gabb's figure. This species is closely allied to *T. terebellata* Lamarck, as figured by Cossman and Pissaro,[123] and seems to have an analogue in the Cowlitz Group of Washington, as described by Weaver and Palmer.[124]

102. ["Turritella n. sp." Dickerson]

Turritella n. sp. Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, pp. 44, 50, 51; Type Tejon records.

The above name is repeated in the text, and in one place it is recorded from Loc. 452 (U. C. Coll.). We have no means of knowing the species the author had in view in these records, but like many others they must be considered, if only for completeness, in this report.

[123] Icon. Vol. 2, 1913, pl. 20, fig. 125-1.

[124] Univ. Wash. Publ. Geol. Vol. 1, No. 3, 1922, p. 33, pl. 12, fig. 17.

103. ["Spiroglyphus ? tejonensis" Arnold]

Spiroglyphus ? tejonensis Arnold, U. S. Geol. Serv. Bull. 396, 1909, p. 51, pl. 4, fig. 18, **Little Tar Canyon, Kings County,** and north of Coalinga, California. (Not Dickerson, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, p. 44, and Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 439, 452, Type Tejon records).— Not *S. tejonensis,* Dickerson, above cit. pl. 37, figs. 5a and 5b, locality not given and not stated on the label of the specimen as preserved in the collection of the University of California.

This species was described from strata in the Mount Diablo Range which may be of older age than the Tejon Group, and as far as we have been able to ascertain it has never been found in the type locality of the same, although it has been repeatedly recorded from there. However, in only one case has the record referred to definite material; Dickerson recorded it from Loc. 245 (C. A. S. Coll.), in the first citation above, but no specimens so labelled, or without labels, have been found in the collections from this locality. The specimens figured by Dickerson,[125] do not appear to have come from the Type Tejon.

104. **Niso pistiliformis** Anderson & Hanna, new species

Plate 8, figure 15

Niso polita Gabb, Geol. Surv. Calif. Vol. 1, 1864, p. 225, and Vol. 2, 1869, p. 224, Type Tejon records.— (Not Vol. 1, 1864, p. 116, pl. 21, fig. 113, from Div. B, northeast of Martinez, which is a distinct species.)

Niso polito (typ. err.) Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913. p. 264,—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 50 and 51, Type Tejon records.

This species which is quite distinct from that described by Gabb from near Martinez, is perhaps the basis for all of the records of the latter in the Type Tejon Group. In *pistiliformis* the apical angle is much larger (26°) than in *polita* (17°) and the spire is accordingly lower. In the former, whorls number about 10, sides flat, suture but little impressed, not channeled as in *Pyramidella;* body whorl obtusely angled around the base; umbilicus one-fifth the width of the basal whorl, deeply rimate, bounded on the outside by an angulation; surface polished, lines of growth very weak, the incised lines irregularly spaced, extending from suture to

[125] Pl. 37, figs. 5a and 5b, of his last paper.

suture and on the base as well, slightly oblique to the axis; aperture unarmed; altitude 10 mm.; diameter 4.6 mm.

Type: No. 841, Mus. Calif. Acad. Sci.; collected by Bruce G. Martin at Loc. 244 (C. A. S. Coll.) in Live Oak Creek, Kern County, California; Type Tejon Eocene.

Gabb did not record *N. polita* as occurring at Tejon in the original description, but stated that it was based upon four specimens from near Martinez. His figure shows a much more acutely pointed shell, with the suture lines sloping at a steeper angle, and a correspondingly longer whorl, than is the case with our species. Dickerson stated in one place that it is a "characteristic and most abundant species" of the Type Tejon, etc., in addition to misspelling the name in most cases. Nevertheless, he omitted it from all of his later and more formal lists of the Tejon fauna where it should have appeared if he had really found it there. So far as our observations go the genus as well as the species is rare in the Tejon and Gabb's form does not occur there.

105. **Turbonilla gesteri** Anderson & Hanna, new species

Plate 11, figure 10

Shell large, conical, sides of spire straight; apical angle acute; fifteen post-nuclear, flat sided whorls; nucleus missing; suture deeply impressed; junction of spire with base of body whorl rounded; spiral sculpture absent; all post nuclear whorls ornamented with coarse, rounded, axial ribs which are slightly curved and "protractive"[127] on the lower ends; these ribs extend from suture to suture and to the basal angle of the body whorl, on which there are 25; the interspaces are rounded depressions equal in width to the ribs; aperture pointed above and apparently rounded below; columella heavily calloused, straight, with a deeply channeled groove at its juncture with the body whorl; altitude, 11.5 mm.; diameter, 3.0 mm.

Type: No. 955, Mus. Calif. Acad. Sci.; collected by Mr. G. C. Gester in Live Oak Creek, Kern County, California; Type Tejon Eocene.

[127] The terminology used in the description of Pyramidellids is that devised by Bartsch; U. S. Nat. Mus. Bull. 68, 1909, p. 7.

This species is fairly common in many strata of Live Oak Creek, but the specimens are usually injured in removal from the matrix. Mr. Gester was fortunate in finding a place where many small forms had weathered out and were preserved in almost perfect condition. It was upon some imperfect specimens of this species that Dickerson based his record of *Terebra californica* in the Type Tejon strata if we may trust the labels he placed with the specimens. The species does not appear to fit readily into any of the groups of the genus *Turbonilla* as defined by Bartsch, but agrees nearer with *Pyrgolampros* than any other of the living forms. If a new group were defined for it a distinctive character would probably be the deep channel at the juncture of the columella and the basal wall. The curvature of the axis in the type specimen is apparently due to pressure, as this condition was not observed in other specimens of the species that were obtained from the same beds.

106. **Turbonilla kernensis** Anderson & Hanna, new species

Plate 14, figure 8

Shell small, conical, sides of spire straight; apical angle 23°; whorls five in the type, (original number about eleven); sides of whorls flat; suture deeply impressed, but not channeled; spiral sculpture absent; body whorl with 15 vertical, axial, rounded ribs; on the upper whorls these extend from suture to suture, and on the body whorl to the basal angle; interspaces somewhat wider than the ribs, and deepest in the center of the whorl, making each interspace a concave depression which slopes toward the suture on each side; aperture rounded below, pointed above, with a lamellar plication at the juncture of the columella and the body whorl; altitude, 2.4 mm.; (originally about 3.75 mm.;) diameter, 0.9 mm.

Type: No. 983, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

This small species clearly belongs to the subgenus *Turbonilla* s. s., as defined by Bartsch.[128] It occurs not infre-

[128] U. S. Nat. Mus. Bull. 68, 1909, p. 29, etc.

quently in some of the harder layers of the Type Tejon strata, although the type specimen was the only one successfully extracted from the matrix.

107. **Melanella acuella** Anderson & Hanna, new species

Plate 14, figure 1

Shell small, smooth and polished; spire very slender and pointed, whorls about nine, (the basal whorl only remaining in the type specimen) sides entirely flat; suture not impressed; apical angle, 22°; aperture very slender and pointed above, rounded below. Altitude, 2 mm. (originally about 3 mm.); diameter, 0.8 mm.

Type: No. 977, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Call.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

Only a single specimen of this species was found. Bartsch[129] has separated *Melanella* and *Strombiformis* by the presence of color markings in the latter; the shape of the members of the two genera seems to intergrade completely. The fossil forms, therefore, lacking color, must necessarily fall into the genus *Melanella*.

108. **Alvania vinosula** Anderson & Hanna, new species

Plate 14, figures 5, 6

Shell small, conical, sides of spire slightly convex; apical angle, 65°; whorls five, convex; suture deeply impressed; nucleus composed of about two smooth whorls; remainder of shell heavily sculptured, but with no definite line of demarkation between; body whorl with 17 heavy, axial, slightly oblique ribs, which extend around the periphery and to the imperforate umbilical region; a slight constriction just beneath the suture, scarcely more than an indentation on the ribs; on the upper whorls the ribs extend from suture to suture; ribs rounded on top, and separated by concave interspaces much wider than themselves; interspaces marked by

[129] Proc. U. S. Nat. Mus. Vol. 53, 1917, p. 302.

spiral threads smaller than the ribs; spiral sculpture heaviest on the body whorl on which it covers the base as well as the sides; aperture rounded, slightly elliptical; outer wall heavily calloused on the outside; peristome continuous on the parietal wall, but closely appressed; length of shell, 1.6 mm.; diameter, 1 mm.

Type: No. 981, paratype, No. 982, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

The species is abundant in some of the harder layers of sandstone at the locality where it was found. Usually the shells are easily extracted from the matrix without injury. Some variation in the spiral sculpture of the shell and in the subsutural constriction, was noted in the series obtained; in the extreme cases the part of the ribs above the constriction becomes blunt spines as shown in the paratype figured. Among the recent species, this one resembles *A. profundicola* Bartsch[130] more than any other of the west American forms. We have followed that author in the use of the name *Alvania* although Iredale has indicated that it should be rejected.[131] The generic nomenclature in the family Rissoidæ seems to be in a state of great confusion.

109. **Odostomia insignifica** Anderson & Hanna, new species

Plate 14, figure 2

Shell small, with conical spire, sides straight; apical angle 25°; whorls about six (apex of the type missing); base of the body whorl obtusely angled; suture having a V-shaped channel or groove; sculpture consisting only of lines of growth; imperforate; aperture semi-elliptical; altitude of type, 2.3 mm. (originally about 2.75 mm.); diameter, 1.2 mm.

Type: No. 978, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

[130] U. S. Nat. Mus. Vol. 41, 1912, p. 345, pl. 30, fig. 5.
[131] Trans. New Zealand Inst. Vol. 47, 1915, p. 450.

This small unornamented species has few characters to distinguish it from some others, particularly of the living fauna belonging to the west coast, such as *O. mammillata* Carpenter.[132]

The straight-sided whorls suggest some species of *Melanella,* but the apical angle is greater than is usual in that genus, and the surface does not seem to have been polished in our specimens; the slightly grooved suture seems to be decisive, however, and places it definitely in the genus *Odostomia.*

110. **Pyramidella slevini** Anderson & Hanna, new species

Plate 14, figures 3, 4

Shell small, spire conical, sides slightly convex, composed of five straight sided, post-nuclear whorls; nucleus composed of about two smooth whorls, with the axis at right angles to the axis of the remainder of the shell; suture well marked, but not channeled; the shell substance elevated into an indistinct ridge just beneath the suture; surface marked only with very faint lines of growth; aperture ovate, with a strong plication at the lower juncture of the basal wall with the body whorl; peristome simple, bearing on its inner surface two low rounded ridges, and beneath these an indistinct short one which does not extend far within the shell; altitude, 2.1 mm.; diameter, 1.0 mm.

Type: No. 979; paratype No. 980, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

This species belongs to the subgenus *Syrnola* as described by Dall and Bartsch.[133] It is found frequently in some of the harder sandstones at the type locality. It is similar in size and form to some of the smooth forms of *Odostomia,* but the presence of the internal lamallæ on the outer wall seems to place it definitely in the genus *Pyramidella.*

Named for Mr. Joseph R. Slevin, Herpetologist of the California Academy of Sciences, who accompanied Mr.

[132] See Dall and Bartsch, U. S. Nat. Mus. Bull. 68, 1909, p. 233, pl. 30, fig. 8.
[133] Bull. 68, U. S. Nat. Mus. 1909.

Bruce Martin in 1914 when extensive Type Tejon collections were made.

111. **Pyramidella fremonti** Anderson & Hanna, new species

Plate 15, figures 4, 5

Shell very long and slender, length about 10 mm.; whorls about 12, as judged by those remaining in type, having slightly rounded sides; suture well marked but not channeled; surface marked by faint growth striæ, and about 17 well marked, incised spiral grooves on body whorl; aperture long and slender, with a small plication at the junction of the columellar wall with the outer whorl; altitude of type, (not complete) 5.1 mm.; diameter, 2.0 mm.

Type: No. 969; paratype No. 970, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), in Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

This species appears to belong to the subgenus *Syrnola* Dall and Bartsch,[134] the type of which is *Syrnola densistriata* Garrett.[135] The paratype here figured is somewhat distorted due to injury in removing from the matrix and subsequent repair; the surface markings are very similar to those of the type and it has been on the basis of these that the identification has been made. The differences in proportion, however, may necessitate the making of two species when better material shall have been collected.

112. **Pyramidella mucronis** Anderson & Hanna, new species

Plate 8, figure 17

Odostomia n. sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 44 and 50, Type Tejon records. Not p. 86, pl. 5, figs. 10a and 10b, from the Cowlitz Group, Washington.

Odostomia sp. a, Dickerson, Above cit. p. 44, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421 and 451, Type Tejon records.

Odostomia packi Dickerson, above cit. pp. 421, 427, 433, 451, Type Tejon records; not p. 496, pl. 37, fig. 11, from Rose Canyon, San Diego County.

[134] Bull. 68 U. S. Nat. Mus. p. 10.

[135] Acad. Nat. Sci. Phila. Proc. 1873, p. 224, pl. 3, fig. 44.

The type of this species has six whorls intact, about four having been lost with the apex; sides of whorls straight, suture channeled; apical angle 16°; base obtusely angulated around the periphery; surface polished, but having minute silky lines of growth, crossed by faint spiral striations of about equal strength; sculpture on base same as on spire; umbilicus minutely open, with base of shell angulated around the opening; aperture lengthened axially; columella with two spiral plications, the upper of which is the stronger; palatal wall of the body whorl with two plications inside of about equal strength; one of these follows the angulation on the body whorl; the other is above and follows the center of the whorl as a spiral; altitude of broken type, 9.0 mm.; diameter, 4.3 mm.

Type: No. 850, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

O. packi was described from near San Diego, and the type was too fragmentary for the apertural characters to appear in the figure. Dickerson stated that there were two plications on the columella and one on the outer wall, but his figure shows very clearly that there are two on the outer wall of the penultimate whorl; these were mistaken by Weaver and Palmer for outside spiral striations.[136] The Cowlitz species referred by Dickerson to *Odostomia,* new species, is now *Pyramidella vaderensis* of Weaver and Palmer.

113. ["Cerithiopsis alternata" Gabb]

Cerithiopsis alternata Gabb, Geol. Survey. Calif. Pal. Vol. 1, 1864, p. 116, pl. 21, figs. 114 and 114a, northeast of Martinez and Cochran's.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, p. 224.

Not *C. alternata* Gabb, Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, p. 43, and Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 438, and 448, Type Tejon records.

C. alternata was described from near Martinez, and presumably came from the formation of that name. Dickerson's record of it from the type locality of the Tejon Group

[136] Univ. Wash. Publ. Geol. Vol. 1, No. 3, 1922, p. 29, etc.

was based upon a specimen alleged to have come from Loc. 452 (U. C. Coll.), but a search of the collection from that point has failed to disclose any specimen which can be identified with Gabb's species.

114. ["Potamides sp." Dickerson]

Potamides sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. V, 1915, p. 44, Type Tejon record.— *Potamides* sp. Dickerson, Univ. Calif. Publ. Geol. Vol. IX, 1916, pp. 421, 451, Type Tejon records, Loc. 244, (C. A. S. Coll.).

The collections from Loc. 244 (C. A. S. Coll.) contain a single fragmentary specimen which may belong to this genus, to which certain species in the west coast Tertiary faunas have heretofore been referred. It is not sufficiently complete for specific determination, and the record, therefore, is omitted from our list of species until better material can be obtained.

115. **Teinostoma profunda** Anderson & Hanna, new species

Plate 14, figure 10; plate 15, figures 9, 11, 16

Shell resembling *Vitrinella* in form, spire rounded, completely enveloped and calloused over; boundary of the last whorl marked by a slight indentation on the top of the shell; aperture circular; peristome not thickened, sinuous axially, oblique and continuous over the parietal wall; umbilical region covered by a separate callous deposit with distinct boundary, and marked by faint spiral striations; elsewhere the sculpture is entirely obscured; altitude 1.2 mm.; diameter 2.4 mm.

Type: No. 973; paratype, No. 974, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

116. **Teinostoma ? exoleta** Anderson & Hanna, new species

Plate 15, figures 12, 13

Shell like *Vitrinella* in form, spire low and rounded; whorls about four, very slightly convex; suture well marked,

but not deeply impressed; a slight concave depression just beneath the suture of the last whorl; sculpture consisting only of very fine incremental lines of growth; aperture expanded, circular, very heavily calloused in the umbilical region, but peristome simple elsewhere; umbilicus slightly perforate; altitude 1.4 mm.; diameter, 2.5 mm.

Type: No. 975; paratype, No. 976, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

This species was not found in abundance, and only two specimens were successfully extracted without injury from the hard matrix rock. With the collections and literature available for study, it was not possible to determine positively the generic position of the species. The uncovered spire would appear to separate it generically from *T. profunda* with which it was associated, but it is more closely related to that group than to the widely umbilicated *Vitrinellas*.

117. **Solariella enamellata** Anderson & Hanna, new species

Plate 15, figures 10, 14

Shell small, with diameter and height of spire nearly equal; whorls five, the upper two being without sculpture; body whorl biangulate, the upper angulation marking the boundary of a shoulder in an angle of 105°; the tabular shoulder meeting the next whorl nearly at right angles; the shoulder bearing one beaded cord; the peripheral zone between the shoulder and the basal angle almost flat, with six or more raised spiral threads, and with a raised line below the last; base of whorl almost flat, and bearing nine or more low, rounded, spiral threads with narrow interspaces; umbilicus wide, bordered by an angulation between it and the base of the shell, marked by 18 rounded beads on the portion preserved in the type specimen; interior of umbilicus marked by coarse spiral sculpture similar to that on the base of the shell; spiral sculpture on the shoulder and outer wall of the shell is slightly beaded, due to coarse and irregular lines of

growth. The surface of the entire shell is enamelled and lustrous in the fossil specimen serving as the type.

Type: No. 972, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at Loc. 711 (C. A. S. Coll.), in Grapevine Canyon, Kern County, California, June, 1921; Type Tejon Eocene.

The genus *Solariella* is represented on the west coast by several living forms, and one has been described from the Cowlitz Group of southern Washington. The beautiful preservation and enamelled surface in which the pearly luster is still retained is perhaps due to the hard, fine grained rock in which it was embedded.

118. Vitrinella uvasula Anderson & Hanna, new species

Plate 14, figure 9

Shell small, vitreous, spire almost flat; whorls about four, slightly convex; suture very lightly impressed; growth lines conspicuous and irregular on both upper and lower surface; above and below the periphery of the body whorl are two incised spiral grooves; aperture circular; peristome continuous, thickened in the umbilical region, but not elsewhere; umbilicus perforate; altitude, .7 mm.; diameter, 1.5 mm.

Type No. 984, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at Loc. 711 (C. A. S. Coll.), in Grapevine Creek, Kern County, California, June, 1921; Type Tejon Eocene.

The spiral markings and very lightly impressed sutures serve at once to distinguish this species from *Teinostoma profunda* with which it was associated.

119. Acmæa tejonensis Gabb

Figure 5

Acmæa tejonensis Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 172, 230, pl. 28, fig. 56; genus questioned and the locality is given as that of the Type Tejon Group.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 271.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 14.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 447.

Gabb's type specimen was evidently a young shell, only 8.5 mm. long. The only other specimen, so far as known, that has been found was obtained from Loc. 245 (C. A. S. Coll.) near the type locality, by Mr. Martin. It is an inter-

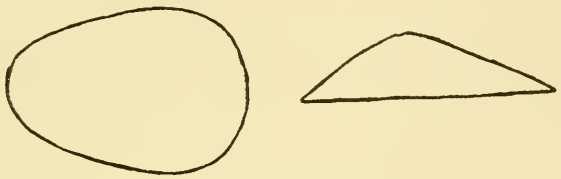

Fig. 5. *Acmæa tejonensis* Gabb; outlines of plesiotype No. 760 (C. A. S. Coll.) from Loc. 245, Type Tejon Group.

nal cast measuring 41.4 mm. in length, 28.9 mm. in width, and 11.0 mm. in height. Although a positive identification can rarely be made from a cast, it seems safe to assume that this is Gabb's species.

120. [Scaphander costatus (Gabb)]

Cylichna costata GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 143, 229, and pl. 21, fig. 107.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 232.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 198, 200.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 280.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 49, 51.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 432, 438, 449 .

The name, *Cylichna costata,* has been applied to nearly all of the forms of opisthobranchiate mollusks of our western formations from the Upper Cretaceous through the Eocene to the Tejon Group. This species, if such exists, appears to be a composite form, based upon specimens from more than one locality, Martinez being the first one mentioned; but it has been supposed to occur also in the Chico Group of the Cretaceous deposits, as well as in the Tejon Group of the Eocene.

Each of the above citations contains a reference to records of it in the locality of the Type Tejon. Stanton has stated that the specimens from the various localities, in the original collections, were not kept separate, and he cites it as one

of the few species that might well be expected to pass across from the Cretaceous to the Tejon Group.

In view of the fact that there are few if any such wide ranging species, it seems wisest to hold the identity of any with suspicion until it is clearly demonstrated, and in this case identity has not been so proved. The question as to whether the specific name should be retained for any of the forms is not a matter to be determined here, for the reason that no such form has been found in the type locality of the Tejon Group.

It seems to be impossible to determine at this date upon what forms Gabb's description and figure were based, or upon what his record of its occurrence at the type locality of the Tejon Group was based. Most of the records of its occurrence there since Gabb's time appear to have been based upon his error. Dickerson, however, refers to specimens of this species from Loc. 244, and 245 (C. A. S. Coll.), and from Loc. 462 (U. C. Coll.), but a search of these collections has failed to disclose any that are satisfactorily covered by Gabb's figure and description. The smaller species described in this paper as *Cylichnella tantilla* is so distinct from Gabb's apparent composite representation as scarcely to need comparison.

