DEPARTMENT OF AGRICULTURE, INSURANCE, STATISTICS, AND HISTORY.

GEOLOGICAL SURVEY OF TEXAS,

E. T. DUMBLE, State Geologist.

# BULLETIN No. 4.



# A PRELIMINARY ANNOTATED CHECK LIST

OF THE

# CRETACEOUS INVERTEBRATE FOSSILS

OF

# TEXAS,

ACCOMPANIED BY A SHORT DESCRIPTION OF THE LITHOLOGY AND STRATIGRAPHY OF THE SYSTEM.

BY

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# LETTER OF TRANSMITTAL.

Hon. L. L. Foster, Commissioner of Agriculture, Insurance, Statistics, and History, Austin Texas:

DEAR SIR—The accompanying Bulletin No. 4, "A Preliminary Annotated Check List of the Cretaceous Invertebrate Fossils of Texas," was prepared at my request by Mr. Robert T. Hill, in order that the different field parties engaged in actively prosecuting the work of the survey might have at hand a concise statement of our present knowledge of this system, not only as an aid to the proper understanding and interpretation of its various horizons as they come upon them in their work, but in order that work already done may be fully verified or corrected without unnecessary duplication, and each be prepared to add such new discoveries as may be made from time to time.

I may add that in this bulletin is exemplified the typical co-operation of State and National surveys, i. e., the working out and preparation by the National survey of such purely scientific matters as is contained herein, which, while it is absolutely necessary to the proper prosecution of the work of the State survey in the discovery and description of the economic materials contained within the system, yet lacks that direct interest to the people of the State that obtains in the economics themselves.

Our thanks are therefore due to the Director of the United States Geological Survey for the assistance thus afforded us, as well as to Mr. Hill for his valuable services in its preparation.

Yours, respectfully,

E. T. DUMBLE,
State Geologist.

# INTRODUCTION.

Mr. E. T. Dumble, State Geologist, Austin, Texas:

DEAR SIR—I herewith transmit the manuscript of a check list of the Invertebrate Fossils of the Cretaceous Series of Texas, which has been prepared by me without cost to the State. To ascertain and record the stratigraphic and faunal position of these fossils has long been an accompanying subject of the writer's investigations, but the fundamental questions of stratigraphy have precluded the publication of the paleontologic details, and the brief and still incomplete information contained in these pages would be even longer withheld were it not for the fact that the local studies of the formations can be advanced more rapidly with this information before the observer. The work is as condensed as is consistent with clearness. A brief statement is made of the present state of our knowledge of the Cretaceous formation of Texas. This is followed by a short description of the rocks of the standard section along the Colorado river, which transects these formations. The details of this section have been worked out with great care by Messrs. J. A. Taff and N. F. Drake under my direction, and will serve as a temporary standard by which to work out stratigraphic relations and prove invaluable in determining artesian well areas, in classifying the agricultural soils, building materials, and other economic features.

Following this is the Annotated Check List of known species and pseudo species, accompanied by catch references to name of author, place and year of publication, and stratigraphic occurrence of species, if known, together with notes. An attempt is made to show in tabulated form the range of these species, and to classify them into faunas. Finally the reference bibliography is added.

Nearly all the species herein mentioned were originally described without reference to their stratigraphic occurrences or faunal association, and this paper is an attempt to supply these omissions, as far as possible, and to make the paleontologic literature available to the student. The Check List, imperfect as it is, has been the result of many years observation and study. It was originally undertaken while the writer was a student in the laboratory of Cornell University in the year 1883, and has been amplified and remodeled from time to time as occasion afforded the opportunity. Although it contains, as far as it has been possible to ascertain, nearly all that is known at present upon the subjects treated, it is still incomplete in many details.

Acknowledgement should here be made to Mr. C. B Boyle, of the Divi-

sion of Invertebrate Paleontology of the United States Geological Survey, for his valuable aid in verifying references and preparing the list. Similar acknowledgement is also made to Mr. C. C. McCulloch, Jr., of your survey, for his valuable assistance in completing the manuscript and preparing it for the printer. His painstaking services and paleontologic ability have been invaluable.

A few pages of the check list have previously been published, at my own expense, as a bulletin of the School of Geology of the University of Texas, but as its completion was of immediate importance to the geological survey the pages already printed have been fully revised and included in the present work, and its publication from the University discontinued.

Very respectfully yours,

ROBERT T. HILL,

Assistant Geologist United States Geological Survey, in Co-operation with Texas State Geological Survey.

# PRELIMINARY NOTES UPON THE CRETACEOUS SYSTEM OF THE TEXAS REGION.

The two series comprising the Cretaceous System occupy the areas of the State known as the Black Prairie, the Grand Prairie, and the two Cross Timbers, and unstudied areas in the eastern and trans-Pecos regions of the State.

To these strata the State owes a large part of her agricultural and general prosperity, for they are the foundation and source of the rich black waxy and other calcareous soils of the Black and Grand Prairie regions. In addition to their agricultural features, these formations are the most productive source of building material, while along the parting between them, extending the entire length of the State and dependent upon their stratigraphy, is a remarkable area of natural and artesian springs, as seen at Fort Worth, Austin, San Marcos, and elsewhere.

It is not the purpose of this paper, however, to enter into the economic discussion of these formations, but to give in brief language, for the benefit of the professional geologist, a resume of the scattered results which have been published from time to time concerning the strata under discussion, in order to aid in the field examination and to enable the geologist to ascertain exactly what is to be known and what is to be found out concerning them.

In beginning it should be distinctly understood that, notwithstanding the many scattered publications upon these formations, very little exact detail has been published concerning them, and that we are now just ready to begin their systematic study, and to publish results that will be of value both to the practical development of the country and to knowledge.

## PRESENT STATE OF KNOWLEDGE OF THE TEXAS CRETACEOUS.

It is now known that the series of rocks which a few years ago were considered as the whole Cretaceous group of the United States east of the Rocky Mountains, or the section published by Meek and Hayden, rests in Texas unconformably upon another great series* of rocks of even greater thickness, to which I have given, out of deference to the town of Comanche where I first studied them, the name of the Comanche series; hence, we now have in the United States two great series, the Lower or Comanche and the Upper or Meek and Hayden series. Each of these is entirely distinct from the

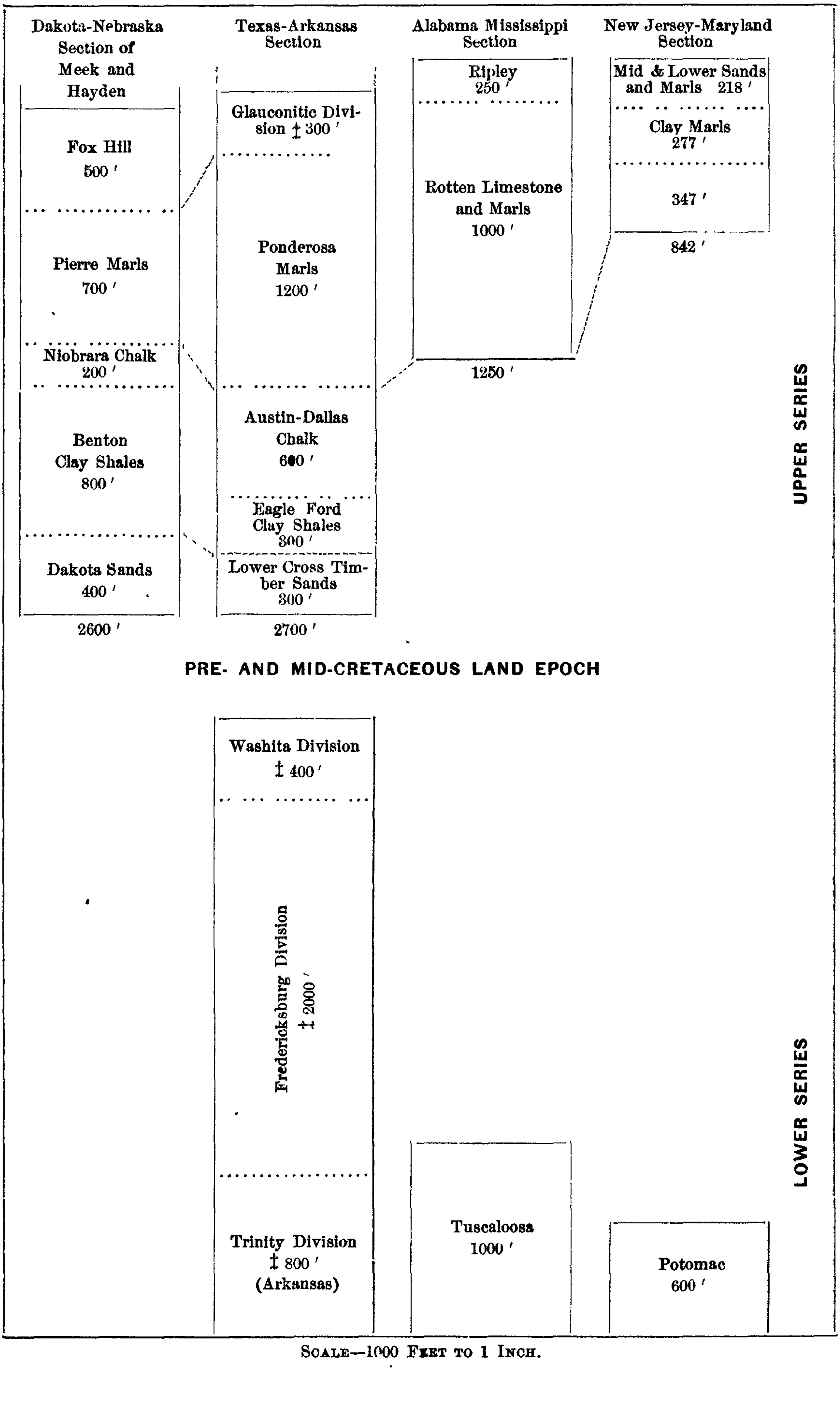
*The first announcement of this series was published by me in the American Journal of Science, January, 1887, p. 75. See Record of Science for 1886, Smithsonian Report, 1887-8, p. 220.

other, and each records a profound subsidence of the oceanic bottom and a subsequent elevation. Between them there was a land epoch, probably as long or longer than either of them.

This separate identity of the two series is shown by (1) the absolute stratigraphic break between them, as can be seen in numerous contacts in the city of Austin and elsewhere; (2) the radical change in character of sediments, as seen along the partings of the Lower Cross Timbers and the Comanche series; (3) the absolute change of life in the two formations, not a single species, as far as known, passing from the Lower series into the Upper, thus indicating a lapse of time between them sufficiently long for an almost complete change of specific characters in the ocean's inhabitants.

The supposed relations of these formations to similar areas in the United States is set forth in the accompanying table:

**Table showing Theoretical Relation of the Cretaceous System of Texas to other Cretaceous Rocks of the United States, east of the Sierras—1890.**




Scale—1000 Feet to 1 Inch.

## EXPLANATION OF THE NOMENCLATURE IN THIS PAPER.

In the present unstable condition of geologic nomenclature it is difficult to describe geologic facts in language that will convey the same meaning to all readers, and hence a few words are necessary concerning the terms used in this work. These are as follows: Group, System, Series, Division, Beds, and Horizon, as exemplified in the section on pages xiii and xiv. The term Group is used to indicate a series of formations produced in an interval coincident with a great geologic time, i. e., the rocks of Mesozoic time are called the Mesozoic group.

System is used to indicate the collection of rocks formed during a geologic period, e. g., the Cretaceous.

Series denotes the structural product of a single uninterrupted geological event corresponding to the writer's conception of a formation—a word which, owing to its ambiguity, however, is not here used. Each series of sedimentary rocks represents a more or less complete ternary succession of strata, i. e., the succession of deposits, first along shore, followed by deepening, and then by shallowing deposits to land again, as laid down by each subsidence and elevation of the ocean's bottom.

Division is used to express a broad subdivision of the conspicuous features of a series, usually founded upon some change in lithologic aspect, and not necessarily denoting minute differentiation or sharp line of demarkation. It may also be used to denote relative position in a series, as Upper, Middle, and Lower, without at all implying lack of continuity between them.

The term Beds denotes a well defined lithologic stratum or collection of strata within a series, possessing common characteristics, as the Exogyra Arietina clay. This term is equivalent to the word formation as employed by many geologists, and is only used tentatively until a more exact word is invented.

Horizon indicates the point of range of occurrence of a species (lithologic or paleontologic) within a stratum. Thus the horizon of *Terebratula Wacoensis*, Roemer, is at the top of the Washita limestone beds of the Washita division of the Comanche series of the Cretaceous system of the Mesozoic group.