121. **Cylichnella tantilla** Anderson & Hanna, new species

Plate 7, figures 4, 8, 9

Shell small, spindle shaped, the ends tapering to almost equally blunt points; apex narrowly umbilicate; outer lip simple and straight; lower columellar wall having a very low plication; umbilicus not perforate, and the area covered by a slight expansion of the columella; surface uniformly striated by narrow impressed lines, or about 50 narrow spiral channels, or grooves in the surface of the shell; the ridges between, relatively wide and flat-topped; toward the aperture there is a tendency for them to divide in older specimens, so that the number of raised spiral lines increases with the age of the individual. Length of type, 7.1 mm.; diameter, 3.0 mm.

Type: No. 958; paratypes, No. 959 and No. 960, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A.

Hanna at Loc. 711 (C. A. S. Coll.) in Grapevine Canyon, Kern County, California, June, 1921; Type Tejon Group.

This minute species cannot easily be confused with the form described by Gabb as *Cylichna costata,* and here placed in the genus *Scaphander.* In addition to the three specimens figured, the collection from Loc. 711 contains 24 others, ranging in size from 1 mm. in length to that of the type, which is the largest seen. The spiral markings on the smaller specimens are difficult to discern except under favorable conditions of magnification and light.

122. Bullaria hornii (Gabb)

Bulla hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 143, pl. 29, fig. 235.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 232; type locality, near Fort Tejon, Tejon Group.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.— Meyer, Acad. Nat. Sci. Phila. Proc. 1884, p. 111. Compared with Claiborne species.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 277.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 14.— Dickerson, Calif. Acad. Sci. Proc. 4th ser. Vol. 5, 1915, p. 43; locality, Salt Creek, west of Grapevine Canyon.

Bullaria hornii (Gabb), Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 432, and 442; Type Tejon records only.

This species was originally described from near Fort Tejon, and it appears to belong there, although it is rare. Dickerson recorded it from Salt Creek, a few miles west of Grapevine Creek, Loc. 464 (U. C. Coll.), which may be within the area of the Type Tejon, and also from Loc. 672 and Loc. 1817 (U. C. Coll.), both of which are clearly outside of the type locality of the Tejon Group. We have not checked the occurrence of the species outside of the Type Tejon locality. The reference of shells belonging to the old genus *Bulla* Linnæus to *Bullaria* Rafinesque is in conformity with modern zoological usage. The change was apparently first proposed in 1908.[137]

123. Acteon quercus Anderson & Hanna, New species

Plate 8, figure 1

Actæon n. sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 43, 98, pl. 11, fig. 5. Loc. 244 (C. A. S. Coll.)

[137] Dall, Mus. Comp. Zool. Harvard, Bull. Vol. 43, No. 6, 1908, p. 243.

Acteon moodyi Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 448, 508, Type Tejon records; not p. 488, pl. 38, figs. 10a, 10b, from north of Coalinga, California.

Shell small, composed of six rounded whorls, with deep sutures; spire conical, elevated, with nearly straight sides; body whorl cylindrical-ovate; aperture long and narrow; sculpture on the body whorl consisting of 25 spiral threads which are flattened on top, and separated by channels one-third as wide as the threads; channels crossed by minute lines of growth, closely spaced.

Type: No. 319, Mus. Calif. Acad. Sci.; collected by Bruce G. Martin at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California**; Type Tejon Eocene.

This species differs from *A. moodyi* Dickerson in several respects. That species has a smaller number of spiral cords, which are accordingly coarser, and they are separated by channels as wide as the cords; the spire is dome-shaped, showing but four whorls in the figure, although it is larger in size; body whorl regularly ovate, in which respect it differs from our species in which the sides are straighter. The lines of growth in *A. moodyi* are finer than in *quercus*.

Dickerson's references to *A. moodyi* occurring in the type locality of the Tejon Group were undoubtedly based upon the incorrect determination of *A. quercus*.

124. **Helminthoglypta obtusa** Anderson & Hanna, new species

Plate 3, figures 12, 13

Shell depressed, consisting of 4¾ whorls, (originally almost five); whorls flattened on top; spire slightly elevated above plane of body whorl; surface marked only with faint growth lines; margin of body whorl obtusely angled; umbilicus perforate but entirely covered with a heavy deposit of callus; peristome broadly reflected, the expanded portion meeting the umbilical callus very close to the umbilicus; base of body whorl more inflated than spire; diameter, 16 mm., (originally about 19 mm.); altitude, 9.6 mm.

Type: No. 1016, Mus. Calif. Acad. Sci.; collected by Marcus A. Hanna in 1922 in **Live Oak Creek, Kern County, California.**

This species is closely related to *H. marginicola* (Conrad)[138] of the Oligocene of Bridge Creek, Oregon. The depressed, flattened spires are the same in both and the size does not differ greatly. Unfortunately the complete shell with apertural characters of the Oregon species is unknown. It is true that the present specimen is imperfect in this respect but it is believed to be sufficiently intact to warrant description. It would seem best to retain it as a distinct species, at least until the Oregon form becomes better known.

The common California land snails have been placed in many different genera in the past, *Epiphragmophora* being the last to come into general use. Lately, however, the tendency has been to place them in *Helminthoglypta* where they may be expected to remain for a considerable time. The type species of the genus is a western shell.

The extremely long geological range of the land shells as compared with the marine is brought forcibly to mind by this species. It is barely possible to find characters by means of which it can be separated from living species. The best seem to be the closed and heavily calloused umbilicus. The finding of a land shell in a marine deposit is sufficiently rare to excite comment. The present specimen was embedded in the typical hard Type Tejon sandstone with marine forms.

125. Dentalium cooperii Gabb

Dentalium cooperii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 139, pl. 21, fig. 100; listed from San Diego, Martinez and Fort Tejon.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 230; reported also from the Chico Group, near Mount Diablo.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 280; San Diego, Tejon, etc.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 15, Tejon record.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 432, 438; Type Tejon records.

In some cases it is now impossible to ascertain the type locality of Gabb's species; the inference that the first mentioned locality is that of the type has often proved misleading. In this case, however, since Dr. Cooper really made collections at Rose Canyon near San Diego, from which Gabb described certain species, it is entirely probable that the type of *D. cooperii* came from there.

[138] See Hanna, Univ. Oreg. Publ. Vol. 1, No. 6, 1920, p. (2).

The simple form of the species, and in fact of the genus, allows but few distinctive features to be found in it, and forms similar in outward appearances have been found in groups older and younger than the Tejon, from which it would be difficult to exclude it. It has been obtained at localities 245 and 711 (C. A. S. Coll.), where it is not uncommon. A large series from Loc. 711 varies much in size, the largest specimens measuring as much as 40 mm. in length, but the identity of form and sculpture, with the subordination of longitudinal striations, allows for only a single species among them, in view of the confusion which exists among west American Scaphopoda. The entire group living and fossil needs thorough revision. Gabb's descriptions and figures of the Eocene species are confusing and it seems probable that he has included more than one in each.

126. Dentalium stramineum Gabb

Figure 6

Dentalium stramineum GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 139, pl. 21, fig. 101, northeast of Martinez, San Diego, etc.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 220, also recorded from the Chico Group, near Mount Diablo, Martinez Group, Martinez, San Diego and Tejon.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 280.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, Type Tejon record.— DICKERSON, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, pp. 43, 49, Type Tejon records.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 438, 447, Type Tejon records.

The simple form of this genus and also of this species allows but few distinguishing features to be discovered, and even though the type may have come from older strata elsewhere, forms similar to it are found plentifully at the type locality of the Tejon Group. It has been collected at Locs. 245 and 711 (C. A. S. Coll.), and accordingly is enumerated among the species of the Type Tejon. The specimen figured from Loc. 711 is 7.2 mm. long and has a curvature of less radius than Gabb's figure of *stramineum,* but this may be attributed to differences in age. On the other hand, the entire group of western Scaphopoda has been so poorly understood that positive specific identification in many cases is impossible.

March 18, 1925

Fig. 6. *Dentalium stramineum* Gabb, x 8; plesiotype No. 899 (C. A. S. Coll.) from Loc. 711, Type Tejon Group.

127. **Dentalium stentor** Anderson & Hanna, new species

Plate 13, figure 17

Shell large, thick, strongly curved, and strongly sculptured with longitudinal grooves; angle of convergence of the sides near 7°; sculpture of the shell consisting of longitudinal grooves, separating threads or cords which are sometimes alternately coarse and fine, though more often unform in size, rounded or flat; in some specimens the ribs coalesce to form an occasional broad, flat-topped ridge, but this is not usual; section of shell nearly circular, shell substance thick. Length of type 81 mm.; width at base 10 mm.; angle of convergence 7°.

Type: No. 819, Mus. Calif. Acad. Sci.; collected at **Loc. 792 (C. A. S. Coll.), west side of Tecuya Creek, Kern County, California,** by the writers in December, 1922; Type Tejon Eocene. Numerous specimens were found a little below the middle of the Tejon Group there exposed.

This species recalls *D. cooperi*, the type of which probably came from Rose Canyon, near San Diego. It is distinguished from that species, however, in the 50 per cent greater angle of convergence in the sides, by its coarser sculpture and much greater size.

128. **Cadulus gabbi** Sharp & Pilsbry

Plate 11, figure 11

Dentalium (Ditrupa ?) pusillum Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 139, pl. 21, fig. 99; type locality, **Martinez**, but also listed from **Alizos Creek, near Fort Tejon.**

Gadus pusillus Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 303.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 230, listed as before.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 198.

Siphonodentalium pussillum (Gabb), Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 291.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 15.

Cadulus gabbi Sharp & Pilsbry, Man. Conch. 1st Ser. Vol. 17, 1898, p. 236; new name for *Dentalium pussillum* Gabb, not Philippi.

Cadulus pusillus (Gabb), Meyer, Acad. Nat. Sci. Phila. Proc. 1884, p. 111.— Dickerson, Calif. Acad. Sci. Proc. 4th ser., Vol. 5, 1915, pp. 43, 49; listed from type locality of Tejon Group.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 432, 447; listed from the type locality of the Tejon Group.

This species may have been originally found at Martinez, but it was listed also from Alizos Creek, near Fort Tejon, where it occurs quite plentifully at Loc. 244 (C. A. S. Coll.); it may have been that Gabb's type came from the locality of the Type Tejon Group, instead of from Martinez, because he did not necessarily list the locality first from which the described and figured specimens came.

129. ["Teredo sp." Dickerson]

Teredo sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43; Loc. 452 (U. C. Coll.), Type Tejon locality.— Dickerson, Univ. Calif. Publ. Geol. Geol. Vol. 9, 1916, pp. 421, 447, Type Tejon records.

Evidences of Teredo, or other wood boring mollusks, occur among the fossils obtained from Loc. 452 (U. C. Coll.), as reported by Dickerson, and similar specimens are numerous at Loc. 816 (C. A. S. Coll.) on the east side of Pastoria Creek, about 600 feet above the base of the group. They are of importance only as they serve to indicate the shore conditions belonging to this particular stage of the group. As the species has not been determined it cannot properly be included in a faunal list of the group at this time.

130. ["Martesia clausa" Gabb]

Martesia clausa GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 145, pl. 22, fig. 115; **locality, Pence's ranch, Butte County, California.** Not recorded from Type Tejon locality.—*M. clausa* GABB, Op. cit. Vol. 2, 1869, p. 233, listed from Type Tejon.

Although Gabb recorded this Chico species from the Type Tejon locality in his Vol. 2, we do not know of any valid reason for his doing so, as no material has been found upon which such a record should be based. No other author has followed him in the matter, so far as known, and we do not feel warranted in doing so now.

131. **Solen novacula** Anderson & Hanna, new species

Plate 6, figure 9

Shell large, elongated, thick; sides parallel; ends cut squarely, or only slightly rounded; anterior end bearing a strong constriction, deeply impressed, but not terminal; posterior end of valves slightly diverging in most specimens; hinge margin straight, with hinge near anterior end; surface of shell marked by irregular growth lines, concentric to the margins.

Type: No. 882, Mus. Calif. Acad. Sci.; collected at **Loc. 792 (C. A. S. Coll.) in Tecuya Creek, Kern County, California, about 1000 feet or less above the base of the beds;** Type Tejon Eocene.

This species differs from *S. parallelus,* in its larger size, thicker form and shell, and squarely cut ends. The constriction which is not terminal, is not shown in Gabb's form, and the growth lines which are squarely turned contrast with the rounded ones seen on the other species; length of type, 91 mm.; width, 21 mm.

132. [Solen parallelus Gabb]

Solen parallelus GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 146, 229, pl. 22, fig. 117, **Bull's Head Point, near Martinez,** but also listed from the Tejon locality.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p.

233, recorded from Tejon locality, and elsewhere.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 291. — Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 265.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, listed from Locs. 244 and 245 (C. A. S. Coll.), and from Loc. 463 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 431, 438, 442 and 447.

This species was first described from near Martinez, but was listed also from Alizos Creek, near Fort Tejon. There is one, and perhaps two species of *Solen* found in the type section of the Tejon Group, but most of the fossil material seen of this genus is too fragmentary for specific determination. Many of the specimens appear to belong to a species shorter than *parallelus,* as figured, but they are too much broken for positive statements. We are of the opinion that when good material is obtained there will be found to be two species, namely, *S. novacula,* and another which is shorter, and distinct from *S. parallelus.*

133. Corbula hornii Gabb

Plate 2, figures 3, 4

Corbula hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 149, 229, pl. 29, fig. 238, near Fort Tejon.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 176, pl. 29, figs. 62, 62a, 62b, Tejon.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 279.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42, 49, 50.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 430, 444, all Type Tejon records.

Not of Dickerson, Calif. Acad. Sci. Proc. 4th Sec., Vol. 5, pl. 4, figs. 5a and 5b, Cowlitz Group, Vader, Washington.

The description and figure given by Gabb in Pal. Vol. 1, was amended in Vol. 2, with better figures. The species properly belongs to the type section of the Tejon Group, and has usually been so regarded by all writers upon this part of the Eocene. Occasion is here taken to re-figure it. The specimens from the Cowlitz Group of Washington show differences that are probably specific. Weaver and Palmer have figured and described them as *Corbula dickersoni.*[140]

[140] Univ. Wash. Publ. Geol. Vol. 1, 1922, p. 24, pl. 9, figs. 9 and 10.

134. [Corbula parilis Gabb]

Corbula parilis GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 150, pl. 29, figs. 239, 239a, **type locality, Martinez.**— *C. parilis* GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 234, not listed from Type Tejon.

Not *Corbula parilis,* DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, Type Tejon record.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, Loc. 245 (C. A. S. Coll.), nor pl. 4, fig. 8, Marysville Buttes.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 430, 437, 444, Type Tejon records, nor pl. 40, fig. 10, Loc. 1853, (U. C. Coll.), Marysville Buttes, Sutter County, California.

Dickerson stated under the last citation that "this is a very common Tejon form". In view of the many times that he has listed it from the type locality of the Tejon Group, special search has been made for material upon which a confirmation could be based. Our belief is that he based his records upon the mistaken identity of some other species. In the collections from Loc. 245 (C. A. S. Coll.) there is a single specimen of *Corbula;* this is much distorted, and not identifiable specifically, although it is apparently not Gabb's species. We have carefully examined all the other collections mentioned by Dickerson, including those from Locs. 451, 458, 462, and 463 (U. S. Coll.) and are unable to confirm the occurrence of this species in any of them.

135. Spisula acutirostrata Packard

Spisula acutirostrata PACKARD, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 295; **Loc. 463 (U. C. Coll.), near Salt Creek, Kern County, Type Tejon locality.**— WAGNER & SCHILLING, Univ. Calif. Publ. Geol. Vol. 14, No. 6, 1923, p. 241.

This species was described by Packard from specimens obtained from the Tejon strata near Salt Creek, a few miles west of Grapevine Creek, Kern County. We have not seen the type, but have no reason to doubt the authenticity of the species as one belonging to the type section of the Tejon Group.

136. Spisula bisculpturata Anderson & Hanna, new species

Plate 3, figure 7

Mactra ashburnerii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 153, 230, type locality, **Pence's ranch, Butte County, Calif.,** but recorded also

from Type Tejon locality.— Conrad, Am. Jour. Conch. Vol. 1, 1865, p. 364.— Gabb, Am. Jour. Conch. Vol. 2, 1866, p. 91.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.

Cymbophora ashburnerii Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 180, 181, Type Tejon records.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199, 200, 201.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 280, Type Tejon record.

Spisula merriami Packard, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, *Nomen nudum*, Type Tejon record, Loc. 244, (C. A. S. Coll.), and Locs. 459 and 463 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 431, 438, 447, Type Tejon records. (Not p. 510, pl. 39, figs. 2a, 2b, and 2c, from Loc. 672, (U. C. Coll.), near Coalinga, or fig. 2d, from Loc. 2225 (U. C. Coll.), Table Mountain, Butte County.)

Not *Spisula merriami* Packard, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 294, pl. 27, figs. 3 and 4, Loc. 672 (U. C. Coll.), same specimen as figured by Dickerson.

Shell small, trigonal, produced posteriorly, moderately inflated; anterior dorsal slope very convex, bounded by a distinct ridge extending from the beak to the basal margin in a gentle curve; ridge immediately followed by a shallow depression; posterior dorsal slope straight, bounded by a ridge similar to that of the anterior slope, but concave when compared to a vertical line from the beak to the margin of the shell; base of the shell forming the arc of a circle, the center of which is 5 mm. below the apex. Surface marked by fine irregular lines of growth, or quite smooth except at the ends; anterior and dorsal slopes marked by distinct concentric ridges; the anterior slope bisculpturate, bisected by a line extending from the beak to the margin, the anterior half having distinct concentric ridges, the remainder showing chiefly radial sculpture. Length of type, 26.2 mm.; altitude, 19.0 mm.; ratio nearly 4:3; thickness of single valve, 6.0 mm.

Type: No. 794, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin.

Compared to *S. merriami* this species differs in some important particulars: the surface of *S. merriami* is ornamented with decided, or coarse concentric ridges, very regular in character, with no depression behind the anterior umbonal

ridge; valves more nearly equilateral; the basal margin curved on a longer radius; posterior dorsal slope slightly convex. Notwithstanding these differences the new species resembles *S. merriami* more closely than any other. There is little relationship between the new species and *S. ashburnerii,* the Chico form with which it has been confused.

Through an unfortunate misinterpretation of strata a different species from the Meganos (?) near Lower Lake, Lake County, has been named *Spisula tejonensis;* it has not been reported from the type locality of the Tejon Group.[141]

The form figured by Dickerson as *S. merriami* (Op. cit., pl. 39, fig. 2d, from Loc. 2225 U. C. Coll.), South Table Mountain), belongs apparently to a distinct species, having a less prominent beak, and a smaller axial ratio than the species from the type locality of the Tejon Group.

In 1907 Arnold[142] listed "*Mactra* cf. *uvasana* Conrad" from "Tejon Eocene" at the west end of the Santa Inez Mountains but we know of no such species having been described by Conrad.

137. Psammobia hornii (Gabb)

Plate 3, figure 6; plate 9, figure 16

Tellina hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 160, 231, pl. 30, fig. 244; near Fort Tejon.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 238; Type Tejon.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 293.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Psammobia hornii (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 431, 438, 446, Type Tejon records.

Psammobia (Gobræus) hornii (Gabb), Dall, Acad. Nat. Sci. Phila. Proc. 1898, p. 60. Classification of family.

This species was originally described from the Type Tejon locality, where it is fairly abundant. Dickerson's reference

[141] Packard, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 303, pl. 27, fig. 5.
[142] Smith. Misc. Coll. Vol. 50, 1907, p. 420.

of it to the genus *Psammobia* appears to be well founded. It is here listed as an authentic species of the Type Tejon.[143]

138. [Psammobia texta (Gabb)]

? *Gari texta* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 155, p. 22, fig. 130; **Division B, Martinez.**— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 237; Tejon Group, Martinez.

Psammobia texta (Gabb), Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 431; probably reported incorrectly from the type locality of the Tejon Group.

This species was originally described from the neighborhood of Martinez, as occurring in Division B of the "Cretaceous", which according to Gabb's view included all the strata above the Martinez Group now known to belong to the Eocene. It did not, therefore, necessarily follow that the strata in which it occurred belongs to the group represented at Tejon. Only a single reference, the last cited above, has been found of it in the type section of the Tejon Group. As it was not included by Dickerson in any of the more formal lists of Type Tejon species in his latest paper, (pp. 421, 446), the inclusion of it in the table cited may have been unintentional.

139. ["Psammobia sp." Dickerson]

Psammobia sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, recorded from Loc. 245 (C. A. S. Coll.), Type Tejon locality.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 421, reported as above.

The records above cited were apparently based upon an internal cast which is specifically indeterminate. It might even belong to any one of several genera of Tellinidæ. The record is not important, and is included here only for completeness.

[143] As in the case of Leda the use of the name Psammobia will probably be abandoned sooner or later unless the present code of nomenclature is modified. Gari was given to a shell by Schumacher in 1817 which is considered to belong to the same genus as the type of Psammobia as Iredale has pointed out. (Trans. New Zealand Institute, Vol. 47, 1915, p. 496.) It is believed, however, that when the change is made in America it should come from one who is able to check the references to the literature from original sources, a task which we are at present not in a position to do.

140. **Tellina castacana** Anderson & Hanna, new species

Plate 2, figure 13

Shell small, thin, and inconspicuous; the anterior dorsal slope straight; basal margin almost straight; upper and lower marginal lines almost parallel, or the prolongation of them forming a very acute angle; anterior end regularly rounded; posterior end truncate, very slightly convex; angle at beak about 143°; posterior and basal margins meeting in an angle of about 50°; surface sculptured with fine, flat-topped, concentric ridges which are twice as wide on the anterior end as on the posterior; posterior slope flat, separated from remainder of surface by a sharp angle, in front of which, and near the margin is a shallow depression. Length of type, 13 mm.; height, 7.4 mm.