It has not always been, but is fast becoming, a fundamental principle of geologic investigation that definition of strata should always precede their correlation, and hence local geographic names have been given to the strata described in this work wherever possible. Such nomenclature, however, during the reconnoissance stage of investigation may be imperfect, and subject to change.

The nomenclature used here for these subdivisions, though tentative and subject to change at any time, is considered the best that can be arranged at

present, and it is believed that into this classification can be placed all the rocks of the Cretaceous system as discovered.

There has been little attempt at revision of the genera or species of genera herein enumerated, all of which are in need of study, especially the Foraminifera, the Corals, and the Mollusca. Among the latter the Ammonitidæ, the Inocerami, the aberrant Chamidæ, and all of the Gasteropoda, are in special need of specific revision.

# A BRIEF DESCRIPTION OF THE STRATIGRAPHY AND ROCKS OF THE CRETACEOUS SERIES OF TEXAS.

*Based Principally upon a Preliminary Section along the Colorado River from near Smithwick Mills to Webberville.*

It is essential that there should be a definition of the stratigraphic arrangement and composition and structure of the rocks composing the two Cretaceous series of Texas, as far as this is known, and in the following pages an attempt is made to fulfill this need. It is believed that, with a few exceptions, the general sequence of the principal features have been solved, but concerning the subdivisions and local variations very little has been recorded. The following descriptions are based upon the writer's personal study and upon an accurately measured section of the Comanche series, made under his direction, by Mr. J. A. Taff, of the State Geological Survey, the whole of which will be published later. No attempt has as yet been made to accurately measure the Upper series.

**Progress Section Illustrating the Cretaceous System of Texas as Investigated to January 1, 1890.**

**II.**

THE UPPER OR BLACK PRAIRIE SERIES.

| DIVISIONS. | BEDS. | HORIZONS. | TYPICAL OCCURRENCE. |
|---|---|---|---|
| **Glauconitic Division.** | | | Mostly covered by tertiary overlap. Found in Anderson and Bowie counties, but best exposed north of Red River, in Arkansas. |
| **Exogyra Ponderosa Marls, or Blue Bluffs Division.** | Navarro - Webberville beds with arenaceous concretions. | Beginning of *E. costata.*<br>E. Ponderosa, sub-costate var.<br>Culmination of E. Ponderosa, Roem. | Main or eastern portion of the Black Waxy Prairie area of Texas, seen in Colorado section from Montopolis bridge to Webberville, especially at blue bluffs of Colorado.<br>Walnut Creek, Travis Co. |
| **Austin-Dallas Chalk, or "White rock."** | | Inoceramus. | In eastern portion of Austin, underlying all the chalky portion of city. Also at Waco, San Antonio, Dallas, McKinney, Sherman, and Rocky Comfort, Arkansas. |
| **Eagle Ford Clays (Shales).** | Upper calcareous clays.<br>Lower blue clays, with giant nodules. | O. Bellaplicata, Shum. | Minor Black Prairie or Mountain Creek Prairie, lying between white rock scarp and Lower Cross Timbers. |
| **Lower Cross Timber Sands.*** | | | Coincident with extent of Lower Cross Timbers south of Grayson Co. |

*Missing in Colorado section.

## I.

### THE LOWER OR COMANCHE SERIES (COLORADO SECTION).

| DIVISIONS. | BEDS. | | HORIZONS. | | TYPICAL OCCURRENCE. |
|---|---|---|---|---|---|
| **Upper or Washita Division.** | Shoal Creek limestone (at Austin).<br>(Impure.) | | In north Texas replaced by Denison O. Quadriplicata beds. | | Shoal Creek, Austin.<br>S. bank of Colorado, at fish ponds. |
| | Exogyra arietina clays. | | Final G. pitcheri, var. navia<br>E. arietina. | | Shoal Creek at Twenty-fourth Street.<br>Bluff near Barton Springs. |
| | Washita or Fort Worth limestone (chalky). | | Terebratula Wacoensis.<br>3d Gryphæa beds. G. Washitaensis, with O. Carinata, O. Sinuata, Macraster elegans. | | Fort Worth, Texas; railroad cut, W. Austin, Salado, etc. |
| | Upper Caprotina limestone. | | Final Caprotina horizon. | | S. base of Bonnel; McDonald's brickyard, Austin. |
| | Limestone Flags. | | | | |
| **Middle or Fredericksburg Division.** | Caprina chalky limestone with flints. (Persistent.) | | Rudistes, Monopleura, Caprotina, etc. | | Summit of Jollyville and Jehosephat Plateaus, and bluffs of Deep Eddy, Austin. |
| | Comanche Peak chalk beds. (Persistent.) | | Schloenbachia acute-carinatus, Comanche Peak Fauna, Ammonites pedernalis, Toxaster texanus.<br>G. pitcheri beds with E. texana. Culmination bed of E. texana. | | Comanche Peak, etc.<br>Summit of Mount Barker, and many other localities.<br>Bench of Mount Barker. |
| | Lower or alternately arenaceous, magnesian, calcareous division. | *Sub-Divisions.*<br>Upper beds of thin oolitic strata. | E. texana | Gadolina Beds. | Summit of Mount Bonnel above celestite beds. |
| | | Middle beds, with thick magnesian strata. | Celestite beds.<br>Nerinea Austinensis.<br>Tinoporus? chalk. | | Bases of Mounts Barker and Bonnel, north of fault.<br>Base of Bonnel ridge, near Bull Creek. |
| | | Basal arenaceous beds, with thin strata. | 1st Caprotina horizon. | | Travis Peak P. O. |
| **Lower or Trinity Division.** | Upper or Packsand Beds. (Locally variable.)<br>Basal or Contact Beds. (Locally variable.) | | | | Sycamore Creek, Burnet County; Travis Peak P. O., Travis County. |
| **Pre-Cretaceous.** | | | | | |

The two series of Cretaceous rocks in Texas are as distinct from each other in origin and occurrence as they are from the rocks of the overlying Tertiary and Quaternary systems, and hence it is necessary to describe them separately. They possess the following similarities, however: (1) Each is composed of sediments laid down upon a slowly subsiding and rising sea bottom, thus recording all the different ocean depths from littoral or shore condition to deep sea. (2) The general strike and dip of their rocks are in the same direction. (3) Each is characterized more or less throughout by an excess of lime—usually in the form of chalky calcium carbonate, pure, or mixed in every im-

aginable proportion with sand or clay. In every detail of these and other generic characters they are different.

The words limestone and chalk are used in these pages as follows: Limestone is employed generically for species of widely different origin and structure. Specifically they may be of five kinds. (1) Breccias composed of more or less comminuted and cemented shells of ancient ocean bottoms or shore. (2) Concretions or segregations formed by the segregation of the lime in clays and sands after original deposition—rare in our rocks. (3) Chalky rocks or those composed of amorphous calcium carbonate, usually more or less foraminiferal, void of lamination, and of comparatively deep sea (not abyssal) origin. These may be hardened by metamorphism into firm limestones; hence the term chalky limestone will imply chalky origin, and the term chalk present chalky condition. (4) Laminated impure limestones, occurring as alternating beds in sands and clays, indicative of shallower origin than chalk. (5) Metamorphosed limestones, or any of the above which have undergone induration or other secondary change.

All *laminated* limestones thus far found are more or less arenaceous or argillaceous, further proving their origin to have been in shallower waters than those in which chalk is laid down.

## THE LOWER OR COMANCHE SERIES

### (AS SEEN IN THE COLORADO SECTION.)

In general the Comanche series is predominantly calcareous, although, as will be shown later, there are a few exceptions. Its rocks from bottom to top record a complete Ternary succession of strata, to-wit: 1. A lower stage of sandstones, shales, and other sedimentary deposits, representing prevalence of land with downward movement. 2. A middle stage, chiefly of limestone, representing prevalence of sea. and general quiescence and elaboration of calcareous organic formations. 3. An upper stage, and more of mechanical sediments, indicative of proximity to land.

The whole Comanche series is thus divided into three grand divisions, to-wit: The Trinity or Basal (sandy beds); the Fredericksburg or Medial (chiefly chalky beds), and the Washita or Upper division (impurer chalks and clays, alternating in stratification, becoming slightly arenaceous in the Denison region. but not so at Austin, for reasons explained later).

#### A.—THE TRINITY DIVISON.

This division is essentially arenaceous in composition, clastic in structure, and of littoral mechanical origin, being composed at its base of conglomerates or sands, the origin of every pebble of which can be located in the adjacent and more ancient strata of the Paleozoic region in the edges of Travis and Burnet counties, where the Trinity sands are in contact with the Paleozoic

rocks, schists, limestones, sandstones, and pre-Trinity granites. Succeeding the basal conglomerates are coarse, angular, cross-bedded sand, becoming finer and finer until it reaches the fine condition known in Texas as "pack sands," i. e., a fine grained sand which is cemented by included chemically precipitated calcium carbonate. Fossils have been found by the writer at Sycamore Creek, Burnet County, in the contact conglomerates, but they are neither plentiful nor distinct until the upper or pack sand beds are reached, one mile below Travis Peak postoffice, where the arenaceous layers are full of casts and moulds consisting of indeterminate Trigonias, Pholadomyas, Cyrenas, and an undescribed Ammonite resembling *Hoplites dispar*. In this vicinity, also, appears the first of the several conspicuous Grypheate beds of the Comanche series. This is composed of a solidified mass of large Grypheate oyster shells resembling the dilate species figured by Marcou as *Gryphæa dilata*, but not yet positively determined. These were found to form a breccia seven or eight feet in thickness, just below the crossing of the Travis Peak and Nameless road. Accompanying the *Gryphæa* breccia there is also the first appearance of another conspicuous feature in the Comanche series, i. e., an excess of magnesian sulphate. The oyster shells are being rapidly cemented into massive limestone beds or decomposing into a powdered earthy substance accompanied by incrustations of Epsom salts (Epsomite). This magnesian feature, which becomes more conspicuous higher in the series, is a fine illustration of an instance of the conversion of a shell limestone into dolomite by an alteration subsequent to the formation of the original rock, as has been recorded by Irish geologists.*

In places throughout the sands are occasional patches of red and greenish white clays resembling very much the characteristic features of the red beds of the lower formations. The cause of these discolorations has not been studied. There are about 300 feet of these arenaceous Trinity beds in the Colorado section, at the top of which appears a fossiliferous horizon—the first or lowest appearance of Monopleura and Requienia (Caprotina)—which we assume to be the beginning of the second division of the Comanche series. Thus the Trinity beds in the Colorado section are seen to be composed of locally derived debris, which, as the waters deepened, became more and more comminuted and calcareous until the sand grains at the top are almost imperceptible to the eye, and the whole mass becomes quite chalky and magnesian in appearance. As shown elsewhere, these basal arenaceous beds everywhere vary with the shore line upon which they were laid down, and are entirely different in the Brazos and Arkansas sections. (See Hill 1 and 4.)

### B.—THE FREDERICKSBURG DIVISION.

The *Caprotina* horizon No. 1, which, according to our classification, lies at the

*See Prestwich's "Geology, Chemical, Physical, and Stratigraphical," Vol. 1, pp. 113, 114.

base of the Fredericksburg division, is apparently composed of equal parts of pack sand, calcareous matter, and magnesia in bands or strata of alternating degrees of consolidation, although showing a deeper and more uniform condition of sedimentation than the Trinity sands, yet, as shown by the alternating sediments, the deeper conditions of the Comanche Peak beds have not been reached. The alternation of harder and softer layers of arenaceous-calcareous strata now becomes prevalent, and the beds get thicker and more massive as the ocean's bottom descended. Such is the beginning of the Fredericksburg division, which may be divided into three lithologic subdivisions, to-wit:

(c) The Caprina Chalky Limestone Beds.

(b) The Comanche Peak Chalk Beds.

(a) The Basal or Alternating Beds.

THE BASAL BEDS.—The basal beds consist of white limestones of a coarse, crystalline, and chalky aspect, sometimes slightly brecciated, but seldom exceeding one or two feet in thickness and of great uniformity in extent of stratification. These beds are separated by softer unconsolidated, magnesian, arenaceous slightly argillaceous marls, resembling the yellow marls of France as I understand them to be.