Type: right value, No. 796, and three paratypes, Nos. 797, 798, and 799, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

We have been unable to identify this small form with any hitherto described species, and believe it to be entirely new, and worthy of description. It is represented in the collections by four specimens from the type locality, all of which conform in size and sculpture to the type. In a genus of so many species and variations it seems remarkable that some form resembling this one has not been found before at some locality, but so far as known to us at present it stands alone.

141. Tellina howardi Dickerson

Tellina howardi Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 55, pl. IV, figs. 2a and 2b; **Loc. 244 (C. A. S. Coll.), Type Tejon section.**— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 447, Type Tejon records.

This large and handsome species is common in the type section of the Tejon Group. It is shorter, and the angle at the beak is less than in *Psammobia hornii,* which is the only species with which it is likely to be confused.

142. **Tellina lebecki** Anderson & Hanna, new species

Plate 3, figure 10

Tellina remondii GABB, (in part,) Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 156, 230, Type Tejon records; not pl. 22, fig. 132; **Cochran's, near Mount Diablo.**— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 293, Type Tejon record only; (not p. 182, pl. 29, fig. 71, which is *T. tehachapi*, new species.)— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 293, Type Tejon record.—ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14, Type Tejon record.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43, Type Tejon record.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 431, 438, 447, Type Tejon records.

The form of this shell is not unlike *T. remondii* Gabb, as at first described and figured, but quite unlike that which he subsequently included under this name; the latter is here described as *T. tehachapi*, new species. The posterior slope in *T. lebecki* is straighter than in the species originally described as *T. remondii* from near Cochran's, the basal margin is straighter, and the anterior end is longer; the beak of the new species is nearly in the center of the valve; no radial sculpture visible. This last characteristic constitutes one of the most distinguishing features, and differentiates it from both forms described by Gabb. In *T. remondii*, as described and in specimens at the University of California from the type locality, the radial sculpture is clearly shown, as it is also in the figure later published by Gabb, but which is another species.

Type: right valve, No. 800, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

The similarity of this species to *T. remondii* is sufficient to prove it to be an analogue, but the specimens available for comparison do not intergrade in a manner to indicate identity with that form. Still another closely related species is *T. tenuilineata* Clark, from the San Lorenzo Oligocene, Group. There may be others. Length of type, 24.5 mm.; original length, nearly 27 mm.; height, 15.4 mm.

The species is named for Peter le Beck, the victim of an unfortunate tragedy in the Tejon region; he was killed by a grizzly bear Oct. 17, 1837.[144]

[144] An account of this has been given by Blake in Pac. R. R. Repts. Vol. 5, 1857, p. 47. A much fuller account is given by Saunders, C. F., in "The Southern Sierras of California", 1923, pp. 79-81; Houghton, Mifflin Co., Boston.

143. **Tellina tehachapi** Anderson & Hanna, new species

Plate 6, figures 5, 6

Tellina remondii Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 182, pl. 29, fig. 71, near Fort Tejon. (Not *T. remondii* GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 156, pl. 22, fig. 132, near Fort Tejon.)

A careful comparison of Gabb's figures and descriptions is enough to make it obvious that he confused two distinct species in his revised description of *T. remondii* in Vol. II. The species first figured does not occur in Type Tejon strata but is replaced there by *T. lebecki* n. sp. We have been fortunate enough to obtain a large fragment of the species last figured by Gabb as *T. remondii,* and it is easy to discern the differences between the two. First, there is considerable difference in size, about in the proportion of 8 to 5; second, the sculpture is decidedly coarser in the larger species, nearly 3 to 1; third, the angle subtended by the dorsal anterior and posterior margins is as 130° to 110°. The radial sculpture of the larger species is scarcely visible on the other, and in fact is usually absent. We propose the above name for the new species, the second figured by Gabb under the name of *T. remondii.* The name is derived from the mountain range upon the flank of which the Type section of the Tejon Group lies.

Type: No. 878; *paratype:* No. 879, Mus. Calif. Acad. Sci.; collected at **Locs. 244, (C. A. S. Coll.), Live Oak Creek,** and 792, Tecuya Creek, Kern County, California; Type Tejon Eocene.

144. [Tellina æqualis Gabb]

Tellina æqualis GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 182, 238, pl. 29, fig. 73, Martinez Group, Martinez.— *T. æqualis,* COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 292, Martinez.— *T. æqualis,* DICKERSON, Univ. Calif. Publ. Geol. Vol. 8, 1914, p. 108; recorded from three Martinez localities, and with a (?) from Tejon.— Not *T.* cf. *æqualis,* DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 438; recorded with a (?) from the type locality of the Tejon Group; omitted from other lists.

Since Dickerson has recorded this species definitely as belonging to the Martinez Group, and has omitted it from

all of his more formal and later lists of Type Tejon species it is probable that he doubted if it formed a part of the Type Tejon fauna, where it does not appear to us to have been found.

145. [Tellina longa Gabb]

Tellina longa Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 155, 230, pl. 22, fig. 131; **Division B, near Martinez,** recorded also from near Fort Tejon.—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 237; recorded from Tejon.—Heilprin, Acad. Nat. Sci. Phila, Proc. Vol. 34, 1882, p. 199, Gabb's record repeated.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 293.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49, 51; recorded as occurring at Tejon.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 431, 442, recorded from Tejon.

Dickerson recorded this species as occurring in the "Type Tejon", and also included it as a "characteristic and most abundant species" of the same; nevertheless he omitted it from his later and more formal lists of Type Tejon species, (above citation, pp. 421, 437, etc.). The species was originally described from near Martinez, but was also recorded from Marsh's, and from Alizos Creek, near Fort Tejon. All records of its occurrence at the latter locality, however, seem to have been based upon Gabb's original reference without the addition of any new material. We have been unable to find any trustworthy specimens of it from the type section of the Tejon.

146. [Tellina sutterensis Dickerson]

Tellina sutterensis Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, pp. 290, pl. 14, figs. 3a and 3b; **Locs. 1853 and 1856 (U. C. Coll.), Sutter County, California;** listed, perhaps unintentionally as occurring at Tejon, p. 265.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 49; listed with (?) from the type section of the Tejon.

This species was described from the Marysville Buttes, Sutter County, and the record of its occurrence in the Type Tejon section probably occurred by mistake, by accidentally placing an X in the wrong column.

The species does not appear to belong to the genus *Tellina,* and certainly does not form a part of the fauna of the Type Tejon Group.

147. **Macoma viticola** Anderson & Hanna, new species

Plate 2, figure 12

Tellina californica Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 161, 231, Type Tejon records; (not pl. 30, fig. 245, from Marsh's near Mt. Diablo.).— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Vol. 2, 1869, p. 238, Type Tejon records only.— Heilprin, Acad. Nat. Sci. Phila. Proc. 1882, p. 189.— Cooper, Calif. St. Min. 7th Ann. Rept. 1888, p. 293, Type Tejon records.— Arnold, U. S. Geol. Surv. Prof. Ppr. No. 47, 1906, p. 14, Type Tejon record.—Dickerson, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, p. 43, recorded from Loc. 244 (C. A. S. Coll.), also pl. 4, fig. 3, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 447, Type Tejon records.

? *T. joaquinensis* Arnold, Dickerson, Calif. Acad. Sci., Proc. 4th Ser., Vol. 5, 1915, p. 43, recorded from Loc. 245 (C. A. S. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 447, Type Tejon records. — Not *T. joaquinensis,* Arnold, U. S. Geol. Surv. Bull. 396, 1909, pp. 13, 49, 106, pl. 2, fig. 11, locality, near Coalinga, California.

Shell small, moderately inflated, inequilateral, very thin; truncated posteriorly, having a shallow depression immediately before truncation in right valve; basal and anterior margins regularly rounded; sculpture consisting of very fine growth lines, slightly uneven; apical angle 128°. Length, 11.9 mm.; height, 8.7 mm.; thickness, 2 mm.; right valve.

Type: No. 1701; paratype No. 273, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin, in 1914; Type Tejon Eocene.

This species has been recorded from the Type Tejon locality under different names. Dickerson recognized the specific distinctness of it because he so labelled the specimens in the collection, but he gave no description. His figure published as *T. californica* (Op. cit. pl. 4, fig. 3), shows the left valve of *Macoma viticola* very well. His reference to *T. joaquinensis* from Loc. 245, (p. 43), is based upon the right valve of our species from this locality, the specimen bearing his label having been examined in the collection.

148. ["Macoma sp." Dickerson]

Macoma sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42; Loc. 456 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, Type Tejon records.

A generic determination of this sort has little value for stratigraphic use, or for faunal comparison, and cannot be admitted in an accredited list of species of the Type Tejon fauna. It is referred to here only to complete the record as far as practicable.

149. **Antigona hornii** (Gabb)

Plate 3, figure 9; plate 5, figure 5

Meretrix hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 164, 231; (not pl. 23, fig. 144); **near Fort Tejon.**— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 185, 239, pl. 30, fig. 78, revised, **Type Tejon locality.**— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199, 212, Tejon records.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 286.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 431, 438, 441, 445, Type Tejon records, but clearly not p. 508, figs. 1a and 1b, from near Coalinga.

A large number of specimens of *A. hornii* (Gabb), from the type locality, in the collections of the Academy have been available for comparison, and it is quite evident that Dickerson's specimen from Loc. 672 (U. C. Coll.) is specifically distinct. The outline of Gabb's species is variable, and some young specimens resemble *Macrocallista conradiana* (Gabb), in their posterior elongation. The specimen figured by Gabb in his first attempt, (Pal. Vol. 1, pl. 23, fig. 144), appears to belong to another species, *Pitaria tejonensis* Dickerson, referred to in another place.

An examination of the hinge of *A. hornii* makes it necessary to remove it from the genus *Meretrix* Lamarck, (genotype, *Venus meretrix* Linnæus); it appears definitely to belong to the genus *Cytherea* Bolten as defined by Dall in 1903.[146] Bolten's name dates from 1798. Dall was apparently unaware of a prior use of the name since Scudder failed to notice it in the Nomenclator Zoologicus. But ac-

[146] U. S. Nat. Mus. Proc. Vol. 26, 1903, p. 354.

Diptera in 1794,[148] by J. C. Fabricius. This of course forbids cording to Sherborn[147] the name was used for a species of its use in Mollusca. Without going exhaustively into the the group of Pelecypoda is *Antigona* of Schumacher, 1817, (genotype, *Cytherea lamellaris* Schum.). This was adopted question it would appear that the next available name for by Iredale as long ago as 1914.[149]

150. Pitaria californiana (Conrad)

Plate 5, figures 1, 2

Meretrix californiana Conrad, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st Sess. 1855, p. 9, App. to Rep. of W. P. Blake; also Pac. R. R. Repts. Vol. 5, 1857, p. 320, pl. 2, fig. 4; **Canada de las Uvas, Kern County, California.**— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 1872, No. 252, p. 75.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 446.

Meretrix californica (Conrad), Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 166.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 240, Tejon records. —Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 286.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Meretrix tularana Conrad, Pac. R. R. Repts. Vol. 5, 1857, pp. 42, 323, pl. 3, figs. 22, 22a; also preliminary Report 1855, pp. 7, 12; in the final report the name is spelled, *tularena* on p. 319.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.

Meretrix ovalis Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 166, 231, pl. 30, fig. 251; Type Tejon locality.—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 240.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 286.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 49, 82, pl. 3, fig. 4, Loc. 245 (C. A. S. Coll.), Type Tejon locality.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 431, 438, 442, 445, Type Tejon records.

Dione californiana Conrad, Amer. Journ. Conch. Vol. 1, 1865, p. 7.

As this is one of the most common species of the type section of the Tejon Group we have obtained a large number of specimens for comparative study. It varies somewhat in outline, though other characters are more constant. The external sculpture consists of concentric ridges, which are

[147] Index Anamalium, 1902, p. 283.

[148] Ent. Syst. Vol. 4, 1794, p. 413.

[149] Proc. Zool. Soc. Lond. 1914, p. 668. Trans. New Zealand Inst. Vol. 47, 1915, pp. 493-495.

stronger on the anterior and posterior slopes. Rest periods are clearly marked by depressed grooves which are concentric with the lines of growth. Conrad's original figure shows these characters very well. The abundance of the species at his type locality leaves no reasonable grounds for Gabb's failure to find it, which he undoubtedly did, although he claimed to have searched the locality thoroughly without success. Conrad's species is evidently the form which was redescribed by Gabb as *M. ovalis;* for this he chose a defective specimen, and restored the outline somewhat imperfectly. At all events it would have been quite as easy for him to have drawn the outline of his figure to have agreed perfectly with that of Conrad's species. The specimen from which Dickerson's figure of *M. ovalis* was made has been compared with other examples of *P. californiana* in the collections of the Academy of Sciences, and it is found to belong to the same species. The type of *P. californiana* is said to be preserved in the U. S. National Museum as No. 1842.[150]

Conrad assembled *Meretrix tularana* among Miocene species but it occurred in a boulder with *Galeodea petrosa* which is obviously of Eocene age. The boulder was picked up west of Grapevine Creek less than eight miles, as narrated by Blake.[151] The description and figure of *tularana* are scarcely recognizable but in order to dispose of the name definitely it has been placed in the synonymy of *P. californiana* to which the species bears a close resemblance.

151. **Pitaria tejonensis** (Dickerson)

Plate 3, figure 5

Meretrix tejonensis Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 53, pl. 3, figs. 2a and 2b, **Loc. 244 (C. A. S. Coll.), Type Tejon locality.**—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 431, 438, 446.

Not *Meretrix uvasana* Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 320, pl. 2, fig. 3, nor of Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 163, pl. 30, fig. 248.

Meretrix hornii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pl. 23, fig. 144, but not p. 164.

[150] U. S. Nat. Mus. Bull. No. 53, 1905, p. 400.
[151] Pac. R. R. Repts. Vol. 5, 1857, p. 42.

It appears after studying a large collection of specimens from the type locality of the Tejon that *P. tejonensis* is not synonymous with Gabb's conception of *P. uvasana.* The latter's interpretation seems to have been correct, and although Dickerson's name was a substitute his type specimens represent a species which is distinct. His figures are both enlarged to about twice natural size. Exposure of the hinge shows the species to belong to the genus *Pitaria.* Gabb discredits his figure of *Meretrix hornii* as found in Pal. Vol. 1, pl. 23, fig. 144, and substituted another (Pal. Vol. 2, p. 185, pl. 30, fig. 78). The former appears to represent *Pitaria tejonensis* (Dickerson).

152. Pitaria uvasana (Conrad)

Plate 5, figures 3, 4

Meretrix uvasana Conrad, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st Sess. 1855, p. 9, App. to Rep. W. P. Blake.—*M. uvasana* Conrad, Pac. R. R. Repts. Vol 5, 1857, p. 320, pl. 2, fig. 3; **Type Tejon locality.**—Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also, Smith. Misc. Coll. 252, 1872, p. 75.—Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 163, 231, pl. 30, fig. 248, Tejon record.—Gabb, Am. Jour. Conch. Vol. 2, 1866, p. 91.—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 239, Type Tejon record only.—Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 286.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 54, pl. 3, figs. 3a and 3b, Loc. 244 (C. A. S. Coll.), Type Tejon.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 368, 420, 446, Type Tejon records.

Dione uvasana (Conrad), Amer. Journ. Conch. Vol. 1, 1865, p. 7.

Dosinia uvasana (Conrad), Gabb, Am. Jour. Conch. Vol. 1, 1865, p. 364; it is stated that this species is *Dione ovata* Rogers.

This species is very abundant at the type locality of the Tejon Group. Conrad's figure and description are recognizable, although they are defective. Gabb's figure is better and represents the usual form, which is somewhat shorter than Conrad showed. Two good examples of the young have been figured by Dickerson, which, together with Conrad's figure, represent the ends of a continuous series from the young to adult forms. A well exposed hinge shows the species belongs to the genus *Pitaria,* as now generally recognized.

153. [Marcia quadrata (Gabb)]

? *Tapes quadrata* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 169, 232, pl. 30, fig. 249; Division B, at Fort Tejon and **Martinez.**—Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 241; Tejon Group, Martinez, Clayton and Tejon.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 292; Gabb's record repeated.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14; Gabb's record repeated.—Weaver, Univ. Calif. Publ. Geol. Vol. 4, 1905, p. 108; recorded from Lower Martinez Group.—Dickerson, Univ. Calif. Publ. Geol. Vol. 8, 1914, p. 108; recorded from four Martinez localities.

Marcia quadrata (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 51; recorded from Tejon.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445; recorded from Tejon.

Although Gabb cited the Fort Tejon locality first in his description of this species, (Vol. 1, p. 169,) in his second report (Vol. 2, p. 241) the order is revised, and Martinez is first mentioned. His figure looks as if the specimen had come from the Martinez locality, and from the Martinez Group, in which the preservation is not often good. In view of the fact that both Weaver and Dickerson have tentatively recorded the species from the Martinez Group, this assumption seems the more plausible. Excluding Gabb's doubtful record from the type section of the Tejon, and others that seem to have been merely copied from it, the only records of its occurrence there are by Dickerson as above cited, and these were based upon material obtained from Locs. 455 and 464 (U. C. Coll.), Tejon Quadrangle, Kern County. This material has been examined by us and found to be somewhat unsatisfactory. The fossils are poorly preserved, and the collections contain nothing that can be certainly identified with the form figured by Gabb. Among them are casts of a species resembling that of Gabb, but they might also belong to other genera.

154. Macrocallista andersoni Dickerson

Plate 3, figure 8

Macrocallista (?) *andersoni* Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 49, 54, pl. 4, fig. 1a; **Loc. 244 (C. A. S. Coll.), Type Tejon section;** (not pl. 4, fig. 1b, Cowlitz Group).—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445. Type Tejon records.

Macrocallista conradiana (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pl. 3, fig. 1b.

An examination of the type of *M.* ? *andersoni* Dickerson, which is in the collections of the Academy of Sciences, shows it to be a valid species from Loc. 244 (C. A. S. Coll.). A well exposed hinge plate of the first specimen figured shows it belongs to the genus to which the author tentatively referred it. However, the specimen figured from the Cowlitz Group, above cit. fig. 1b, may prove to be a distinct species, although the question need not be considered here.

155. Macrocallista conradiana (Gabb)

Plate 3, figure 11

Tapes conradiana Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 169, 232, pl. 32, fig. 282; **Alizos Creek, near Fort Tejon.**—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 241; listed also from other localities.—Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199 and 203.—Cooper, Calif State Min. 7th Ann. Rept. 1888, p. 292.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 265, Tejon records.

Macrocallista conradiana (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 82, pl. 3, figs. 1a and 1c, only; Locs. 244 and 245 (C. A. S. Coll.), (not fig. 1b,=*M. andersoni* Dickerson.), Type Tejon locality.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 438, 445, Type Tejon records.

This species is abundant in the type section of the Tejon Group where it was originally discovered. Variation in form and sculpture is slight, even in a large series of specimens. Records of the species from other localities and formations have not been checked etxensively, and it may have wide distribution. The hinge figured by Dickerson (above cit. pl. 3, fig. 1a), agrees in essential characters with the genus *Macrocallista,* although the outer surface does not have the radial lines and is not smooth as in the genotype.

156. Dosinia elevata Gabb

Plate 5, figure 6

Dosinia alta Conrad, House Doc. 129, Proj. Vol. 3, 1855, 33d Congress, 1st Sess. p. 9, App. to Rep. W. P. Blake.—Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 320, pl. 2, fig. 2. **Cañada de las Uvas, Kern County, Calif.** — Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.—Conrad, Am. Jour. Conch. Vol. 2, 1866, p. 100.

Not *Artemis alta* DUNKER, Zeitschr. f. Malakozool. Dec. 1848, [Apr. 1849], p. 184. (Habitat, Red Sea.)

Dosinia elevata GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 167, 231, pl. 30, fig. 252.—CONRAD, Am. Jour. Conch, Vol. 1, 1865, p. 364.—GABB, Calif Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 240.— GABB, Am. Jour. Conch. Vol. 2, 1866, p. 91.—HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199, 212. —COOPER, Calif. St. Min. 7th Ann. Rept. 1888, p. 281.—ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 256.—DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42.—DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 442, 445, all Type Tejon records.

Dosinopsis alta (CONRAD), Amer. Journ. Conch. Vol. 1, 1865, p. 6.

This species was described from the type section of the Tejon Group by Conrad, under a name which had been used by Dunker for a different species belonging to the same genus. Conrad[151a] subsequently described a Miocene species from near Monterey, California, under the name *Dosinia alta*. The species was not figured but was stated to be four inches high. It has been renamed, *Dosinia conradi* Gabb.[151b] *D. elevata* has been listed from many other localities, but no attempt has been made here to check the geographic range beyond the type section of the Tejon Group where it occurs frequently.

157. **Corbicula williamsoni** Anderson & Hanna, new species

Plate 1, figure 4; plate 3, figure 2

Meretrix cf. *olequahensis* WEAVER, DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 49, marked with (?).— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 446, listed from Type Tejon locality. No. 244, (C. A. S. Coll.), Not. *M. olequahensis* WEAVER, Wash. Geol. Surv. Bull. 15, 1912, p. 35, pl. 5, figs. 47-50=*Corbicula.*

Shell small, more produced behind than before; beaks very little elevated above hinge line; umbonal ridge obtusely angled; surface marked by coarse lines of growth on posterior slope; these disappear on the umbonal ridge which is almost smooth; anterior slope with fine growth lines only; hinge long and arched; laterals slender and minutely serrated; cardinal area narrow and weak; muscle scars deeply impressed; pallial line forming an arc of a circle, the center

[151a] Acad. Nat. Sci. Phila. Proc. 1856, p. 315.

[151b] Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 25, pl. 5, fig. 43

of which is at the center of the shell. Length, 23.4 mm.; height, 20.1 mm.; thickness, single valve, 7.5 mm.