This alternation of softer marls and harder limestones produces the beautiful bench and terrace topography of the western scarp of the Grand Prairie south of the Brazos and east of the coal measures. They seem to be missing, however, in the northwest. While more or less very finely arenaceous and calcareous at the base, the quantity of sand in the mixed strata gradually continues to decrease upward, and the chalky lime increases until the culmination of the chalky bed recorded in the next division. The yellow magnesian strata also increase in thickness and become very conspicuous in the middle portion of this lower subdivision after being from five to fifteen feet in thickness, as seen in the bluffs of Mount Bonnell north of the great fault. These magnesian limestones are soft enough to be cut with a knife, and are of an intense brownish yellow color. They alternate with similar strata of chalky limestones and yellow marls. The upper 100 feet of the basal subdivision of the Fredericksburg division, as seen at the top of Mount Bonnell, again present the unique stratification of the basal beds, the lime strata averaging about one foot in thickness.

The intervening yellow magnesian marls are soft and laminated, more or less siliceous, and composed of minute shells and concretions, which make it distinctly oolitic in character, and hence I propose for this stratigraphic horizon the name oolitic marls. These marls have very little clay, and pack when wet like fuller's earth. When properly understood they promise much, both from an economic and purely scientific standpoint.

They finally terminate in a persistent bed, which is especially distinguished by the abundance of the beautiful *Exogyra texana* Roemer (*O. flabellata*, type of Goldfuss), from which fact it is called the culminating horizon of *Exogyra texana*. From careful measurements of Mr. J. A. Taff, at Travis Peak, from the basal Caprotina horizon to the culminating horizon of *E. texana* inclusive, is a height of 406 feet. Throughout the series fossils are occasionally found, especially *E. texana*. *Nerinea*, *Requienia* (*Caprotina*), *Cyphosoma*, and casts or moulds of *Tylostoma prægrandis*, Roemer, *Arca*, *Trigonia*, and especially the peculiar globular foraminifera-like form, which has been called *Gadolina* by D'Orbigny. There are also horizons more or less chalky throughout, one of which is quite conspicuous in that it is composed of a small foraminifera, *Orbitolina* (*Tinoporus*) *texana*, Roem. The beds of magnesian limestone which mark the central third of this division are especially worthy of future study and observation from a petrographic and chemical standpoint. They are often accompanied by pockets of calcite, aragonite, celestite, and epsomite. This basal subdivision of the Fredericksburg division is not well known in the northwestern portion of the State, but apparently diminishes in importance in that direction, being only about 100 feet thick in Comanche county, but maintaining considerable thickness at Comanche Peak, Hood County, 100 miles eastward.

Comanche Peak Subdivision.—Immediately above the culminating *E. texana* beds the great series of deepening alternations terminates in a massive persistent chalky division, marking, no doubt, the beginning of the culmination of the subsidence of the sea bottom (as recorded in the succeeding Caprina chalk) which had been going on since the pre-Trinity land epoch. This subdivision is composed of white chalky limestone, which readily yields to disintegration, usually forming the sloping sides of buttes and mesas, and capped by the Caprina chalk, next to be described. It is especially characterized by its abundant fauna, consisting of the species given in the faunal lists at the end of this Check List. The especially characteristic species are *Toxaster texanus*, Roemer, and *Ammonites pedernalis*, Von Buch. At the base of the chalk there is usually another marked bed of Grypheate oysters (*G. pitcheri* with *E. texana*), as seen near the summit of Mount Barker, in the Bonnell ridge, and especially well shown in the town of Weatherford, extending on to Red River. This is the second, in ascending order, of the great Grypheate beds of the Comanche series, and is composed of countless numbers of individual shells of *Gryphæa*, and is of marvelous areal extent.

The chalky beds of the Comanche Peak subdivision are the most extensive and uniform of the Comanche series, and must ever stand as the basis for comparison, from which to estimate the relative value of the overlying and underlying horizons. It presents on weathering a sterile, rocky aspect,

and is covered by sparse, stunted, coriaceous vegetation. An interesting fact concerning this subdivision is that several hundred feet above it, its lithologic conditions are repeated and its faunal features reappear, but almost entirely modified as to species, only the *Neithea quadricostata*, Roemer, and *Gryphæa pitcheri* running into the Washita division, and these presenting broad varietal changes.

THE CAPRINA CHALK AND CHALKY LIMESTONE SUBDIVISION.—Without any serious stratigraphic break in the chalky limestones the abundant Comanche Peak fauna disappears, and there continue 300 feet, more or less, of chalks and chalky limestones of varying degrees of consistency, from a pulverulent condition to firm limestones, which seem to be a secondary condition of the chalk produced by superficial hardening. These hard layers form the table rock of the buttes and mesas of the extensive Grand Prairie region, and are exposed in the river bluffs between Austin and Mount Bonnell, on the Colorado, where the chalk has been more or less hardened into firm limestones by the local metamorphism accompanying faulting. The lime kilns and quarries immediately west of Austin are all located on this subdivision.

Accompanying these chalks and chalky limestones are well defined layers of exquisite flint nodules, occupying apparently persistent horizons in localities. These flint nodules are oval and kidney shaped, ranging in size from that of a walnut to about two feet in diameter. Exteriorly they are chalky white, resembling in general character the flint nodules of the English chalk cliffs. Interiorly they are of various shades of color, from light opalescent to black, sometimes showing a banded structure. These flint nodules are beautifully displayed *in situ* in the Deep Eddy canyon of the Colorado, above Austin, where they can be seen occupying three distinct belts in the white chalky limestones.

Where these chalky limestones form the mesas of extensive plateaus, such as the remnants of the Grand Prairie west and southwest of Austin, the flints are left in great quantities as a residuum (the softer chalks being more readily decomposed into soils and washed away), and they cover large areas of country. They have also been transported eastward in past geologic times by marine and river action, and are distributed over large areas along the margin of the Black Prairie region as a part of the Post-Cretaceous gravels of that region. In some of these flints remarkable decomposition is exhibited, the product being geode-like cavities lined with quartz crystals and pulverulent products. In one instance an apparently unaltered specimen picked up *in situ*, upon being broken open revealed a small cavity filled with a liquid inclusion.

The fact that these are the only flint horizons, so far at least as is known to the writer, in the whole of the immense Cretaceous deposits of the United

States, is very interesting, and especially since they occur about the middle of the Lower Cretaceous series instead of at the top of the Upper series, as in England. It was from them that the Indians made their flint implements, and the ease of their lithologic identity will be of value to the anthropologist in tracing the extent of the intercourse and depredations of former Indian tribes inhabiting this region.

Occasionally the flints, especially an opalescent variety in Comanche county, possess nuclei in the shape of fossils, usually the *Requienia* (*Caprotina*).

The decomposition of these flints and of the adjacent limestones has produced some peculiar and unique effects in the rocks and landscape of the region, the silica replacing the calcium carbonate and leaving as a remnant a peculiar porous, cavernous rock, usually of a deep red color from the hydration of the iron pyrites into limonite, composed of the siliceous pseudomorphs of fossil *Rudistes*, *Hippurites* (rare), and other shells, the interstitial spaces glittering with minute quartz crystals which line them. This red rock is coextensive with the areal outcrop of the Caprina limestone.

Immediately west of Austin, along the downthrow of the great Bonnell fault in the bluffs of the Colorado, another peculiar transformation takes place in the Caprina limestone. Occasional red decomposing spots occur in the massive white chalky limestones. Upon closer examination the apparently non-fossiliferous limestone is seen to be undergoing decomposition into a dry pulverulent inflorescence, and as a residuum there remains a dry red dust and exquisitely preserved calcite pseudomorphs of many rare fossils, such as recently described by Roemer and White, the occurrence of which I have located in this horizon.

As this inflorescence takes place in all the limestones along the Bonnell fault, from the basal subdivision of the Fredericksburg to the top of the Shoal Creek limestone, the writer feels inclined to attribute it to the emanation of sulphur and other gases up the numerous joint and fault planes which they inevitably accompany. The thorough investigation of these important and peculiar phenomena may prove of great economic value, as traces of the following important economic products have already been discovered by a few tests: Potash, Salt, Strontianite, Anhydrite, Epsom Salts, Gypsum, and Gold, but in quantities as yet unknown. These inflorescences are coincident with the fault lines adjacent to the ancient volcanic disturbance of Pilot Knob.

The Caprina limestone is also productive of many rare building stones and other structural material, while the immense flint deposits will no doubt be ultimately utilized. The Caprina limestone was given its name by Dr. B. F. Shumard from the abundance of the peculiar aberrant fossils of the genus *Rudistes* (which have been described as *Requienia*, *Caprina*, *Monopleura*, *Ichthyosarcolithes*, etc.,) occurring in it. These peculiar forms abound, and are

found occasionally in great masses. Accompanying these beds are also many new and undescribed species.

The chalky deposit of the Caprina limestone is no doubt the continuation and culmination of the great Lower Cretaceous subsidence, and will be of great service in future interpretation and final correlation. It is very uniform, and covers large areas of the Grand Prairie plateau in southwest Texas, especially in the region adjacent to the lower Pecos. It also caps the mesas of the remnantal areas in the Abilene country, and as far east as Comanche Peak in Hood County. The railroad from Brueggerhoff to McNeil along the Williamson-Travis County line crosses a typical portion of its strike.

At Austin a fault of about 750 feet downthrow has broken this limestone division into two different areas, and hitherto confused its measurement.

### C.—THE WASHITA DIVISION.

The Caprina chalky limestones which mark the culmination of subsidence in the Comanche series are succeeded by deposits of a lithologic and stratigraphic character which indicate that the ocean's bottom had reached the culmination of the long subsidence which it had been undergoing since the beginning of the Trinity beds, and had commenced the gradual elevation which finally terminated in the Mid-Cretaceous land. This shallowing is well illustrated in the rocks above the Caprina limestone, to which the name Washita Division has been given after the region where its rocks were first seen by early explorers near Fort Washita, I. T.

The Washita Division along the Colorado is composed of the following well marked subdivisions:

| | |
|---|---|
| The Shoal Creek Limestone | + 80 |
| The Exogyra Arietina Clays | 80 |
| The Washita or Fort Worth Limestone | + 150 |
| The Caprotina Beds | + 20 |
| The Flagstones | + 10 |
| Total thickness in feet (estimated) | + 340 |

Of these horizons only the Washita limestone and the *Exogyra arietina* clays are known to have any persistent extent, these being found as far north as the Arkansas-Choctaw line and southwest to the Pecos.

THE FLAGSTONES.—These can be seen at McDonald's brickyard, Johnson's quarry, Taylor's lime kiln, and other points immediately west of Austin. They consist of thin flagstones, of almost pure chalky limestone, varying from one to three inches in thickness, and are void of fossils.

The surfaces of the slabs, which are quarried for paving and building stone, are sometimes covered with the pentagonal markings usually attributed to mud cracks, and these are filled with soft yellow lime material. These

flags are only eight or ten feet in thickness, and their occurrence elsewhere than in the Colorado section has not yet been reported..

THE UPPER CAPROTINA LIMESTONE, OR AUSTIN MARBLE.—Immediately above the flagstones, along the line of the Bonnell fault, at nearly all the localities above mentioned, is a massive stratum of limestone often metamorphosed into marble, which is composed almost exclusively of the calcified shells of *Requienia* (*Caprotina*), *Nerinea*, etc., accompanied by occasional *Hippurites*. This horizon was confused by Dr. B. F. Shumard with the Caprotina horizon some 1000 feet below, which marks the beginning of the Fredericksburg division. Away from the metamorphism of the Bonnell fault and local igneous action, the bed has not the crystalline consistency of marble. This bed is interesting, inasmuch as it represents the final appearance of the more or less continuous *Requienia* fauna which outcrops at various places from the bottom to the top of the Fredericksburg division, and it is possible that this horizon may in reality represent the close of that division Between the Caprotina limestone and the flagstone horizon there are beds of yellow laminated calcareous marls of a few feet in thickness, with the latest known horizon of *E. texana* and a peculiar *Panopæa*.