Type: No. 768, Mus. Calif. Acad. Sci.; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

Only one specimen has been found, and upon this Dickerson based his record of *Meretrix* cf. *olequahensis* Weaver at the Type Tejon locality. That species was described from Olequah Creek, near Vader, Washington, and some of the original specimens form No. 484 of the California Academy of Sciences' type collection. These belong to a decidedly distinct species. They are larger, heavier, less angulated on the umbonal ridges, have higher beaks and in every way are more robust than *C. williamsoni.*

The species is named for Lieutenant R. S. Williamson, U. S. Army, in command of the detachment of the Pacific Railroad Survey to which W. P. Blake was attached as Geologist.

158. [Isocardia tejonensis Waring]

Isocardia tejonensis Waring, Jour. Geol. Vol. 22, 1914, pp. 784 and 785.—Waring, Calif. Acad. Sci. Proc. 4th Ser., Vol. 7, 1917, p. 93, pl. 15, fig. 14. **Type locality, No. 8 (L. S. J. U.) McCray wells, Ventura County, California.**—Not of Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 437, Type Tejon record.

Dickerson's record of this species in the Type Tejon may have been due to accidental placing of an X in the wrong column in his table of species from San Diego County. It can hardly be accounted for in any other way since he has not referred to it as a Type Tejon species elsewhere.

159. Cardium brewerii Gabb

Plate 1, figure 3

Cardium brewerii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 173, pl. 24, fig. 155, **Cañada de las Uvas, Tejon locality.**— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 242, listed from many other localities.—Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 277.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906,

p. 14.—Dickerson, Calif Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 42, 49, 50.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 430, 437, and 444, all Type Tejon records.

Because Gabb's figure is somewhat diagrammatic, we have furnished a photographic illustration of this abundant Tejon species. Dickerson's record of the species in the Cowlitz Group of Washington does not appear to be justified by the material available, though his figure evidently represents an analogue in that formation.[152] He also appears to have suspected the distinctness of the two since, in the explanation of his plate he stated that "it may prove to be a sub-species". Weaver and Palmer refigured and described the Cowlitz species as *C. oldroydi*.[153]

160. **Cardium linteum** Conrad

Plate 3, figure 3

Cardium linteum Conrad, House Doc. No. 129, Projected Vol. 3, 33d Congress, 1st Sess. 1855, p. 9, App. to Rep. of W. P. Blake.—Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 320, pl. 2, fig. 1; **Cañada de las Uvas, Kern County, California.**— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.

Cardium (Lævicardium) linteum Conrad, Smith. Misc. Coll. Checklist Eoc. and Oligoc. Foss. No. 152, 1866.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 242; Tejon Group, Tejon.

Not *Cardium (Protocardium) linteum* Conrad, Acad. Nat. Sci. Phila. Journ. 2nd Ser. Vol. 4, 1860, p. 278, pl. 46, fig. 17, which Johnson, Acad. Nat. Sci. Phila. Proc. 1905, p. 17, placed in Mactridæ, Genus, *Cymbophora*.

Cardium cooperii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 172, 232, Type Tejon record; (not pl. 24, figs. 154, 154a.)—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 242, Type Tejon record.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 277, Type Tejon record only.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14, Type Tejon record, only.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 49, 51, Type Tejon records.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 430, 437, 444, Type Tejon records.

Lævicardium linteum Conrad, Amer. Journ. Conch. Vol. 1, 1865, p. 7.

This species was first listed by Conrad from the type section of the Tejon Group, but was poorly figured and meagerly described. The figure shows characteristics that are specific if not sub-generic; the radial ribs on the pos-

[152] Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pl. 2, figs. 3a, 3b, Loc. 183 (C. A. S. Coll.).

[153] Univ. Wash. Publ. Geol. Vol. 1, 1922, p. 20, pl. 8, figs. 3, 11.

terior one-fourth of the shell are coarser than the rest, and while this area is not set off by an angle on the shell, the line of demarcation is very clear. The umbones are prominent, but not elevated. The form is somewhat rare, but two good specimens have been obtained from the type section of the Tejon Group, at Locs. 244 and 711 (C. A. S. Coll.), both of which agree with the original description and figure.

Gabb's original description and figure of *C. cooperii* represent a shell possessing surface characters somewhat unusual among the Eocene species commonly found on the west coast. The figure shows a much greater umbonal elevation than that found in *C. linteum* and also much coarser ribbing. In *cooperii* the radial ribs are not only coarse, but are nearly uniform in size over the entire surface. In this respect it differs decidedly from *linteum*.

Cardium cooperii was named by Gabb in honor of Dr. J. G. Cooper, who had collected some 20 species from the Eocene of Rose Canyon, seven miles north of Old San Diego, California. Presumably Gabb selected for his type one of the specimens of the Cooper collection. In the collections of the Academy of Sciences obtained from there, there are 19 specimens of *Cardium,* and among them one that agrees with Gabb's figure and description remarkably well. And although San Diego is the second place mentioned in his description, the strong resemblance of this form to the figure has lead us to believe that he did select his type from the Cooper collection. Cooper himself included this species in his lists from that locality, and in 1894, gave additional information regarding the materials collected there.[154]

Although numerous writers have followed Gabb in referring *cooperii* to the type section of the Tejon Group not a single specimen of it has been seen by us in any of the collections from there.

161. [Cardium olequaensis Weaver]

Cardium olequaensis Weaver, Geol. Surv. Wash. Bull. No. 15, 1912, p. 34, pl. 5, fig. 55.

Not *Cardium* cf. *olequaensis* Weaver, Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42, nor Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 444.

[154] Calif. State Min. Bur. Bull. No. 4, 1894, pp. 37, 38 and 60.

The record as above quoted appears in three of Dickerson's "Type Tejon" lists, but in only one does he refer to specimens from there, and these, he stated, come from Loc. 459 (U. C. Coll.), which is in Grapevine Canyon, Kern County. We have examined a specimen from there and have compared it with the type material and other specimens used by Weaver but have been unable to confirm the identification.

162. [? Lucina cretacea Gabb]

? *Lucina cretacea* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 177, pl. 30, fig. 255; **Clayton to Marsh's, near Mount Diablo.**— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 243; Tejon Group, Clayton to Marsh's.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 284; Clayton to Marsh's.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, p. 14; not included in Type Tejon fauna.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42; also Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420 and 445; recorded doubtfully as occurring at Tejon.

This species was referred by Gabb to the "Tejon Group" near Mount Diablo, which does not necessarily represent the Tejon Group at its type locality. Dickerson's tentative record of it was based upon two imperfect and doubtfully identifiable specimens from Loc. 244 (C. A. S. Coll.), which we have examined with some care. In size they are more than twice as large as the figure of *cretacea* and may not belong to the same genus. In the collections of the University of California there are many specimens of *Lucina cretacea* from the type locality. They belong perhaps to the genus *Diplodonta,* and are moderately inflated forms, very different from the specimens from the type section of the Tejon just referred to, which are flat, and very clearly belong to the *Miltha* group of *Lucinidæ*. *L. cretacea* is, therefore, excluded as a valid member of the fauna of the Type Tejon in this report.

163. [Lucina gyrata (Gabb)]

Dosinia gyrata Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 168, 232, pl. 23, fig. 148; Marsh's, etc., recorded from Cañada de las Uvas.—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 241.—Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 281.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Lucina gyrata (Gabb), Conrad, Smiths. Misc. Coll. No. 200, Checklist Eocene Foss., 1866—Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 437, 445.

In his original description of this species Gabb stated that it was "**common at Marsh's, southeast of Mount Diablo**". His record of it also at the type section of the Tejon Group was based upon a cast only. Dickerson has listed the species four times from the Type Tejon locality, but only once did he refer to specimens and these were from Loc. 451 (U. C. Coll.). We have carefully examined the material from this locality, but have not found any specimens which could be identified by us with *gyrata*. The fossils are but poorly preserved at best, if identifiable at all, and not such as to warrant us in including the form in a list of authentic species from the Type Tejon Group.

164. [Lucina nasuta Gabb]

Lucina nasuta Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 175 and 233, pl. 24, fig. 158; **Division A, Martinez.**—*L. nasuta* Gabb, Pal. Vol. 2, 1869, p. 243; Martinez Group, Martinez.

Not *Lucina nasuta*, Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42, listed from Loc. 458 (U. C. Coll.).—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445, Type Tejon records.

This is a minute species which was described by Gabb from the Martinez Group. Dickerson has listed it, however, from at least one Type Tejon locality, but a search for the specimen from this place which formed the basis of the record has been unsuccessful. The species is apparently not found in the Type Tejon Eocene.

165. ["Lucina (Myrtæa) n .s." Dickerson]

Lucina (Myrtæa) n. s. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42; Locs. 244 and 245 (C. A. S. Coll.).

This combination was used in one of Dickerson's Type Tejon lists, but was omitted in all of those in his latest paper, where instead we find recorded "*Phacoides (Myrtæa) taffana* n. sp." from the section of the Type Tejon. Also there are specimens bearing the latter name, labelled by Dickerson, in the Academy of Sciences collections from Locs. 244

and 245 (C. A. S. Coll.), which serve to confirm the view that the earlier combination was intended for the same forms to which he later gave a specific name. It must be pointed out, however, that the specimens so labelled do not belong to the species figured and described as *Phacoides (Myrtæa) taffana,* but to a distinct form, unsuitable for description, on account of poor preservation.

166. [Phacoides (Myrtea) taffana Dickerson]

Phacoides (Myrtea) taffana Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 485, pl. 36, fig. 11; Loc. 672 (U. C. Coll.) north of Coalinga, California. (Not pp. 420, 431, 445, Type Tejon records.)

Not *Lucina (Myrtæa) n. sp.* Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, Type Tejon record.

This species has appeared in several of Dickerson's lists of Type Tejon species, but his type is from Loc. 672 (U. C. Coll.) and it is not clear upon what he based his records of its occurrence elsewhere. He does not mention the Type Tejon in his description and we have not seen any specimens from there with which we may confirm his records. Specimens in the collections of the Academy of Sciences from Locs. 244 and 245 (C. A. S. Coll.), labelled *"Phacoides taffana"* by Dickerson are clearly not of the same species as that figured by him under this name. They are probably the basis of his record of *Lucina (Myrtæa)* n. sp. in his earlier paper, but as they are not sufficiently well preserved to serve for description, none is attempted here.

167. [Diplodonta polita (Gabb)]

? *Mysia polita* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 178, pl. 30, fig. 256; **Division B, Martinez and Clayton.**— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 244.—Cooper, Calif. State Min. 7th Ann. Rept., 1888, p. 287.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.—Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 265.

Diplodonta polita (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49 and 51.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 430.

It appears from the above references that most of the writers, who have dealt with the fauna of the Tejon Group, have followed the error of Gabb in listing this form from

the type section of the same. Dickerson stated in his second paped cited above (p. 51) that this form, among others, is a "characteristic and most abundant species" of the "type Tejon" fauna, although he does not include it in either of his more formal tables of the same in his latest paper, (above cit., pp. 420 and 445,) where it should be found if he really regarded it as occurring there. We know of no specimens from the Group.

168. **Divaricella cumulata** (Gabb)

Lucina cumulata Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 176, 233, pl. 24, fig. 254, **rare near Fort Tejon.**—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 243.—Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 284.—Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42, pl. 2, fig. 4, Loc. 244 (C. A. S. Coll.)—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 444, Type Tejon records.

The records and collections indicate that this little species is confined to the horizon, perhaps to the type locality of the Tejon Group. The collections of the Academy of Sciences contain six specimens from Loc. 244 (C. A. S. Coll.). The divaricate sculpture in all of them extends entirely to the margin of the shell, a feature not shown in the original figure. No other species of the genus *Divaricella* is known to have such heavy concentric ridges as this.

169. **Kellia catacta** Anderson & Hanna, new name

Plate 2, figure 6

Corbula harrisi Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 42, 56, **Loc. 244 (C. A. S. Coll.)**, and pl. 4, fig. 6.—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445, Type Tejon records.

Not *Corbula (Cuneocorbula) swiftiana harrisii* Dall, Trans. Wagner Free Inst. Sci. Vol. 3, pt. 4, 1898, p. 855.

The type locality of this species is **Live Oak Canyon, Kern County, California.** A careful examination of the type and other specimens reveals the fact that they do not belong to *Corbula,* but to the genus *Kellia.* Unfortunately Dickerson's name was a homonym and cannot be retained, according to the rules of nomenclature.

170. Kellia uvasana (Dickerson)

Plate 2, figure 7; plate 9, figure 11

Corbula uvasana Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 56, pl. 4, fig. 7, **Loc. 244 (C. A. S. Coll.), Live Oak Canyon, Type Tejon locality.**—Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445, Type Tejon records.

An examination of the type and other specimens, as in the case of the preceding species, discloses the fact that they do not belong to the genus *Corbula,* but to *Kellia.* Externally this species somewhat resembles *K. eocænica* (de Raina) as figured by Cossman and Pissarro from the Paris Basin.[155] The shell is small, thin, elliptical; surface smooth, except for small radial ridges extending from the umbones to the margins near the anterior and posterior ends, forming small marginal denticulations within.

171. Crassatellites uvasanus (Conrad)

Plate 4, figures 2, 3; text figure 7

Crassatella uvasana Conrad, House Doc. 129, Projected Vol. 3, 33d Congress, 1st Sess. 1855, p. 9, App. to Rep. of W. P. Blake.— Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 320, pl. 2, fig. 5.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.— Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 214.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 244.— Conrad, Amer. Journ. Conch. Vol. 1, 1865, p. 10.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 279.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 368.

Crassatellites uvasana (Conrad), Arnold, U. S. Geol. Surv. 1906, Prof. Ppr. 47, p. 14.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 430, 444, Type Tejon records.

Crassatella alta Conrad, House Doc. 129, Proj. Vol. 3, 33d Congress, 1855, p. 9, App. to Rept. of Blake. —Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 320.— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.— Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 181, and Vol. 2, 1869, p. 189.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 368.

Not *Crassatella alta* Conrad, Foss. Shells Tert. Form. No. 2, 1832, p. 21, pl. 7, from Eocene of Alabama.

[155] Icon. Comp. pl. 28, figs. 89-8.

Crassatella grandis Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 181, and Vol. 2, 1869, p. 244, Type Tejon records.— Gabb, Calif. Acad. Sci. Proc. Vol. 3, 1867, p. 304.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 279, Type Tejon record.

Not *Crassatella grandis* Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 181, pl. 24, fig. 163, from Clayton.

Crassatellites grandis (Gabb), Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 50, pl. 1, fig. 8, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 430, 437, 444, Type Tejon records.

? *Crassatellites mathewsonii* (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, p. 42, and Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 444, Type Tejon records.

Conrad originally described this species briefly, but figured it well, from the type section of the Tejon Group. Gabb erred in identifying Tejon specimens with his *C. grandis,* from near Clayton's, and subsequent writers have copied his error. Dickerson figured a young specimen of the Tejon

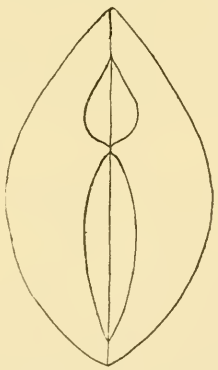

Fig. 7. *Crassatellites uvasanus* (Conrad); one half natural size; drawn from plesiotype No. 1704 (C. A. S. Coll) from Loc. 711, Type Tejon Group.

species as *C. uvasanus,* and an adult specimen as *C. grandis.* An examination of a large amount of material from the Tejon locality has convinced us that there is only one species belonging to this section, and this is *C. uvasanus* (Conrad).

This species is characterized by the undulations on the umbones, formed by the concentric ridges and growth lines, and this character seems to be constant. It is larger than *C. grandis* Gabb, from near Clayton's, and differs in other

characters as well. The hinge is figured here for the first time. Dickerson has identified specimens from the Cowlitz Group of Washington with the Tejon form, but called both *C. grandis*. Probably the Cowlitz form is distinct from either of the California species.

172. [Astarte mathewsonii Gabb]

Astarte mathewsonii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 179, pl. 30, fig. 258, near Martinez.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 244, "Chico Group," Martinez.

Not *Crassatellites mathewsonii* (GABB), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, Type Tejon record.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 444, Type Tejon records, and not pl. 36, figs. 9a and 9b, from Loc. 672 (U. C. Coll.), north of Coalinga.

Gabb's species was described from the Chico Group, near Martinez, and is presumably not a Tejon species. Dickerson has listed it as occurring at Loc. 451 (U. C. Coll.), but figured a specimen from Loc. 672 (U. C. Coll.). It is not known that the species belongs to the genus *Crassatellites*, although this seems probable. At all events there is no other species described to which Dickerson could apparently have referred the specimen he figured as *C. mathewsonii* (Gabb).

173. Venericardia hornii (Gabb)

Plate 4, figure 1

Cardita planicosta LAMARCK, CONRAD, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st Sess. 1855, p. 10, App. to Rep. of W. P. Blake; also Pac. R. R. Repts. Vol. 5, 1857, p. 321, pl. 2, fig. 6; reported from Fort Tejon. — CARPENTER, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 277, Type Tejon record.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, Type Tejon record.

Venericardia planicosta (LAM.), GABB, Am. Jour. Conch. Vol. 2, 1866, p. 88, Tejon record.— CONRAD, Am. Jour. Conch. Vol. 2, 1866, p. 100.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Cardita hornii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 174, 232, pl. 24, fig. 157; near Fort Tejon.— CONRAD, Am. Jour. Conch. Vol. 1, 1865, p. 364.— GABB, Am. Jour. Conch. Vol. 2, 1866, p. 91.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.—GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 187, pl. 30, figs. 83 and 83a.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199 and 211; species

from Tejon reviewed.— Harris, Science, Vol. 22, Aug. 1893, p. 97, stated this is *Venericardia planicosta* (Lamarck).

Venericardia planicosta Var. *hornii* (Gabb), Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14, Type Tejon record.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 43, 49, 51, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 432, 438, 447 Type Tejon records.

This species is very abundant at the type locality of the Tejon Group, where Blake originally found it, and as reported by Conrad. Gabb pointed out the differences existing between it and *V. planicosta* from the Paris Basin.[156]

174. **Nucula vitis** Anderson & Hanna, new species

Plate 2, figure 14; text figure 8

Nucula cooperi Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 431, 446, Type Tejon lists.

Not *Nucula cooperi* Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 290, pl. 14, figs. 2a, 2b, from Marysville Buttes, California.

Shell trigonal in outline, rounded below; beaks full, turned gently backward; anterior slope convex, joining the basal margin with rounded angle; posterior slope flattened, almost straight, joining basal margin with abrupt angle of a little more than 90°, sculptured only with rather coarse lines of

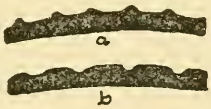

Fig. 8. (*a*) Diagrammatic cross section of *Nucula vitis* near center of marginal area, showing sculpture; (*b*) *Nucula cooperi.*

growth; remainder of surface marked by distinct lines of growth and numerous radiating threads which are very narrow, only about one-third as wide as the flat-bottomed grooves; boundary of posterior slope carinated, slightly convex when viewed horizontally; length 8.2 mm.; height 6.9 mm.

Type: No. 788, Mus. Calif. Acad. Sci., left valve; collected at Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, Califonia, by Bruce G. Martin; Type Tejon Eocene.

[156] See Cossman and Pissarro, Icon. Eocene Env. Paris, 1906, pl. 30, fig. 97-1, pl. 31, fig. 97-1.

The Tejon species is larger than *N. cooperi* Dickerson, in which the posterior slope is not convex; radial threads are broader in the last and are separated by narrow grooves as shown somewhat diagrammatically in the figure herewith. In *Nucula vitis* the posterior and anterior slopes meet at the beak in an angle of 90°, whereas in *N. cooperi* the angle is 110°. All references to *N. cooperi* in the Type Tejon locality appear to have been based upon mistaken identity.

175. Acila gabbiana Dickerson

Plate 9, figure 12

Acila gabbiana Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 430, 437, 444, 481, pl. 36, fig. 1.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 50, *nomen nudum.*

In 1915 Dickerson listed this species as a *nomen nudum* from the type section of the Tejon Group, as recorded above, and stated that it, among others, is "most abundant" there, but he has not included it in the lists on pages 42 or 49, nor did he cite any definite data concerning it. The following year he described the species from **Loc. 1817 (U. C. Coll.), north of Coalinga.** In the latter paper he included it in two Tejon lists (pp. 420, and 444), and mentions it as being found in the section of the Type Tejon (pp. 426, 430 and 437). Thus far only one specimen of the species has been seen from the locality of the Type Tejon; it was obtained by the writers at Loc. 792 (C. A. C. Coll.) on Tecuya Creek, not far above the base of the group. The speices must, therefore, be regarded as belonging to the fauna of the Tejon Group at its type locality.

176. [Acila truncata Gabb]

Acila truncata Gabb, Geol. Surv. Calif. Pal. Vol 1, 1864, p. 198, pl. 26, figs. 184, 184 a-b, **Chico Group, Pence's Ranch.**— Conrad, Am. Jour. Conch. Vol. 1, 1865, p. 364.— Gabb, Am. Jour. Conch. Vol. 2, 1866, p. 92. — Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 197, 250, recorded as occurring at Tejon, as well as at several Cretaceous localities.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199, 200, 202.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 288.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.— Dickerson, Univ. Calif. Publ. Vol. 7, 1913, p. 264, (as *Nucula cf. truncata.)* recorded as being found at Type Tejon locality.

Most writers who have dealt with the Tejon Group have copied Gabb's record of this species as occurring in the type section. After an exhaustive search of the collections from there we have seen no specimens referable to the species. Dickerson has not included it in any of his formal lists of the Tejon species from the type section, although indirectly he has suggested that it may occur there.

177. ["Acila n. sp." Dickerson]

Acila n. sp. DICKERSON, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 42, 49, Type Tejon records; Loc. 245 (C. A. S. Coll.), near Grapevine Canyon, Kern County, and also Loc. 452 (U. C. Coll.), Grapevine Canyon.