THE WASHITA OR FORT WORTH LIMESTONE.—Resting immediately upon the upper Caprotina limestone (whether conformably or not has not been determined) commences the Washita limestone—one of the most important beds of the Comanche series. This consists of a comparatively massive, chalky, sparsely fossiliferous limestone. The base and top are compact and the middle more disintegrated. It consists of impure chalky limestones, shell breccia, and calcareous marls in alternating strata, having the same general aspect upon weathering as the Comanche Peak beds. Lithologically it seems to represent a similar depth of deposition. Accompanying this return of conditions is an excessive abundance of life of great generic resemblance to the Comanche Peak fauna, but, with the exception of *Gryphæa pitcheri* and *Neithea texana*, of entirely different species. In place of the small *Toxaster texanus* of the Comanche Peak, we have the large *Macraster elegans*, Shumard, Roemer; for the beautiful *E. texana* there is substituted the similar but larger *E. sinuata;* while the *Ammonites leonensis* has superseded *A. pedernalis*. Here, too, the *G. pitcheri* (type, var.) breccia, with *E. texana* has its duplicate in a breccia composed of *G. washitaensis* accompanied by *O. carinata*. In its upper beds, however, the Washita or Fort Worth limestone, especially in North Texas, begins to show shallower conditions. At Austin it terminates in a comparatively massive lime stratum with numerous individuals of the only *Brachiopod* species thus far discovered in the Lower Cretaceous series of Texas, to-wit, *Terebratula wacoensis*, Roem. The fossils in the Washita limestone show a tendency to persistent zones, as shown in the section, and

about the same species characterize each zone wherever the writer has observed them. These limstones are well exposed at Salado and Fort Worth, the latter city being situated directly upon them. They contain more clay in the latter vicinity, however.

THE EXOGYRA ARIETINA CLAYS.—In Shoal Creek, at Barton Springs, near Round Rock, and other places in the vicinity of Austin, the *Terebratula wacoensis* horizon of the Washita limestone is surmounted by about eighty feet of unctuous laminated clays of a greenish blue color previous to long exposure to the elements, and dirty yellow afterwards. The lower half of these clays is filled with the unique *E. Arietina* or ram's horn oyster, which occurs in no other known horizon in the world. There is no transition between these clays and the including limestone horizons, but the Washita fauna again appears somewhat modified in the upper portion. At Austin, in the contact of these clays with the Shoal Creek limestone, is found the last horizon of *Gryphæa pitcheri* Mort., which appears as the variety *navia*, but varying in shape and size, being characterized here chiefly by the thickness and size of its shell.

In the clays there are occasional segregations of the fossils into limestone, but these have no persistent extent or size.

There are also numerous crystals of selenite, which are a product of the reaction of the decomposing iron sulphides (pyrites) upon the numerous oyster shells.

These clay beds are worthy of closer study and definition than it has been possible to give them. Their purity, extent, and apparent freedom from littoral debris make them easily distinguishable. The Arietina clays produce a black waxy residual soil, the only truly black soil of the Comanche series, the others being chocolate black or other dull colors. The areal extent of these soils, however, is very limited.

THE SHOAL CREEK LIMESTONE.—In the western portion of the city of Austin, and for a few miles north and south, the uppermost strata of the Comanche series consist of beds of a peculiar limestone, which is especially well displayed in the rocky canyons of Shoal Creek, whence its name. This limestone is from forty to eighty feet thick, and of a dull yellow color, with many spots of red and pink.

It is stratified, and upon close examination it is seen to be made up of minute fragments of shell, which are rapidly losing their integrity by alteration either into a harder condition or by breaking down into a pulverulent powder, as in the case of the Caprina limestone before described. The red blotches have been attributed to several causes, to wit: (1) The decomposition of iron pyrites; (2) the oxidation by heating of adjacent igneous material; and (3) the decomposition of contained volcanic ash and cinder which were deposited

contemporaneously with it. So far no iron pyrites have been found in the rock to sustain the first of these theories, while the second is untenable from the fact that it occurs remote from faulting contacts. The third theory, on the other hand, is made plausible by the occurrence of minute specks, which in thin slices of the rock, as seen under the microscope, appear to be decomposing olivine or other igneous matter breaking down into serpentine and iron oxides. This point has not been finally determined, however.

In places the Shoal Creek limestone is decomposing and crumbling, while everywhere it is much jointed and faulted. The fossils contained therein are interesting, but have been as yet but little studied. The top surface of this limestone has been corroded and waterworn, and deposited unconformably upon it can be seen the radically different sub-littoral unconsolidated clays of the basal Upper series.

### THE DENISON BEDS.

This abrupt conclusion of the Lower Cretaceous, together with the Shoal Creek limestone at Austin, is local, and, as will be shown later, due to the peculiar igneous disturbances that prevailed in this vicinity. To the northward, where these disturbing conditions were not present, the final termination of the Comanche series is quite different, as seen at Denison, for instance, where the Washita limestone, as seen two and one-half miles north of the city, is succeeded by shallowing alternations of clays and impure limestones containing an abundant littoral fauna. The details of these beds have not been as yet accurately determined, but further field work will soon be undertaken in that region.

Dr. G. G. Shumard partially described these beds, as follows:

*Marly Clay or Red River Group.*[1]—Of these he says: "This member immediately underlies the fish bed of the arenaceous group (Lower Cross Timbers), and is described by Dr. G. G. Shumard as 'a blue marly clay, occasionally variegated with red and brown, and with thin bands of sandstone interstratified. The clay contains crystals of selenite, flattened nodules of compact brown and blue limestone, and septariæ of compact blue limestone, reticulated with brown, yellow, and purple spar. The nodules occur in the upper part and the septariæ towards the base of the formation. The best exposures of the group are in Grayson, on Post Oak, Choctaw, and Big Mineral creeks, where sections of from fifty to sixty feet have been measured. It occurs also on Red River, in Fannin and Lamar counties. The estimated thickness of the group in this part of the State is about one hundred and fifty feet; but we have not seen the base of the formation.'

[1]B. F. Shumard: "Observations upon the Cretaceous Strata of Texas." Trans., Acad. Science of St. Louis, Vol. I. 1856–60.

"Fossils are extremely abundant in the septariæ and nodules, and as far as I have been able to learn they belong to hitherto undescribed species. From the collections of Dr. G. G. Shumard I have been able to characterize the following: *Ammonites swallowi*, *A. inequiplicatus*, *A. meekianus*, *A. graysonensis*, *Ancyloceras annulatus*, *Scaphites vermiculus*, *Baculites gracilis*, *Cytherea lamarensis*, *Tapes hilgardi*, *Gervilia gregaria*, *Nucula haydeni*, *Panopæa subparallela*, *Corbula graysonensis*, *O. tuomeyi*, *Inoceramus capulus*, and *Inoceramus* sp. nov. Fossil wood is also common at several of the localities visited."

Dr. B. F. Shumard, however, almost inextricably mixed his brother's results in his generalized section of Texas rocks, and I am inclined to believe that some of these species belong to the Eagle Ford clays, and are so placed in the Check List.