The collections referred to above have been searched, but no *Acila* of any species has been found in them and we are at a loss to know the basis of these records. They are mentioned here only to complete the references of species reported from this locality.

178. Leda[157] vogdesi Anderson & Hanna, new species

Plate 2, figures 8, 9

Leda protexta ? GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 199, 235, Type Tejon records; not pl. 26, fig. 185, Clayton to Marsh's, near Mount Diablo.

Not *Leda protexta* GABB, Jour. Acad. Nat. Sci. Phila. 2nd Ser., Vol. 4, p. 303, pl. 48, fig. 23; New Jersey.— CONRAD, Am. Jour. Conch. Vol. 1, 1865, p. 365.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, pp. 199, 202, Type Tejon records.

? *Nuculana gabbii* CONRAD, Checklist Eoc. and Oligoc. Foss. Smiths. Misc. Coll. No. 200, 1866, p. 3. Absolute *nomen nudum;* no locality or description cited.

Leda gabbii GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 197, 250, Type Tejon records.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 202, Type Tejon record.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 284; listed from San Emigdio Canyon only.— ARNOLD, U. S.

[157] In continuing to use the generic name, *Leda,* it seems possible that the time is only being prolonged when a change will be inevitable if the present code of nomenclature be followed. Nevertheless, we do not feel that the step should be taken in this paper but should come from someone in this country who is able to consult and check original sources of names. Some European conchologists and paleontologists have abandoned *Leda* and adopted *Nuculana* for several years and Iredale has stated (Trans. New Zealand Institute, Vol. 47, 1915, p. 483.) that both names were adopted originally for the same purpose, to replace *Nucula* of Lamarck, and that if *Nuculana* Link, 1807, not be used then both must be discarded because Link's name has 10 years priority.

Geol. Surv. Prof. Ppr. 47, 1906, p. 14, Type Tejon record.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 256.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 49, 51, Type Tejon records; not pl. 1, fig. 1, same paper; Loc. 672 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 431, 438, 445, Type Tejon records; not p. 504, pl. 36, fig. 3, same paper; Loc. 672 (U. C. Coll.).

Leda gabbii Gabb, Hanna, Calif. Acad. Sci. Proc. 4th ser. Vol. 13, 1924, p. 170; further discussion of the nomenclature in which *L. gabbii* is involved.

Shell small, much inflated; sculpture consisting of regular, evenly spaced concentric ridges which do not extend as far as the posterior slope; anterior dorsal margin almost straight, slightly convex; basal margin circular, the center of the arc being 1 mm. above the beak; posterior slope gently concave; posterior end narrowly rounded; the beaks very little forward of the center of the shell. A simple depression passes from the beak to the basal margin just beneath the posterior dorsal margin; growth lines extend only up to this depression, but do not cross it. Length, 8.3 mm.; altitude 4.7 mm.; thickness, about 3.6 mm.

Type: No. 780, Mus. Calif. Acad. Sci.; left valve with a portion of the right, collected at **Loc. No. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin; Type Tejon Eocene.

No species of *Leda* has been seen from the California Tertiary deposits which appears to agree with the specimens from this locality. *Leda gabbii* is considerably larger, much more attenuated behind, and the sculpture is somewhat finer. Right or wrong, Gabb mentioned numerous localities in which he believed his species occurred, such as Clayton, Marsh's, Martinez, San Diego, Alizos Creek (near Grapevine Creek), and San Emigdio. Specimens in the collections of the California Academy of Sciences from the first locality mentioned, and in the University of California from Marsh's, correspond to the original figure, so that it may be assumed that it came from a group older than the Tejon, which has been described by Clark under the name of Meganos.[157] It is believed that all records of *L. gabbii* in the Type Tejon are really based upon specimens of *L. vogdesi,*

[157] Geol. Soc. Am. Bull., Vol. 29, 1918, pp. 281-296.

since we have found no specimens of the former in any of the collections from there. Dickerson recorded it in many places from the "Type Tejon", but his figured specimens were obtained from near Coalinga.

All of the references to *Leda gabbii* above except the last cite the name as of Conrad. The latter's *nomen nudum* has no standing in nomenclature and the name must be cited as of Gabb.

The type of *Leda gabbii* Gabb came apparently from the vicinity of Mount Diablo, and not from the type locality of the Tejon, although Gabb believed that it occurred there.

Leda gabbii Gabb should not be confused with *Leda gabbana* (Whitfield)[158] from New Jersey Tertiary. The two names are probably sufficiently distinct to stand.

Leda vogdesi is named in honor of the late General Anthony W. Vogdes of San Diego, well known for his bibliographical labors on California geology.

179. Leda uvasana Dickerson

Leda uvasana Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 51, 52, pl. 1, figs. 2a and 2b. Type locality, No. 244 (C. A. S. Coll.). — Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445.

This large species of *Leda* has not been found elsewhere than at the Type locality of the Tejon, and is represented in the collections of the Academy of Sciences by five specimens in addition to the type and paratype. Some slight variation is noticeable, even in Dickerson's figures, chiefly in the sculpturing, but it is unimportant. The dark shading on the anterior slope of his figure two is accidental and does not exist on the specimen itself.

180. Leda parkei Anderson & Hanna, new species

Plate 2, figures 10, 11

Shell sculptured with uneven lines of growth, and therefore without the regular concentric ornamentation usually found in members of this genus; anterior end and basal margin gently rounded; posterior dorsal slope concave,

[158] U. S. Geol. Surv. Monog. 9, 1885, p. 106, pl. 11, figs. 11-13.

bounded by an impressed area which is relieved by small sharp ridges, and crossed by distinct concentric sculpturing. The posterior dorsal margin and the basal margin meet in a sharp angle and point.

Type: No. 782, Mus. Calif. Acad. Sci.; left valve; paratype, No. 783, left valve; collected at **Loc. 244 (C. A. S. Coll.), Live Oak Creek, Kern County, California,** by Bruce G. Martin in 1914; Type Tejon Eocene.

The irregular sculpture and peculiar posterior slope distinguish this species from any other known to us. Only two specimens were found.

Named for Lieutenant J. G. Parke of the topographical corps of the Pacific Railroad Survey.

181. Arca hornii Gabb

Plate 2, figures 1, 2

Arca hornii GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 194, pl. 30, fig. 263, **Type locality of the Tejon Group.**— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 249.—GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 274.— ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, Type Tejon record, but not pl. 1, fig. 4, Loc. 672 (U. C. Coll.), north of Coalinga.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 430, 444, Type Tejon records, and possibly pl. 36, fig. 4, Loc. 672, (U. C. Coll.), north of Coalinga.

The original figure of this species is defective; it shows the ribbing much too coarse. The collections studied contain many good examples from the type locality and occasion is taken to re-illustrate it, and to show the hinge for the first time. This is found to have 30 teeth set in a gently curved line.

182. [Barbatia morsei Gabb]

Barbatia morsei GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 216, pl. 32, fig. 286, described from **near San Diego, California.**— GABB, Geol. Surv. Calif. Pal. Vol. 2, same locality, but not listed from the Type Tejon.

Not *Barbatia morsei*, DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 42, 49, 50, Type Tejon records; Loc. 453 (U. C. Coll.).— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 437, Type Tejon records.

This species was originally described from the Upper Eocene deposits of San Diego County, and was not included by Gabb as a Tejon species at the Type locality. The first mention of it from the latter place was by Dickerson, in 1915; in his later paper he also listed it from there in two tables, but omitted it from another which should have contained it, if he had actually found it. An examination of the collections from the type locality of the Tejon Group has not revealed any specimens of this species, and we are unable to confirm its occurrence. The only *Arca* of any species, other than *hornii*, found there is in the basal beds at Locs. 246 (C. A. S. Coll.), and 453 (U. C. Coll.), but the specimens do not appear to be *B. morsei* and probably belong to a new species. They are not sufficiently well preserved for description.

183. Glycymeris sagittata (Gabb)

Plate 1, figure 6

Axinea (Limopsis) sagittata GABB, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 197, 235, pl. 31, figs. 267 and 267a; near Fort Tejon, and Martinez.— GABB, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— GABB, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 196, and 249; reported from Tejon, Griswolds and Martinez.— HEILPRIN, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— COOPER, Calif. State Min. 7th Ann. Rept. 1888, p. 276. — ARNOLD, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Glycimeris sagittatus (GABB), DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 430, 437, 445, Type Tejon records. (Not p. 504, pl. 36, figs. 5a and 5b.)

This species is very abundant at the type locality of the Tejon Group from which it was originally described. Gabb's figure is deficient, in that he did not illustrate the hinge. This is almost, but not quite straight, with the line of the teeth bent downward at each end. There are 12 well defined teeth on each side of the central area; in this they are small and indistinct. The ligamental area is long and narrow and contains about five wide-spreading, inverted V-shaped ridges. The outer surface is usually smooth to the unaided eye, but

is marked on the umbones with about 35 narrow radiating grooves. These disappear above the margin of the shell in well grown specimens, while the flat ribs between the grooves, 12 in number, do not extend to the margin. The ribs are crossed by concentric lines of growth of equal size, which gives the surface a delicate cross-hatched appearance under the lens. The incised V-shaped lines shown in Gabb's figure appear on some specimens as pits caused by the wavy lines of growth around marginal crenulations.

Almost all writers on the Tejon fauna who have given lists of species have included this one as from the Type locality. But unfortunately it has also been recorded from almost every important Eocene locality in the west, from the Martinez group up. Very few of these records have been checked in the preparation of this paper, but it can be stated positively that some of them are incorrect. The specimens from the Cowlitz formation of Vader, Washington, which Dickerson has identified as *"G. sagitattus"* (Gabb)[159] do not belong to this species. The species figured by him in his last Tejon paper[160] is apparently not distinct from *G. hannibali* on the same page.

184. **Glycymeris viticola** Anderson & Hanna, new species

Plate 1, figure 5; plate 3, figure 1

Glycimeris eocenica (Weaver), Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 445, Type Tejon records.

Not *Pectunculus eocenica* Weaver, Wash. Geol. Surv. Bull. 15, 1912, p. 28, pl. 5, figs. 52 and 53; Loc. 227 (U. W. Pal. Coll.).

Shell small, equilateral, not inflated, with umbones rather low; apical angle about 95°; surface sculptured with 35 radial ribs, flattened on top, with interspaces crossed by fine lines of growth and by concentric grooves showing rest periods; hinge with seven anterior and seven posterior lateral teeth, and with four less distinct teeth in the median area; ligamental area marked by six inverted V-shaped ridges; basal margin bearing crenulations corresponding to the intercostal grooves; length of shell, 21.5 mm.; altitude, 21.5 mm.

[159] Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49 and 51.
[160] Op. cit. pl. 36, figs. 5a and 5b.

Type: No. 777, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin, 1914; Type Tejon Eocene.

Several specimens are contained in the collections of the Academy of Sciences. They show that in its younger stages, the apical angle is greater than 95°, and that the ribs in unworn specimens are noded, due to the crossing of regularly spaced concentric grooves. In the details of its ornamentation this species does not closely resemble any other western form.

185. **Glycymeris verticordia** Anderson & Hanna, new species

Plate 2, figure 5; plate 11, figure 1

Glycimeris fresnoensis Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 426, 427, 431, 444, (Type Tejon records). (Not p. 483, pl. 36, fig. 7, Loc. 1817 (U. C. Coll.).

Shell small, sub-triangular, lower margin rounded; beak nearer the anterior than the posterior end; surface sculptured with 16 high, slightly rounded ribs, with slightly rounded interspaces of about equal width; only the seventh rib from the posterior end dichotomous; hinge broad and flat, with seven strong teeth on each side of the central area; ligament area very narrow, and beak elevated but little above the hinge line. Length, 8 mm.; altitude, 7.5 mm.

Type: No. 776, Mus. Calif. Acad. Sci.; collected at **Loc. 245 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** by Bruce G. Martin, 1914; Type Tejon Eocene.

Dickerson referred these specimens to *G. fresnoensis* described from Loc. 1817 (U. C. Coll.) on Salt Creek, north of Coalinga, Fresno County, California, and stated that that species is characteristic of the Type Tejon locality (p. 427).

Although his figure of the Coalinga specimen is poor and his description almost too meager for recognition, a comparison of the type specimen with those from Grapevine Creek shows that the two are distinct. The beak in *G. fresnoensis* is centrally located, but in *G. verticordia* it is much nearer the anterior end. In the former the anterior and posterior margins are almost straight, but in the latter they

are much curved. Furthermore, the ribs in *G. verticordia* are more regular, sharper, and single, whereas, in *G. fresnoensis* they are irregular in size, and are often, but not always dichotomous. It appears that two specimens collected by Mr. Martin at Loc. 245 (C. A. S. Coll.) are the only ones found.

186. **Glycymeris ruckmani** (Dickerson)

Glycimeris ruckmani Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 42, 52, 53, pl. 1, figs. 5a and 5b.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420 and 445.

This species was first cited (p. 42) from **Loc. 452 (U. C. Coll.)**, but under the original description (p. 53), **Loc. 458 (U. C. Coll.)** is given as the Type locality. An examination of the collections at the University of California shows that either may be correct and both are Type Tejon localities.

The species has a smaller apical angle than that here described as *G. viticola,* and also fewer ribs. The statement in the original description that the central area of the hinge is without teeth is not borne out by an examination of the type specimen, and the figure of the interior (fig. 5b) of it shows that it is decidedly denticulate.

187. **Glycymeris evermanni** Anderson & Hanna, new species

Plate 15, figures 1, 2, 3

Shell minute, circular, moderately inflated; umbones central; surface marked by about 26 rounded radial ribs which are closest together at the sides; in the center of the margin the interspaces are slightly wider than the ribs; ribs and interspaces crossed by coarse, equidistant, concentric grooves which extend uniformly from the beak to the lower margin, about 16 in number on the type specimen; hinge line curved, having only three teeth on each side of the beak in the best paratype; length 3.0 mm.; altitude 3.0 mm.

Type: left valve, No. 964, paratypes, Nos. 965 and 966, Mus. Calif. Acad. Sci.; collected by G. D. Hanna and M. A. Hanna at **Loc. 711 (C. A. S. Coll.), Grapevine Creek, Kern County, California,** June, 1921; Type Tejon Eocene.

This little species is beautifully cancellated on the outer surface. Three well preserved specimens were extracted from very hard rock and the inner margin of one shows crenulations. It is not rare in the stratum in which it was found, though this rock is perhaps exceptional.

The species is named in honor of Dr. Barton Warren Evermann, Director, California Academy of Sciences, in recognition of much aid in the publication of this report.

188. [Glycymeris instabilis Anderson & Hanna]

Axinea cor Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 198, 235, pl. 31, figs. 268, 268a; Martinez.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 250; Type Tejon, Martinez.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 276.—Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14; Gabb's error repeated.

Glycimeris cor (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pl. 1, fig. 6; no locality given.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 426, 431, 445, Type Tejon records.

Not *Pectunculus cor* Lamarck, Hist. Ann. Sans Vert. Vol. 6, 1822, p. 55.

Glycimeris gabbi Cossmann, Rev. de Paleozoologie, Vol. 17, 1913, p. 64.

Not *Glycymeris gabbi* Dall, U. S. Geol. Surv. Prof. Ppr. 59, 1909, p. 108, pl. 11, fig. 5.

The type locality of this species was said to be Martinez, but Gabb also listed it in the Tejon column (Pal. Vol. 1, p. 235,) probably through mistaken identity. In his second volume (Pal. Vol. 2, p. 250) he omitted the Tejon locality, but recorded it from the Tejon Group, Martinez.

Dickerson figured a specimen (above cit.) without any description, and without assigning a locality, which may be identical with his *G. ruckmani* from Loc. 458 (U. C. Coll.), Tejon Quadrangle. The specimen is apparently not the same as *G. instabilis* and the record of this species (as *G. cor*) in his latest paper is not altogether satisfactory. He omitted it from his list of species from the Type Locality of the Tejon on p. 420, but included it on p. 426, and on the following page he enumerated it among the "characteristic forms at the type locality of the Tejon". His later lists (pp. 431 and 445) contain it.

With the record so confused and without finding any other specimens in any of the collections examined, which can serve

to confirm Dickerson's record, or the occurrence of the species at the type section of the Tejon Group, it appears best to exclude it until better evidence of its presence there can be obtained.

Cossmann renamed Gabb's species because of a previous use of the specific name by Lamarck for a species in the same genus; but the name he chose had already been used with *Glycymeris*. We are indebted to Mr. Merle C. Israelsky for calling our attention to the name given by Cossmann.

189. Mytilus ascia Gabb

Mytilus ascia Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 183, 233, pl. 30, fig. 259, **Type Tejon locality.**— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 245.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— Cooper, Calif. State. Min. 7th Ann. Rept. 1888, p. 287.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Conrad described *Mytilus humerus* from the type section of the Tejon Group, and although he mentioned no characters which seem to be specifically diagnostic, and his figure is poor, still we have been fortunate enough to obtain specimens that agree in all essential respects with his figure. It is not improbable that there are two species of *Mytilus* in these beds. *M. ascia* seems to be distinct and easily recognized, and is admitted herein even though other collectors have not reported finding specimens.

190. Mytilus humerus Conrad

Figure 9

Mytilus humerus Conrad, House Doc. 129, Proj. Vol. 3, 33d Congress, 1st. Sess. 1855, p. 9, App. to Rep. W. P. Blake.— Conrad, Pac. R. R. Repts. Vol. 5, 1857, p. 321, pl. 2, fig. 10, **Type Tejon locality.**— Carpenter, Rept. Brit. Ass. Ad. Sci. 1864, p. 589; also Smith. Misc. Coll. 252, 1872, p. 75.— Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 184, 233, locality questioned.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 245, Type Tejon locality not questioned.— Conrad, Amer. Journ. Conch. Vol. 1, 1865, p. 10.—Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 287.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

This species was described from the type section of the Tejon Group, but both figure and description are poor. We have been fortunate enough to obtain specimens which are

identifiable with reasonable assurance and supply here an outline drawing of one. Gabb described another species,

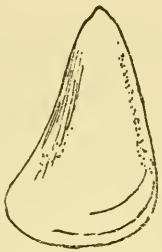

Fig 9. *Mytilus humerus* Conrad, x 2.

from the Tejon locality, but Dickerson did not seem to recognize either of them in his work.

191. Septifer dichotomus Gabb

Plate 1, figure 2

Septifer dichotomus Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 186, 234, p. 30, fig. 261; **near Fort Tejon.**—Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 246, Tejon record.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 291.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 43; Loc. 454 (U. C. Coll.), Type Tejon locality.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 447, Type Tejon records.

Not *Mytilus dichotomus* Cooper, Calif. State Min. Bur. Bull. No. 4, 1894, p. 49, pl. 5, fig. 64; **near Coalinga, California.**

As far as the records show this species has been collected only twice, and that at the type locality of the Tejon Group. The specimens referred to by Dickerson have been examined and his identification confirmed.

Cooper described *Mytilus dichotomus,* and suggested that Gabb's specimen may have belonged to this genus, and not to *Septifer;* but the type specimen (No. 613, in the collections of the Academy of Sciences) from Coalinga has much finer sculpture than Gabb's figure shows, and is wider in proportion to the length. Confirmation of Gabb's generic determination can be made only by an inspection of his type, or by the finding of additional good material at the type local-

ity, neither of which has been done, although the species seems to have been found at Loc. 816 (C. A. S. Coll.) on the east side of Pastoria Creek.

192. **Brachydontes ornatus** (Gabb)

Plate 3, figure 4

Modiola ornata Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 184, 234, pl. 24, fig. 166, **Division B, Martinez and Marsh's**; not recorded from Tejon section.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 304.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 199.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 245, recorded as found at the Tejon locality.— Cooper, Calif. State Min. 7th Ann. Rept. 1888, p. 286.— Arnold, U. S. Geol. Surv. Prof. Ppr. 47, 1906, p. 14.

Modiolus ornatus (Gabb), Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42, listed from Loc. 244 (C. A. S. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 426, 431, 438, and 446.

In the original description this species was not listed from the type locality of the Tejon, but in Vol. 2 this was done. The collections in the Academy of Sciences contain 20 specimens of *Brachydontes* from Loc. 244 (C. A. S. Coll.) which, in all visible characters seem to be a single species, but not all of them resemble the species from Martinez. The umbonal ridge in *B. ornatus* as shown in the figure is arcuate, forming no very decided angle in cross-section, and having a gentle slope toward the ventral margin; in the variation most common at Loc. 244 (C. A. S. Coll.) the umbonal ridge is almost straight, the slopes forming an abrupt angle, with a steep ventral slope. The umbonal ridge is also bordered below by a distinct longitudinal depression. Nevertheless the specimens can hardly be regarded as a distinct species at present.

193. **Pteria pellucida** (Gabb)

Plate 1, figure 1

Avicula pellucida Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 186, pl. 25, fig. 172, **Division B, near Martinez, etc.**— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 246, recorded also from Tejon, and many other places.— Dickerson, Univ. Calif. Publ. Geol. Vol. 7, 1913, p. 264, also Vol. 9, 1916, pp. 420, 430, 437, 444, Type Tejon records.— Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, recorded from Loc. 244 (C. A. S. Coll.), Type Tejon.

In this species the surface is smooth, except for rounded ridges parallel to lines of growth; angle made by lines drawn on the umbonal ridge and the hinge, about 55°.

Gabb listed this form from many points in California, including a number belonging to the Cretaceous period. Stanton stated that the species "belongs to a simple type of *Avicula* that is well represented in the Cretaceous, and on to the present day".[161] Dickerson listed it from Loc. 244 (C. A. S. Coll.), and an examination of the material upon which the record was based enables us to confirm the identification; we were fortunate enough also to find several good specimens at Tecuya Canyon, Locs. 792 and 823 (C. A. S. Coll.), as well as at Live Oak Canyon.

194. [Pinna barrowsi Dickerson]

Pinna barrowsi DICKERSON, Univ. Calif. Publ. Geol. Vol. 8, 1914, p. 125, pl. 8, fig. 3; **Martinez Group, Martinez.**

Not *Pinna barrowsi* DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42; Loc. 452 (U. C. Coll.), Type Tejon section.— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 446, Type Tejon records.

In his paper on the Fauna of the Martinez Eocene of California Dr. Dickerson recorded this species as occurring in the Tejon (p. 160). We have no information as to what the record is based upon, but the species is omitted from the Tejon column (p. 108) of the same paper, though it is included in his later paper in some of his more formal lists of Tejon species, and omitted from others. The only real basis for the record of the species in the Type Tejon section is reputed material from Loc. 452 (U. C. Coll.); in this we have been unable to find any support for the Tejon references.

195. **Spondylus carlosensis** Anderson

Figure 10

Spondylus carlosensis ANDERSON, Calif. Acad. Sci. Proc. 3rd Ser., Vol. 2, 1905, pp. 39, 43, pl. 13, fig. 1, type locality, **Avenal Sands, west of Coalinga, California.**— DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 39, 43, pl. 1, fig. 7, listed from Loc. 246 (C. A. S. Coll.), and Loc. 457 (U. C. Coll.).— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 421, 431 and 447, listed from Type Tejon.

[161] U. S. Geol. Surv. 17th Ann. Rept. 1896, p. 1032.

Anderson's and Dickerson's specimens and several others have been examined, and it appears certain that they belong to the genus *Spondylus*. Characters such as could be used for the specific discrimination of members of this variable group have not been found among the specimens from the

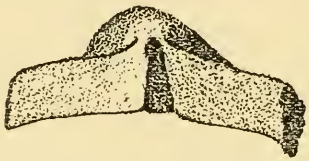

Fig. 10. Hinge of *Spondylus carlosensis* Anderson, x 2. Specimen No. 795 (C. A. S. Coll.) from Grapevine Canyon, Kern County, California.

two localities and the species is therefore accredited to the Type Locality of the Tejon Group although originally described from the vicinity of Coalinga. It has been collected near the base of the section in both Grapevine and Pastoria Creeks.

196. [Placunanomia inornata Gabb]

Placunanomia inornata Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, p. 217, pl. 32, fig. 288a; **near San Diego, and Corral Hollow.**— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, p. 252; localities as before.

Not *Placunanomia inornata* Gabb, Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49 and 51, Type Tejon records.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 431 and 438, Type Tejon records.

Although Gabb has listed many species from the Tejon section which are not found at the type locality, he has not included this one. Dickerson, however, has cited it in some of his lists and omitted it from others. In his earlier paper he omitted it on p. 42, but on p. 51 he included it as one of the "characteristic and most abundant species" of both the Tejon and the Cowlitz faunas. This statement seems the more puzzling since he has omitted it from his later and more formal lists of the Type Tejon species given in his latest paper (above cit. pp. 421, 446, etc.), where it should have occurred if he had evidence of its presence there. We have seen no fossils referable to the species in any of the collections examined. With such unsatisfactory evidence of its occurrence it is not believed that the species should be included in the Type Tejon list.

197. [Ostrea idriænsis Gabb]

Ostrea idriænsis Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 203, 252, pl. 33, figs. 103b, 103c, 103d; pl. 34, figs. 103, and 103a; **Tejon Group, near New Idria, California.**

Not *Ostrea idriænsis,* Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, pp. 49, 51, Type Tejon records.

This species was described by Gabb from the vicinity of New Idria, Fresno County, and from beds which he believed to be of the same horizon as those about Mount Diablo, which are not necessarily the equivalent of the Type Tejon Group. Dickerson has listed the species from the type section of the Tejon, and also includes it among his "characteristic and most abundant species" of this fauna. Nevertheless he has not included it as such, nor mentioned it in any of his later and more formal lists of Type Tejon species published in his latest paper (above cit., pp. 420, 431, 438, and 446).

In the absence of satisfactory information from the published accounts, and not having seen any specimens upon which a confirmation of the record can be based, we cannot, at present, give the species a place in the list of Type Tejon species.

198. ["Ostrea sp." Dickerson]

Ostrea sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, p. 42; Locs. 452 and 458 (U. C. Coll.).— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 421, Type Tejon record.

Various fragmentary specimens of an indeterminate oyster have been observed in the strata of the type section of the Tejon Group, but no important significance has been attached to the fact, and this record is mentioned here only for completeness.

199. [Callianassa stimpsonii Gabb]

Callianassa stimpsonii Gabb, Geol. Surv. Calif. Pal. Vol. 1, 1864, pp. 57, 220, pl. 9, figs. 1a, b, and c.— Gabb, Calif. Acad. Nat. Sci. Proc. Vol. 3, 1867, p. 302.— Gabb, Geol. Surv. Calif. Pal. Vol. 2, 1869, pp. 127, 209, pl. 19, fig. 3; fragments described from various localities, chiefly noted as Cretaceous.— Heilprin, Acad. Nat. Sci. Phila. Proc. Vol. 34, 1882, p. 197.— Cooper, Calif. State Min. 7th Ann. Rept., 1888, p. 271.

The occurrence of this species as a part of the fauna of the Tejon Group at its type locality rests solely upon the statement of Gabb in his original description. However, it appears that none of his figures were drawn from material from this locality, and we may infer that no specimens from there entered into the drafting of the description.

Cooper stated that the original description probably included more than one species, which makes its inclusion in this fauna even more unsatisfactory. We conclude that the evidence is too insecure for acceptance.

200. ["Cancer ? sp. a; and Cancer ? sp. b;" Dickerson]

Cancer ? sp. a; and *Cancer* ? sp. b, DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 427, 434, reported from the type section of the Tejon Group; pl. 42, figs. 11 and 12.

These nondescript records are hardly worthy of notice, but are included for the sake of completeness. They are listed by Dickerson as occurring at the type section of the Tejon Group but the specimens figured are from Salt Creek, north of Coalinga, Loc. 1817 (U. C. Coll.) and the basis of the Tejon records is not known.

201. [Schizaster lecontei Merriam]

Schizaster lecontei MERRIAM, Calif. Acad. Sci. Proc. 3d Ser., Vol. 1, 1899, pp. 164, 165, pl. 21, figs. 1a and 1b, **Martinez Group, Contra Costa County, California.**— KEW, Univ. Calif. Publ. Geol. Vol. 12, 1920, p. 151, pl. 41, figs. 3a, 3b, 3c and 3d.— DICKERSON, Univ. Calif. Publ. Vol. 8, 1914, pp. 121, 156, pl. 6, fig. 7, Mount Diablo region.

Not *Schizaster lecontei,* DICKERSON, Univ. Calif. Publ. Geol. Vol. 7, p. 265, Type Tejon record, nor Vol. 8, 1914, p. 113, nor Vol. 9, 1916, pp. 420, 443, Type Tejon records, nor Calif. Acad. Sci. Proc. 4th Ser. Vol. 5, 1915, pp. 42, and 46.

This species was first described from the Martinez Group, Loc. 337 (U. C. Coll.). Dickerson stated that it occurs abundantly at the "Type section of the Tejon near Fort Tejon" (p. 113 in above citation), but in his descriptive note he does not record its occurrence there. In his monograph of the Echinoidea Dr. Kew referred the species listed by Dickerson as *S. lecontei,* to *S. diabloensis* Kew, and did

not mention the occurrence of either in the Type Tejon Group. Dickerson listed the species from Loc. 461 (U. C. Coll.), which is near Grapevine Creek, Kern County, but a search of the collections from the Type section of the Tejon has failed to reveal a specimen referable to it.

202. ["Serpula sp." Dickerson]

Serpula sp. DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 442, Loc. 785 (U. C. Coll.) Lower Lake, Lake County, and Type Tejon record.

A record of fossil worm tubes such as the above has but little, if any, value in stratigraphic work, since they occur in many formations. Specimens representing more than one species are in the collections from the type locality of the Tejon, but no attempt has thus far been made to identify them, or even to study them seriously as a part of the fauna.

203. **Dendrophyllia tejonensis** Nomland

Plate 6, figure 4

Dendrophyllia tejonensis (NOMLAND ms.), DICKERSON, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, *Nomen nudum.*— NOMLAND, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 67, pl. 4, figs. 1 and 5; **Loc. 458 (U. C. Coll.), Grapevine Creek, Kern County, California.**— DICKERSON, Univ. Calif. Publ. Geol. Vol. 9, 1916, pp. 420, 443, Type Tejon records. — DICKERSON, Calif. Acad. Sci. Proc. 4th ser. Vol. 7, 1917, p. 195.

This coral was described from the type section of the Tejon Group in Grapevine Creek, Kern County, and from near the middle of the section. The original type was not well preserved, but the same may be said of subsequent collections. The specimen figured herewith is by no means complete, but may serve to supplement the information heretofore published; it came from Loc. 816 (C. A. S. Coll.), on the east side of Pastoria Creek, Kern County, about four miles east of Grapevine Creek and 600 feet above the base of the Group. The specimens are casts, but nevertheless show some structural points not shown in Nomland's figure.

Another species of coral, probably belonging to the genus *Trochocyathus,* was found at Loc. 711 (C. A. S. Coll.) in

Grapevine Creek. The best specimen in the collection is illustrated herewith (pl. 9, fig. 5), but it is not considered sufficiently well preserved to warrant more than passing notice.

204. ["Turbinolia sp." Dickerson]

Turbinolia sp. Dickerson, Calif. Acad. Sci. Proc. 4th Ser., Vol. 5, 1915, p. 42, listed from Loc. 451 (U. C. Coll.) west side of Grapevine Creek, Kern County.— Dickerson, Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 420, Type Tejon record.

We have no means of knowing what the author had in view in the records here given. He might possibly refer to "*T. pusillanima,* n. sp." Dickerson (*nomen nudum,* first cit. p. 40), or to *T. pusillanima* Nomland,[162] from near Mount Diablo. However, there is no authentic material from which it can be known that this genus occurs in the strata of the Type Tejon Group, and therefore we cannot include it as a part of this fauna.

[162] Univ. Calif. Publ. Geol. Vol. 9, 1916, p. 62, pl. 3, figs. 9 and 10, Loc. 476 (U. C. Coll.).

PLATE 1.

Fig. 1. *Pteria pellucida* (Gabb); plesiotype in U. C. Coll.; cast of same No. 897 (C. A. S. Type Coll.) from Loc. 460 (U. C. Coll.), Type Tejon Group; enlarged to 1.09; p. 188.

Fig. 2. *Septifer dichotomus* Gabb; plesiotype No. 763 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.09; p. 187.

Fig. 3. *Cardium brewerii* Gabb; plesiotype No. 766 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.09; p. 165.

Fig. 4. *Corbicula williamsoni,* new species; type No. 768 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.09; p. 164.

Fig. 5. *Glycymeris viticola,* new species; type No. 777 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.09; p. 182.

Fig. 6. *Glycymeris sagittata* (Gabb); plesiotype No. 775 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.09; p. 181.

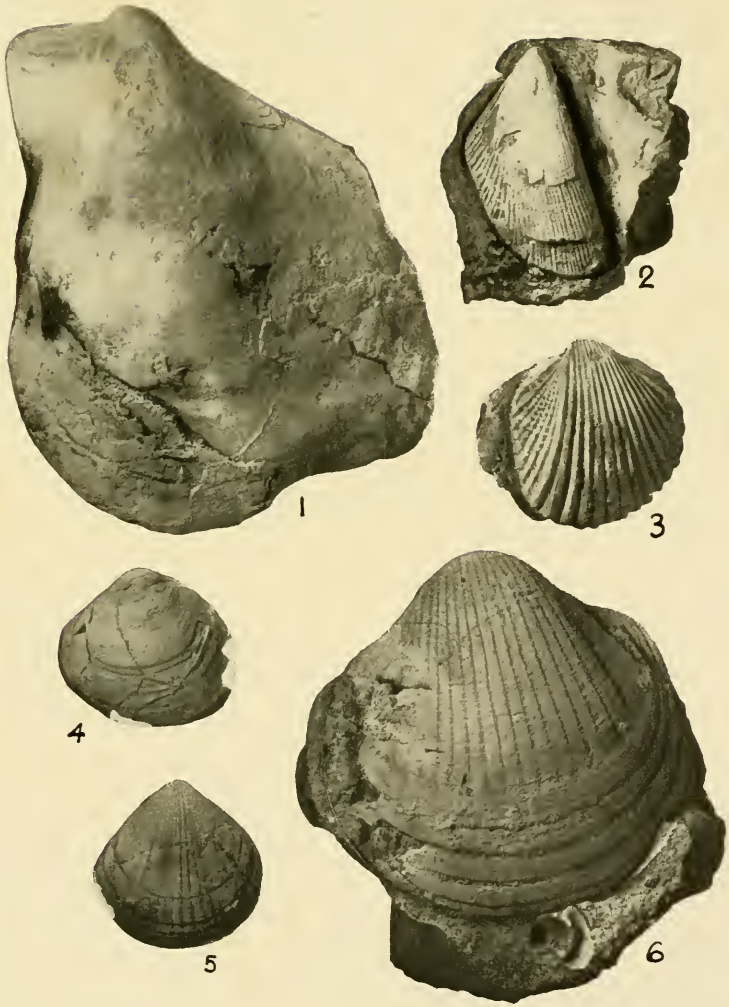
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PLATE 2.

Fig. 1. *Arca hornii* Gabb; plesiotype No. 761 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 180.

Fig. 2. *Arca hornii* Gabb; plesiotype No. 762 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 180.

Fig. 3. *Corbula hornii* Gabb; plesiotype No. 1699 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 148.

Fig. 4. *Corbula hornii* Gabb; plesiotype No. 1700 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 148.

Fig. 5. *Glycymeris verticordia,* new species; type No. 776 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 183.

Fig. 6. *Kellia catacta,* new species; plesiotype No. 778 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 171.

Fig. 7. *Kellia uvasana* (Dickerson); plesiotype No. 779 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 172.

Fig. 8. *Leda vogdesi,* new species; type No. 780 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 177.

Fig. 9. *Leda vogdesi,* new species; paratype No. 781 (C. A. S. Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 177.

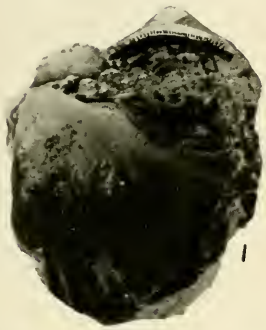
Fig. 10. *Leda parkei,* new species; type No. 782 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 179.

Fig. 11. *Leda parkei,* new species; paratype No. 783 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 179.

Fig. 12. *Macoma viticola,* new species; type No. 1701 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 157.

Fig. 13. *Tellina castacana,* new species; type No. 796 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 153.

Fig. 14. *Nucula vitis,* new species; type No. 788 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 175.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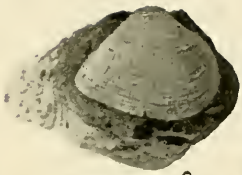
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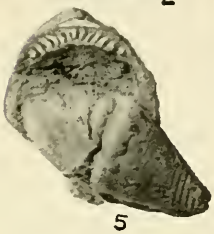
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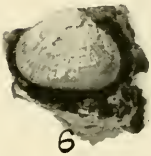
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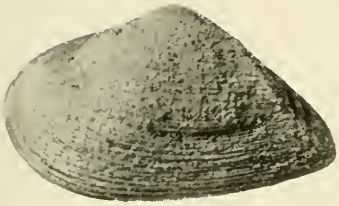
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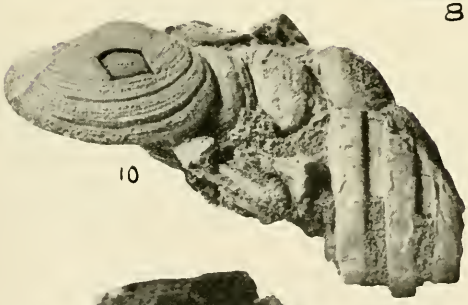
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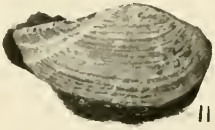
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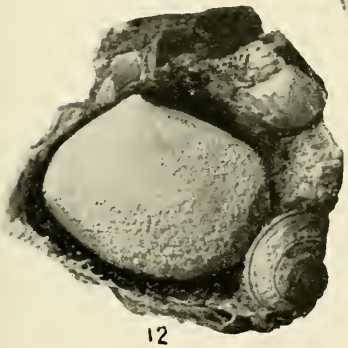
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PLATE 3.

Fig. 1. *Glycymeris viticola,* new species; type No. 777 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.5; p. 182.

Fig. 2. *Corbicula williamsoni,* new species; type No. 768 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5; p. 164.

Fig. 3. *Cardium linteum* Conrad; plesiotype No. 767 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.5; p. 166.

Fig. 4. *Brachydontes ornatus* (Gabb); plesiotype No. 764 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5; p. 188.

Fig. 5. *Pitaria tejonensis* (Dickerson); type No. 262 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5. The outside of this specimen was figured by Dickerson (Calif Acad. Sci. Proc. 4th ser. Vol. V, 1915, p. 82, pl. 3, fig. 2a.) and there erroneously stated to be enlarged "X 1"; the figure there is twice natural size, approximately. See p. 160.

Fig. 6. *Psammobia hornii* (Gabb); plesiotype No. 793 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5; p. 151.

Fig. 7. *Spisula bisculpturata,* new species; type No. 794 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5; p. 149.

Fig. 8. *Macrocallista andersoni* Dickerson; plesiotype No. 1703 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.5; p. 162.

Fig. 9. *Antigona hornii* (Gabb); plesiotype No. 765 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.5; p. 158.

Fig. 10. *Tellina lebecki,* new species; type No. 800 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5; p. 154.

Fig. 11. *Macrocallista conradiana* (Gabb); plesiotype No. 787 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.5; p. 163.

Fig. 12. *Helminthoglypta obtusa,* new species; type No. 1016 (C. A. S. Type Coll.) from Live Oak Canyon, Kern County, California; Type Tejon Group; p. 142.

Fig. 13. *Helminthoglypta obtusa,* new species; type No. 1016 (C. A. S. Coll.) from Live Oak Canyon, Kern County, California; Type Tejon Group; p. 142.

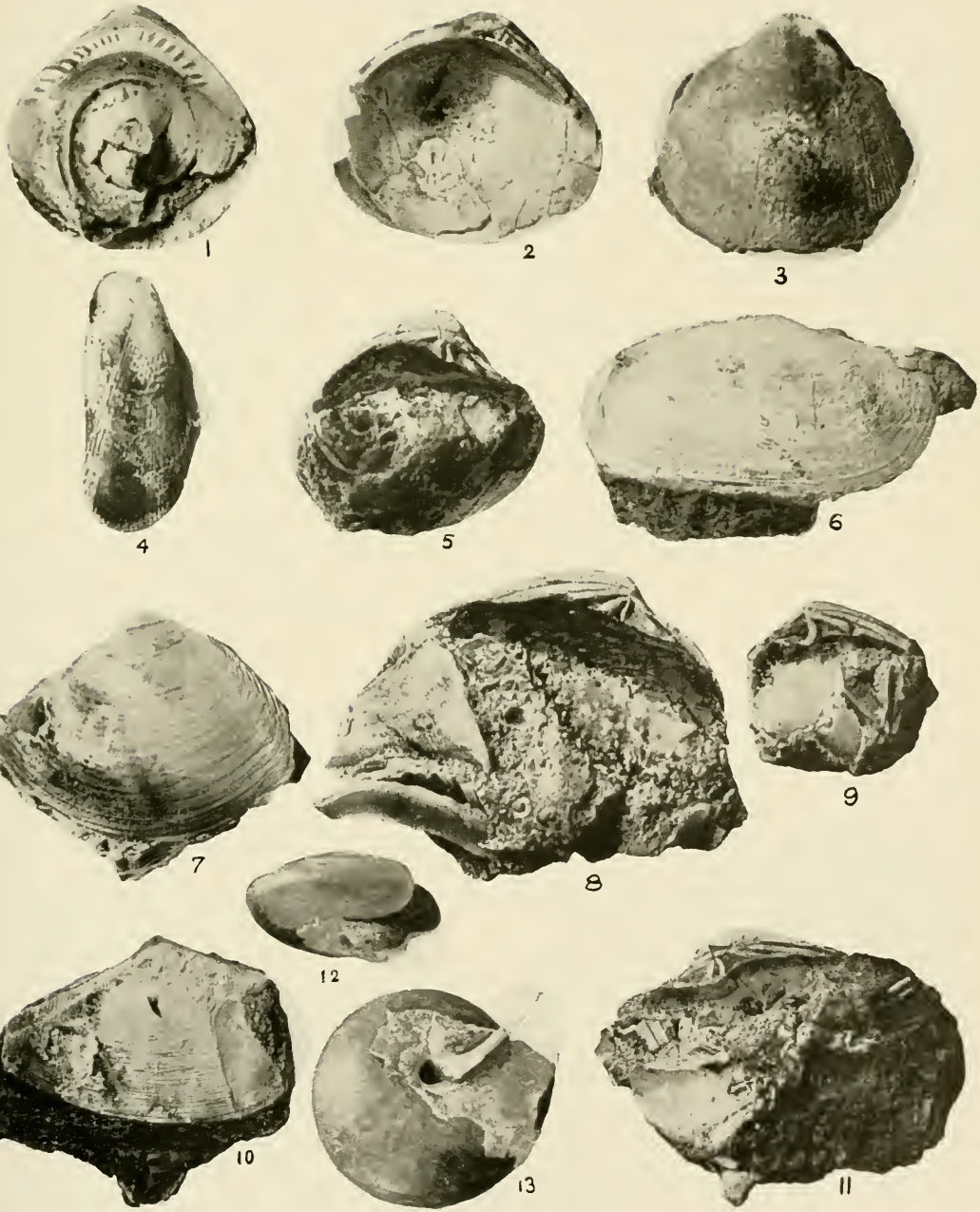
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PLATE 4.

Fig. 1. *Venericardia hornii* (Gabb); plesiotype No. 686 (C. A. S. Type Coll.) from Loc. 245, Type Tjon Group; reduced to .9; p. 174.

Fig. 2. *Crassatellites uvasanus* (Conrad); plesiotype No. 1705 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; reduced to .9; p. 172.

Fig. 3. *Crassatellites uvasanus* (Conrad); plesiotype No. 1706 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; reduced to .9; p. 172.

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PLATE 5.

Fig. 1. *Pitaria californiana* (Conrad); plesiotype No. 790 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; natural size; p. 159.

Fig. 2. *Pitaria californiana* (Conrad); plesiotype No. 789 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; natural size; p. 159.

Fig. 3. *Pitaria uvasana* (Conrad); plesiotype No. 792 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; natural size; p. 161.

Fig. 4. *Pitaria uvasana* (Conrad); plesiotype No. 791 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; natural size; p. 161.

Fig. 5. *Antigona hornii* (Gabb); plesiotype No. 1702 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; natural size; p. 158.

Fig. 6. *Dosinia elevata* Gabb; plesiotype No. 774 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; natural size; p. 163.

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PLATE 6.

Fig. 1. *Gyrineum uvasalis,* new species; paratype No. 872 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; natural size; p. 57.

Fig. 2. *Amauropsis alveata* (Conrad); plesiotype No. 873 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; natural size; p. 119.

Fig. 3. *Cardium cooperii* Gabb; plesiotype No. 876 (C. A. S. Type Coll.) from Loc. 826, Rose Canyon, San Diego County, California; natural size; p. 166.

Fig. 4. *Dendrophyllia tejonensis* Nomland; plesiotype No. 877 (C. A. S. Type Coll.) from Loc. 816, Type Tejon Group; natural size; p. 193.

Fig. 5. *Tellina tehachapi,* new species; type No. 878 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; natural size; p. 155.

Fig. 6. *Tellina tehachapi,* new species; paratype No. 879 (C. A. S. Type Coll.) from Loc. 792, Type Tejon Group; natural size; p. 155.

Fig. 7. *Aturia angustata* (Conrad); plesiotype No. 880 (C. A. S. Type Coll.) from Loc. 175, Knapton Washington; natural size; p. 49.

Fig. 8. *Aturia kerniana,* new species; type No. 881 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; natural size of immature specimen; p. 49.

Fig. 9. *Solen novacula,* new species; type No. 882 (C. A. S. Type Coll.) from Loc. 792, Type Tejon Group; natural size; p. 147.

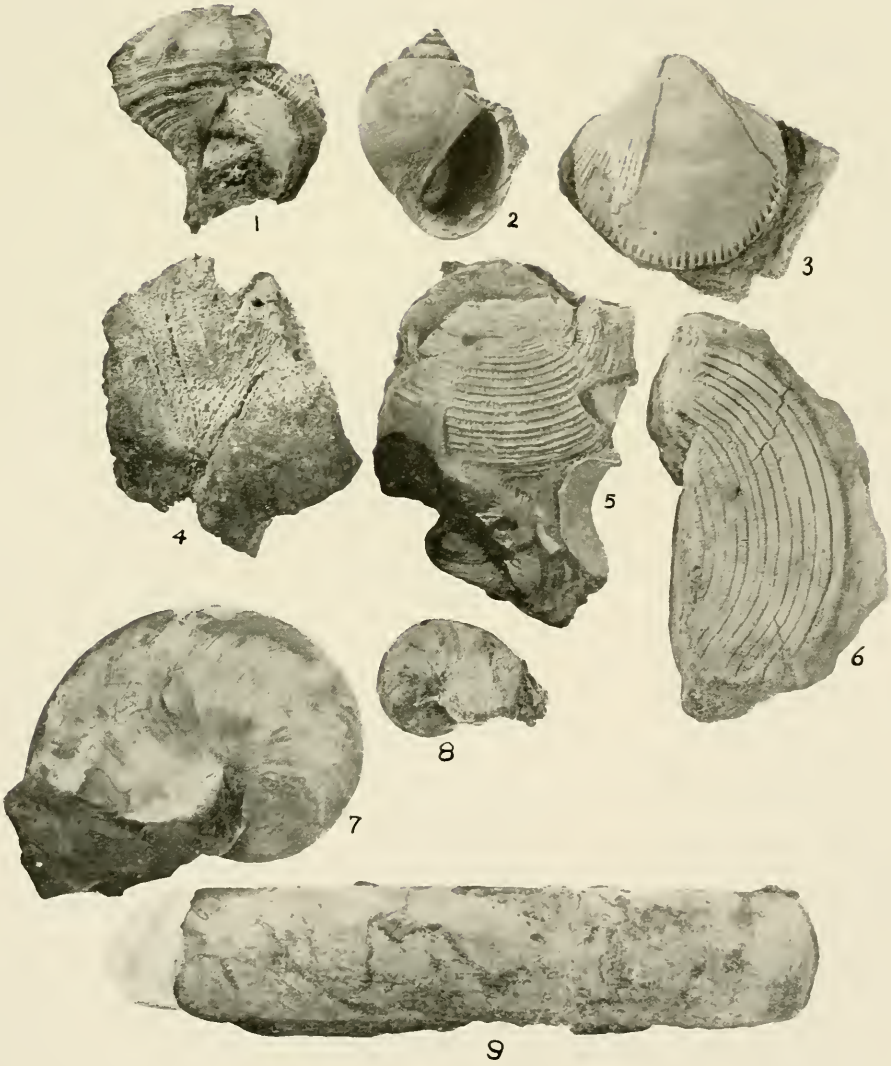
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PLATE 7.

Fig. 1. *Amauropsis alveata* (Conrad); plesiotype No. 875 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 119.

Fig. 2. *Marginella multifilosa*, new species; type No. 956 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 79.

Fig. 3. *Marginella multifilosa*, new species; paratype No. 957 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 79.

Fig. 4. *Cylichnella tantilla*, new species; paratype No. 960 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 140.

Fig. 5. *Cominella colemani*, new species; paratype No. 896 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 71.

Fig. 6. *Gemmula abacta*, new species; type No. 826 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 92.

Fig. 7. *Gemmula abacta*, new species; paratype No. 962 (C.A.S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 92.

Fig. 8. *Cylichnella tantilla*, new species; type No. 958 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 140.

Fig. 9. *Cylichnella tantilla*, new species; paratype No. 959 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 140.

Fig. 10. *Exilia novatrix*, new species; type No. 961 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.5; p. 60.

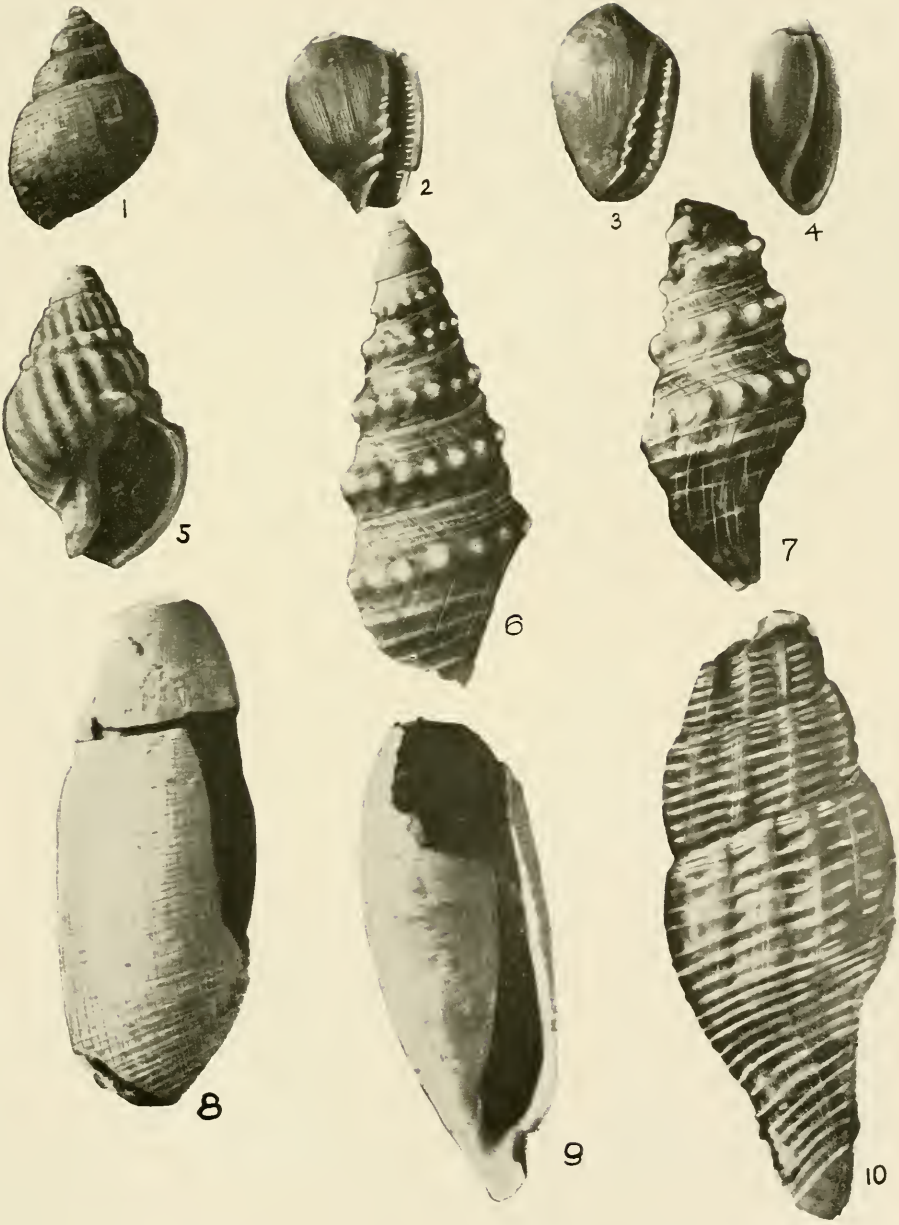
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PLATE 8.

Fig. 1. *Acteon quercus,* new species; type No. 319 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3. This specimen was figured by Dickerson (Calif. Acad. Sci. Proc. 4th ser. Vol. V, pl. 11, fig. 5) as *Actæon.* n. sp. and presumably was subsequently referred to his *A. moodyi* from north of Coalinga. See p. 141.

Fig. 2. *Architectonica hornii* Gabb; plesiotype No. 801 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 123.

Fig. 3. *Cancellaria paucivaricata* (Gabb); plesiotype No. 804 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 81.

Fig. 4. *Cancellaria paucivaricata* (Gabb); plesiotype No. 805 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 81.

Fig. 5. *Conus californianus* (Conrad); plesiotype No. 811 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 97.

Fig. 6. *Conus submonilifer,* new species; type No. 812 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 99.

Fig. 7. *Conus remondii* ? Gabb; plesiotype No. 813 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 100.

Fig. 8. *Exilia fausta,* new species; type No. 820 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 59.

Fig. 9. *Exilia fausta,* new species; paratype No. 821 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 59.

Fig. 10. *Gemmula encinalis,* new species; type No. 825 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 93.

Fig. 11. *Gemmula abacta,* new species; paratype No. 963 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 92.

Fig. 12. *Mitra murietta,* new species; type No. 834 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 76.

Fig. 13. *Mitra murietta,* new species; paratype No. 835 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.3; p. 76.

Fig. 14. *Molopophorus striata* Gabb; plesiotype No. 836 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 74.

Fig. 15. *Niso pistilliformis,* new species; type No. 841 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; page 128.

Fig. 16. *Phos blakianus,* new species; type No. 844 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 2.3; p. 73.

Fig. 17. *Pyramidella mucronis,* new species; type No. 850 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 134.

Fig. 18. *Terebra californica* Gabb; plesiotype No. 871 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 2.3; p. 82.

Fig. 19. *Olivella mathewsonii* Gabb; plesiotype No. 843 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.3; p. 80.

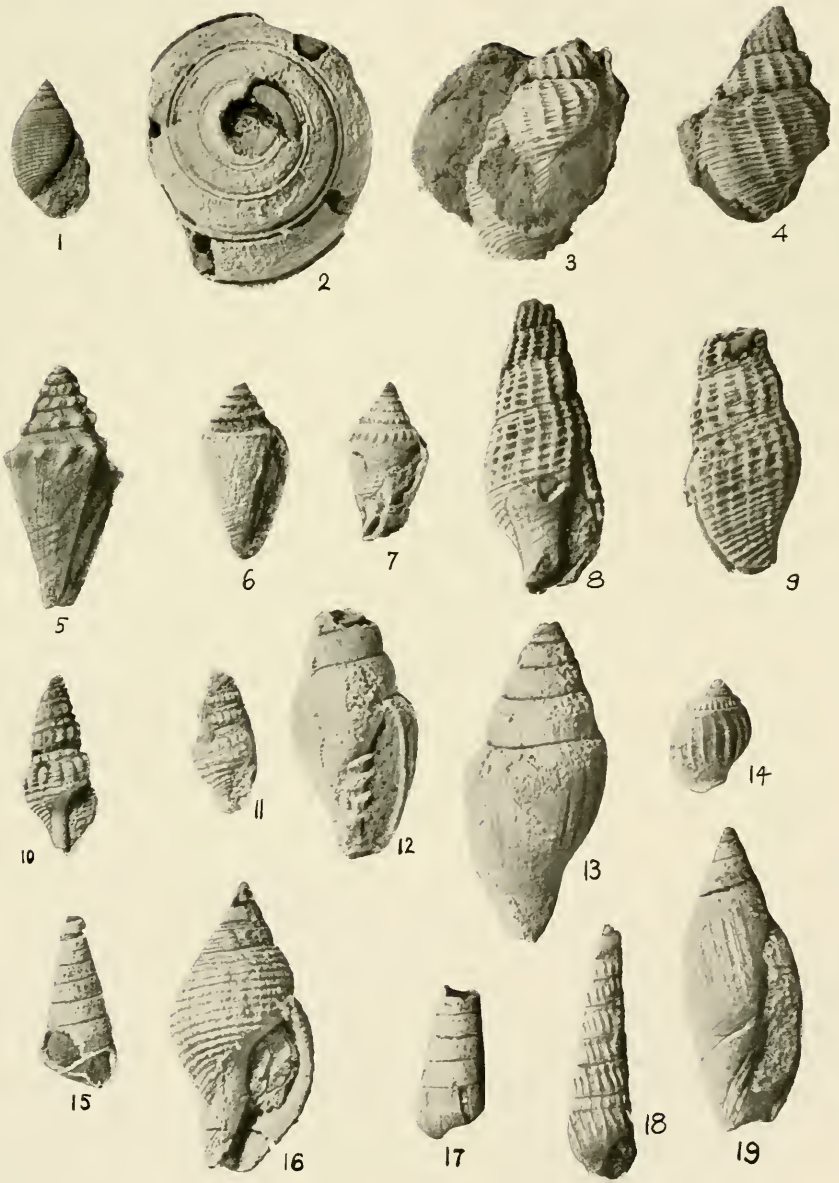
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Plate 9.

Fig. 1. *Architectonica hornii* Gabb; plesiotype No. 801 (C.A.S. Type Coll. from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 123.

Fig. 2. *Marginella adumbrata*, new species; type No. 968 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9.07; p. 78.

Fig. 3. *Natica uvasana* Gabb; plesiotype No. 884 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 116.

Fig. 4. *Natica uvasana* Gabb; plesiotype No. 885 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 116.

Fig. 5. *Trochocyathus* ? sp. plesiotype No. 886 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.74; p. 193.

Fig. 6. *Cowlitzia canalifera* (Gabb); plesiotype No. 889 (C. A. S. Type Coll.) from Loc. 341, Southern Pacific Railroad Coll., Type Tejon Group; enlarged to 1.74; p.

Fig. 7. *Phacoides* sp.; plesiotype No. 888 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 170.

Fig. 8. *Diplodonta* sp.; plesiotype No. 887 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 167.

Fig. 9. *Cowlitzia canalifera* (Gabb); plesiotype No. 891 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.74; p. 102.

Fig. 10. *Sinum coryliforme*, new species; type No. 851 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 120.

Fig. 11. *Kellia uvasana* (Dickerson); plesiotype No. 894 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 172.

Fig. 12. *Acila gabbiana* Dickerson; plesiotype No. 892 C. A. S. Type Coll.) from Loc. 792, Type Tejon Group; enlarged to 1.74; p. 176.

Fig. 13. *Cowlitzia canalifera* (Gabb); plesiotype No. 890 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.74; p. 102.

Fig. 14. *Cominella colemani*, new species; type No. 895 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.74; p. 71.

Fig. 15. *Exilia perkinsiana* (Cooper); cotype No. 18 (C. A. S. Type Coll.) from Marysville Buttes, Sutter County, California; this is one of Cooper's original specimens, described and figured in Bull. 4, Calif. State Mining Bureau, 1894, p. 40, pl. 2, figs. 23, 24; enlarged to 1.74; see p. 61.

Fig. 16. *Psammobia hornii* (Gabb); plesiotype No. 893 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.74; p. 151.

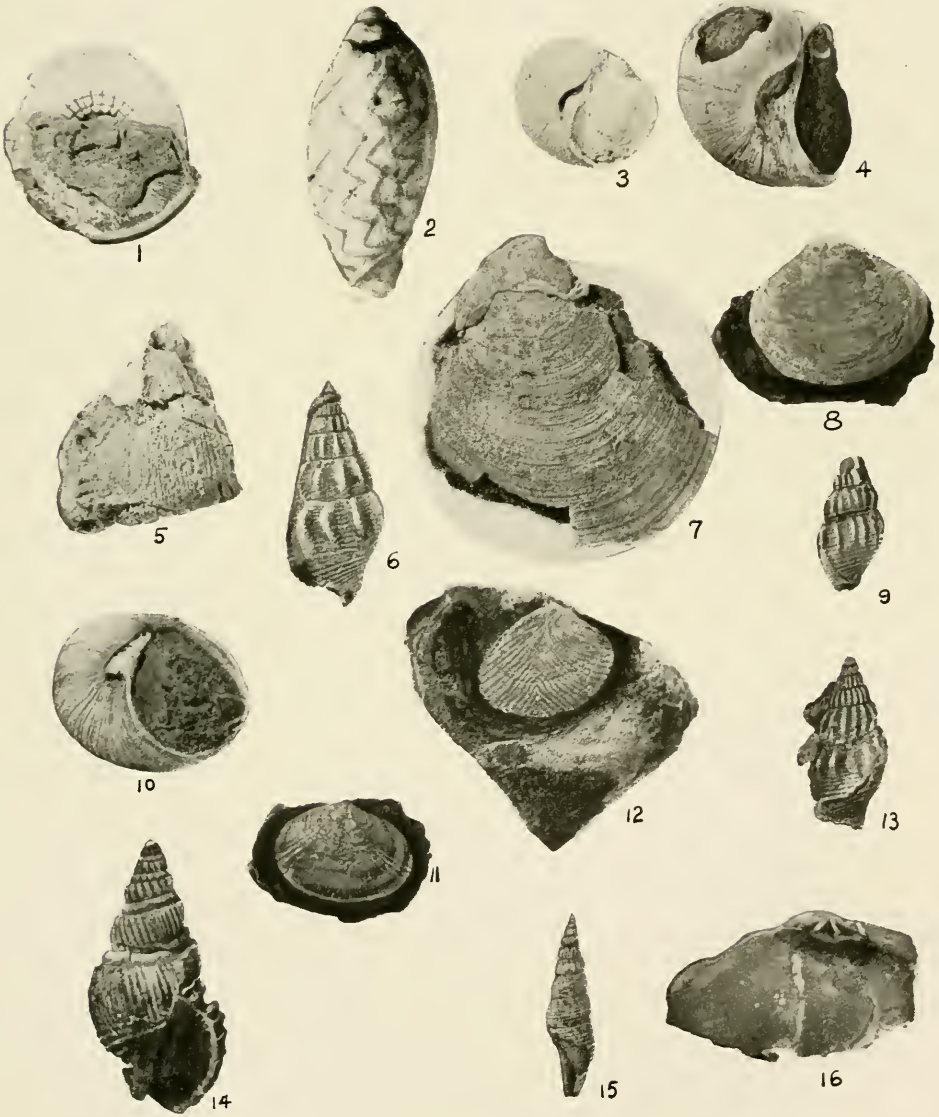
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Plate 10.

Fig. 1. *Siphonalia tularensis,* new species; type No. 854 (C. A. S. Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 67.

Fig. 2. *Galeodea petrosa* (Conrad); plesiotype No. 823 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 108.

Fig. 3. *Galeodea petrosa* (Conrad); plesiotype No. 824 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 108.

Fig. 4. *Gyrineum kewi* (Dickerson); plesiotype No. 827 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 56.

Fig. 5. *Gyrineum uvasalis,* new species; type No. 829 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 57.

Fig. 6. *Mitra uvasana* Dickerson; plesiotype No. 833 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.23; p. 78.

Fig. 7. *Natica hornii* (Gabb); plesiotype No. 838 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.23; p. 115.

Fig. 8. *Natica nuciformis* (Gabb); plesiotype No. 839 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.23; p. 116.

Fig. 9. *Natica secta* Gabb; plesiotype No. 840 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.23; p. 117.

Fig. 10. *Pseudoperissolax blakei* (Conrad); plesiotype No. 848 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.23; p. 69.

Fig. 11. *Surcula io* (Gabb); plesiotype in University of California Collection; cast of same No. 864 (C. A. S. Type Coll.) from Type Tejon Group; enlarged to 1.23; p. 88.

Fig. 12. *Surcula cohni* Dickerson; plesiotype No. 859 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 84.

Fig. 13. *Surcula cohni* Dickerson; plesiotype No. 861 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 84.

Fig. 14. *Surcula cohni* Dickerson; plesiotype No. 860 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.23; p. 84.

Fig. 15. *Sinum coryliforme,* new species; type No. 851 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.23; p. 120.

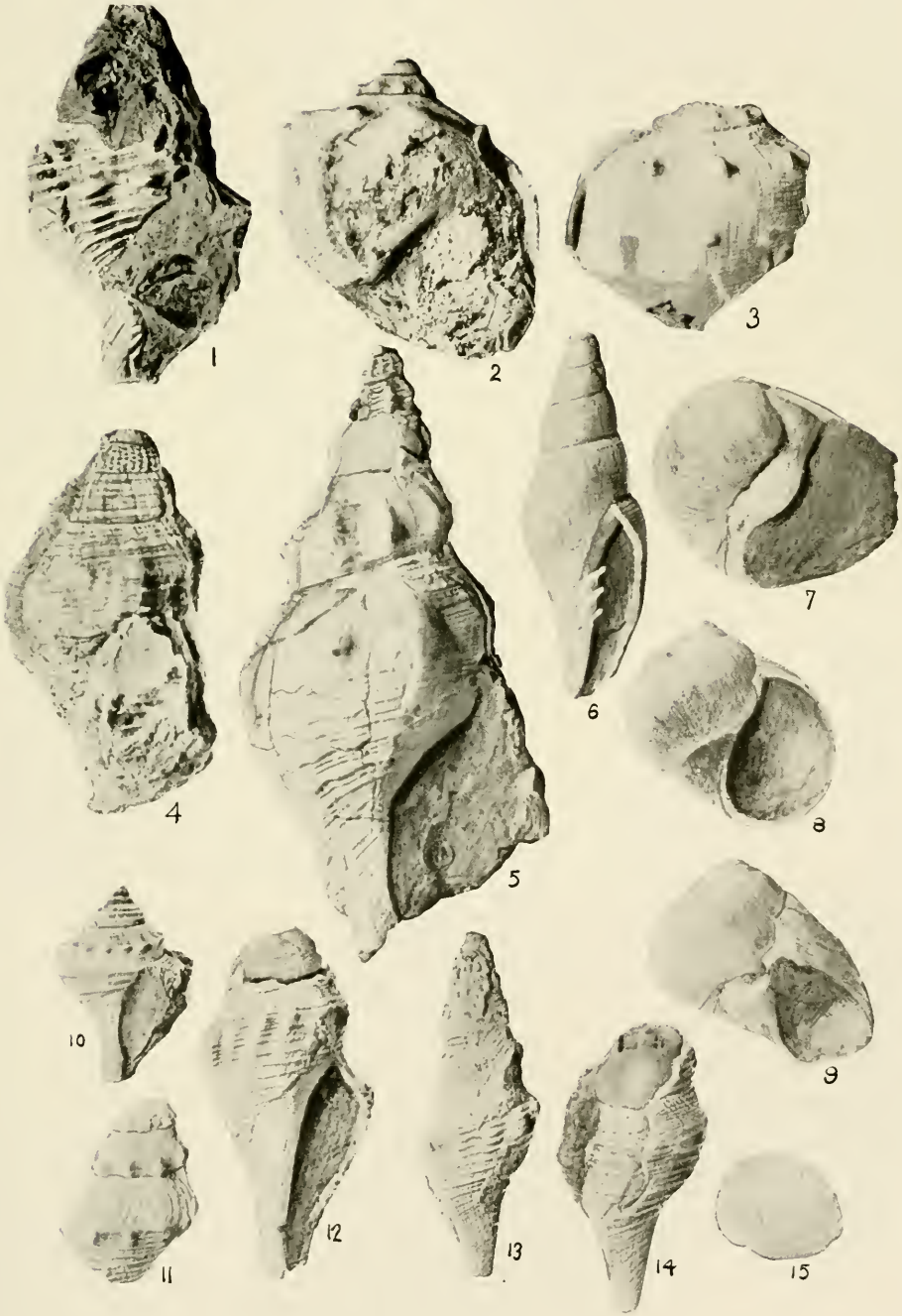
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PLATE 11.

Fig. 1. *Glycymeris verticordia,* new species; type No. 776 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 183.

Fig. 2. *Surcula coæqualis,* new species; type No. 866 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 85.

Fig. 3. *Surcula cohni* Dickerson; plesiotype No. 863 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 2.5; p. 84.

Fig. 4. *Surcula cohni* Dickerson; plesiotype No. 862 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 84.

Fig. 5. *Turritella uvasana* Conrad; plesiotype No. 870 (C. A. S. Type Coll.) from Loc. 825, Type Tejon Group; enlarged to 2.5; p. 126.

Fig. 6. *Turritella uvasana* Conrad; plesiotype No. 869 (C. A. S. Type Coll.) from Loc. 825, Type Tejon Group; enlarged to 2.5; p. 126.

Fig. 7. *Siphonalia tularensis,* new species; type No. 854 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 67.

Fig. 8. *Phos blakianus,* new species; paratype No. 845 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 73.

Fig. 9. *Phos blakianus,* new species; paratype No. 846 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 2.5; p. 73.

Fig. 10. *Turbonilla gesteri,* new species; type No. 955 (C. A. S. Type Coll.), from Loc. 341, Southern Pacific Railroad Company's Collection, Type Tejon Group; enlarged to 3.56; p. 129.

Fig. 11. *Cadulus gabbi* Sharp & Pilsbry; plesiotype No. 954 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 3.56; p. 146.

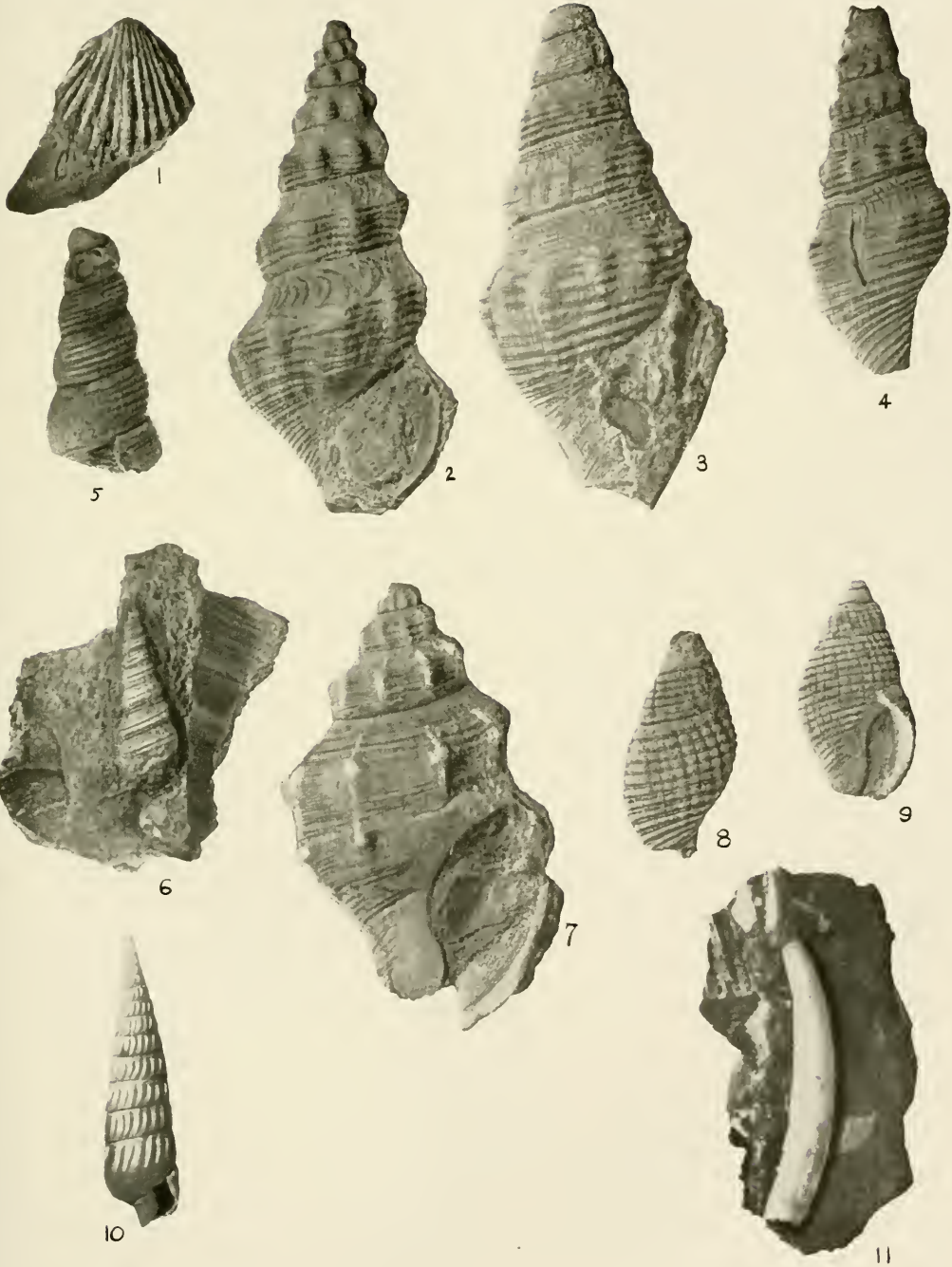
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Plate 12.

Fig. 1. *Pseudoliva inornata* Dickerson; plesiotype No. 849 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.4; p. 52.

Fig. 2. *Surcula alizensis,* new species; paratype No. 858 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.4; p. 89.

Fig. 3. *Surcula ioformis,* new species; paratype No. 865 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.4; p. 89.

Fig. 4. *Surcula alizensis,* new species; type No. 344 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.4; p. 89.

Fig. 5. *Surcula sinuata* Gabb; plesiotype No. 867 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.4; p. 90.

Fig. 6. *Pseudoperissolax blakei* (Conrad); plesiotype No. 847 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 1.4; p. 69.

Fig. 7. *Surcula ioformis,* new species; type No. 311 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.4; p. 89.

Fig. 8. *Ficopsis hornii* (Gabb); plesiotype No. 883 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.4; p. 111.

Fig. 9. *Turritella uvasana* Conrad; plesiotype No. 868 (C. A. S. Type Coll.) from Loc. 825, Type Tejon Group; enlarged to 1.4; p. 126.

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Plate 13.

Fig. 1. *Clavilithes californicus* (Conrad); plesiotype No. 802 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 63.

Fig. 2. *Clavilithes californicus* (Conrad); plesiotype No. 803 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.74; p. 63.

Fig. 3. *Bursa hornii* (Gabb); plesiotype No. 807 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 54.

Fig. 4. *Bursa hornii* (Gabb); plesiotype No. 808 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 54.

Fig. 5. *Conus ægilops,* new species; type No. 809 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.76; p. 97.

Fig. 6. *Conus ægilops,* new species; paratype in University of California Collection; cast of same No. 810 (C. A. S. Type Coll.) from Loc. 452 (U. C. Coll.), Type Tejon Group; enlarged to 1.76; p. 97.

Fig. 7. *Crepidula pileum* (Gabb); plesiotype No. 814 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 122.

Fig. 8. *Bursa hornii* (Gabb); plesiotype No. 806 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 54.

Fig. 9. *Cypræa kerniana,* new species; type No. 816 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.76; p. 104.

Fig. 10. *Cypræa kerniana,* new species; paratype No. 818 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.76; p. 104.

Fig. 11. *Cypræa kerniana,* new species; paratype No. 817 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.76; p. 104.

Fig. 12. *Gyrineum kewi* (Dickerson); plesiotype No. 828 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.76; p. 56.

Fig. 13. *Gyrineum uvasalis,* new species; paratype No. 830 (C. A. S. Type Coll.) from Loc. 245, Type Tejon Group; enlarged to 1.76; p. 57.

Fig. 14. *Latirus sinuatus* (Gabb); plesiotype No. 831 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 64.

Fig. 15. *Latirus sinuatus* (Gabb); plesiotype No. 832 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 64.

Fig. 16. *Murex beali,* new species; type No. 837 (C. A. S. Type Coll.) from Loc. 244, Type Tejon Group; enlarged to 1.76; p. 50.

Fig. 17. *Dentalium stentor,* new species; type No. 819 (C. A. S. Type Coll.) from Loc. 792, Type Tejon Group; enlarged to 1.76; p. 145.

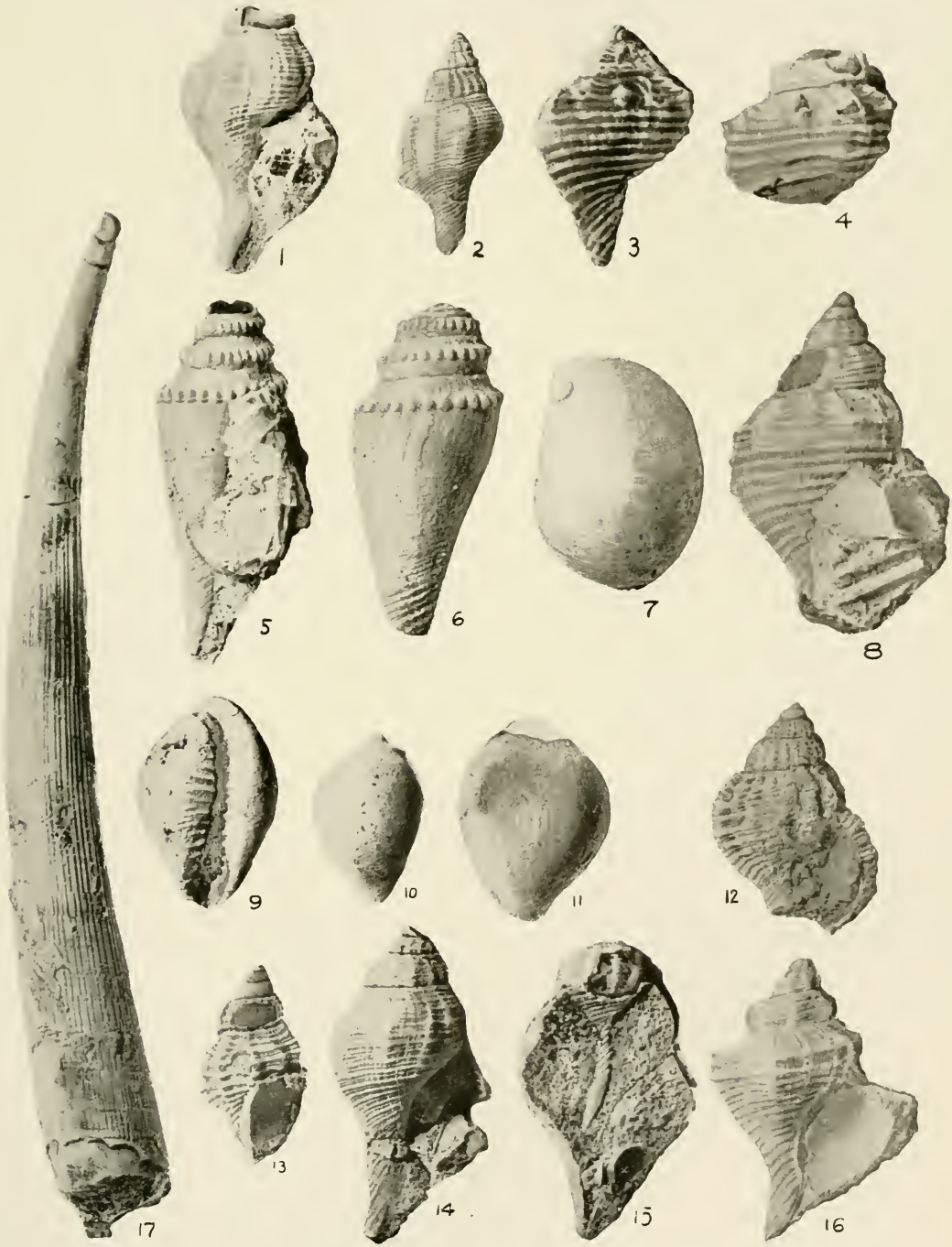
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Plate 14.

Fig. 1. *Melanella acuella,* new species; type No. 977 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 131.

Fig. 2. *Odostomia insignifica,* new species; type No. 978 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 132. The aperture is blocked; if there were internal teeth they were obscured by the matrix rock.

Fig. 3. *Pyramidella slevini,* new species; type No. 979 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 133.

Fig. 4. *Pyramidella slevini,* new species; paratype No. 980 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 133.

Fig. 5. *Alvania vinosula,* new species; type No. 981 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 131.

Fig. 6. *Alvania vinosula,* new species; paratype No. 982 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 131.

Fig. 7. *Mangilia fibrata,* new species; type No. 967 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 95.

Fig. 8. *Turbonilla kernensis,* new species; type No. 983 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 130.

Fig. 9. *Vitrinella uvasula,* new species; type No. 984 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 138.

Fig. 10. *Teinostoma profunda,* new species; type No. 973 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 20; p. 136.

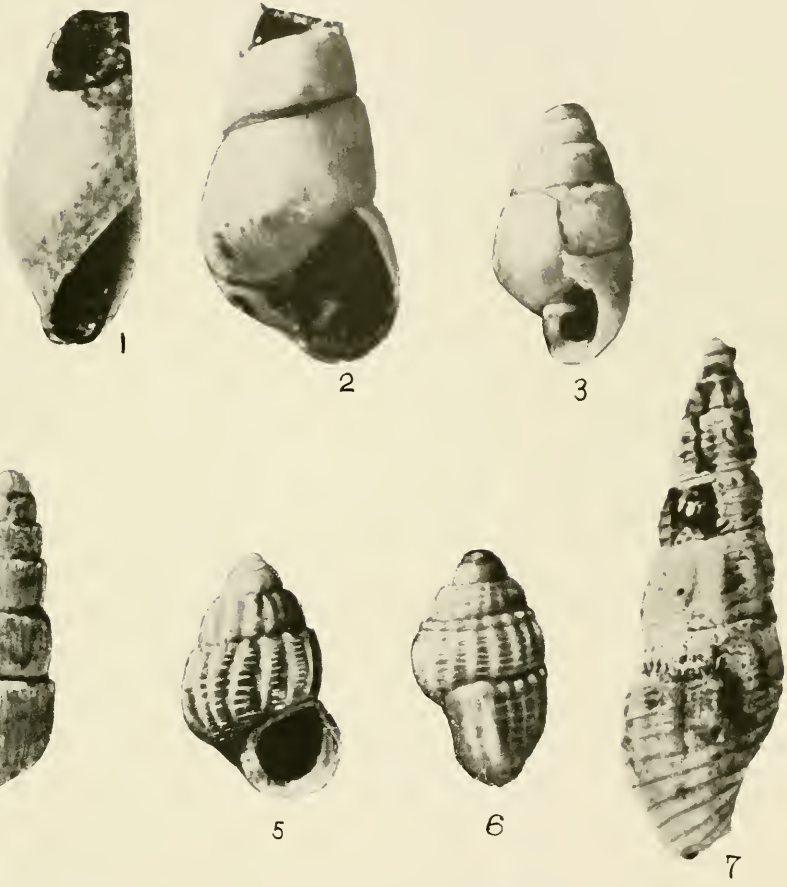
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Plate 15.

Fig. 1. *Glycymeris evermanni,* new species; type No. 964 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 184.

Fig. 2. *Glycymeris evermanni,* new species; paratype No. 965 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 184.

Fig. 3. *Glycymeris evermanni,* new species,; paratype No. 966 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 184.

Fig. 4. *Pyramidella fremonti,* new species; type No. 969 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 134.

Fig. 5. *Pyramidella fremonti,* new species; paratype No. 970 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 134.

Fig. 6. *Marginella adumbrata,* new species; type No. 968 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 78.

Fig. 7. *Mangilia fibrata,* new species; type No. 967 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 95.

Fig. 8. *Sinum coryliforme,* new species; paratype No. 971 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 120.

Fig. 9. *Teinostoma profunda,* new species; type No. 973 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 136.

Fig. 10. *Solariella enamellata,* new species; type No. 972 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 137.

Fig. 11. *Teinostoma profunda,* new species; paratype No. 974 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 136.

Fig. 12. *Teinostoma ? exoleta,* new species; type No. 975 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 136.

Fig. 13. *Teinostoma ? exoleta,* new species; paratype No. 976 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 136.

Fig. 14. *Solariella enamellata,* new species; type No. 972 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 137.

Fig. 15. *Teinostoma ? exoleta,* new species; type No. 975 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 136.

Fig. 16. *Teinostoma profunda,* new species; type No. 973 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 9; p. 136.

Fig. 17. *Amauropsis alveata* (Conrad); plesiotype No. 875 (C. A. S. Type Coll.) from Loc. 711, Type Tejon Group; enlarged to 3.56; p. 119.

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PLATE 16.

Sketch map of areal geology of Tejon region, based on Tejon and Mt. Pinos Quadrangles, U. S. Geological Survey topographic map; area west of Salt Creek adapted from Clark. (See p. 24.)

SAN JOAQUIN VALLEY
Los Alamos Valley
Cuyama Valley
Caliente Creek
Tejon Pass
Eagle Rock
Cuddy Valley
Tertiary Volcanics
Temblor Group Lower Miocene
San Lorenzo Group Oligocene
Tejon Group Upper Eocene
Meganos Group Middle Eocene

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* Valid Type Tejon species are in boldface type. See pp. 42-45 for checklist of species.

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Occasional Papers

OF THE

CALIFORNIA ACADEMY OF SCIENCES

XI

SAN FRANCISCO
PUBLISHED BY THE ACADEMY
MARCH 18, 1925

COMMITTEE ON PUBLICATION

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BARTON WARREN EVERMANN, *Editor*