### THE STRATIGRAPHY OF THE COMANCHE SERIES IN GENERAL.

From the foregoing facts it is evident that the Comanche series possesses a well defined lithologic and stratigraphic history. Its lower division is essentially sandy, but becomes less and less so and more calcareous as the bottom upon which they were laid down subsided.

The alternating beds of the Basal subdivision of the Fredericksburg clearly show a deeper sea condition of origin than the Trinity, but not as deep as the chalk of the Comanche Peak and Caprina limestone subdivisions. After the latter there is a hiatus in our knowledge, but the Washita division reveals an elevation of the ocean's bottom as slow and positive as is the subsidence recorded in the other basal divisions. In brief, there is recorded[1] (1) a long continued subsidence, during which nearly one thousand feet of deepening sediments were laid down; (2) a long continued deep sea condition in which four or five hundred feet or more of chalks were deposited; (3) an elevation in which from three hundred to five hundred feet of shallowing sediments were deposited (the Washita division).

The lithology of the Comanche series is predominantly calcareous and is marked by several essentially chalky horizons.

There are also magnesian and arenaceous beds, but these are modified in color and appearance by the predominance of the accessory chalky matter. In color the tint is chalk white, yellow, cream-colored, and occasionally the white rock weathers into a dark grey, and not even in a single case are these rocks concretionary as recently recorded,[2] unless it is in a few feet of the Denison beds above mentioned.

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[1] A recent writer has alleged concerning these rocks: "I have no doubt that the 4000 feet of limestone which I found in the San Carlos Mountains of Chihuahua were accumulated on a subsiding sea bottom. Deep sea forms seem to be either wanting or very rare. I did not detect any forms from top to bottom of the series that might not have lived in comparatively shallow waters." Am. Jour. Science, Jan., 1890, p. 70.)

[2] Am. Jour. Science, Dec., 1889, p. 443.

Portions of the section are stratified into bands of one foot or more, but a large majority of the strata are massive, while the whole series, except a few alternating marls and layers of the Trinity, are remarkably free from lamination.

## THE UPPER OR BLACK PRAIRIE SERIES.

The writer believes the day will come when it will not be considered essential to discuss together the Comanche series and the Upper Cretaceous series, so different are they in every geologic aspect.

There can be but little doubt that the rocks now composing the Comanche series were elevated into dry land, that the succeeding land epoch continued as long as the time of deposition of either of the including series, and that the rocks of the Upper series were largely derived from the underlying Comanche strata, and laid down during an entirely different and later oceanic subsidence.

The Upper series has been well studied in the Northwestern States, by the late Prof. F. B. Meek, the geologist who has contributed the most that is known concerning the Cretaceous formations of that country. His descriptions are found in a volume entitled "A Report of the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country." By F. B. Meek, Washington, 1876. The Upper Cretaceous series of Texas, while varying in many specific details from the section therein described, is so generically allied that it is evident those variations are merely local differences in the same great subsidence, and that nothing but long and arduous labor, to be yet performed, will reveal their exact affinities.

The Upper Cretaceous series of Texas is divided into five conspicuous lithologic divisions, each unmistakable in its stratigraphic and topographic individuality, yet gradating into its adjacent divisions. Not one of these divisions has been minutely or systematically studied, further than here presented, although work in this direction is now in progress.

### THE LOWER CROSS TIMBER SANDS.

North of the Brazos to Red River the base of the Upper series is composed of a brown, more or less ferruginous, predominately sandy littoral deposit, resting unconformably upon various horizons of the semi-chalky beds of the Washita division. These sandy deposits present an infinite variety of conditions of cross-bedding, clay intercalations, lignitic patches, and variation in fineness of size and angularity of the uncemented particles, characteristic of typical littoral deposits, while occasionally there are found fossiliferous horizons. One of these on Timber Creek, near Lewisville in Denton County, occurred in association with lignite and cross-bedded sands, and was composed

of undetermined Cerithiidae, *Neritina*, *Ostrea*, *Aguillaria cumminsi* (White), and other littoral species. From a well at Whitesboro, which was dug in the sharp sands of this division, I procured fish teeth (*Otodus*), an Ammonite (*Scaphites*), and indeterminate mollusks.

In the vicinity of Red River these sands are covered by a Post-Tertiary sand, which confuses their identity there. South of the Brazos and at Austin these beds are entirely missing, a fact which is explicable in connection with certain volcanic events which took place just after they were laid down, exposing them to denudation before the next division was deposited.

No systematic study of these beds, as a whole, has yet been made, and the thickness is estimated from casual observations by the writer. There is no more inviting field in Texas for study than these beds. Dr. B. F. Shumard discovered dicotyledonous leaves in this formation, and reported the same in the proceedings of the St. Louis Academy of Science, vol. 2, p. 140. He also correlated these sands with the Dakota group, or No. 1 of Meek and Hayden's section. They are probably the same as the Arenaceous group of Shumard's Texas section.

### THE EAGLE FORD SHALES.

Beneath the scarp of the white rock (Austin chalk) at Dallas, and extending westward through the "Mountain Creek country" to the Lower Cross Timbers, can be seen the clays of this division of the Upper series, the thickness of which I place at 400 feet as a low estimate. These clays in their medial portion are dark blue and shaly, highly laminated, and occasionally accompanied by gigantic "cannon ball" nodular septariæ. Their lower contact with the Cross Timber sands has not been seen by the writer, nor recorded to his knowledge. The uppermost beds gradually become more calcareous, gradating rather sharply into the chalk. At Austin these beds occur in the same relative position, but are of varying thickness, and at one place—where Tenth Street crosses Shoal Creek—they are missing, the chalk resting on the Shoal Creek limestone. The northwestern part of the city is underlaid by these clays, which are here more calcareous, and accompanied by thin bands of laminated limestone. South of the river, along the International Railroad, they are finely displayed in Bouldin's Creek, with the characteristic blue color on fresh exposure.

They also appear at San Antonio near the cement works there, and probably occur at many intermediate points. North of Waco they increase in extent and thickness, forming extensive black waxy areas in Hill, Johnson, and Dallas counties, west of the white rock scarp. I have proposed for these areas the name Minor Black Waxy Areas, to distinguish them from the main Black Prairie Area underlaid by the Ponderosa marls.

### THE AUSTIN-DALLAS CHALK, OR WHITE ROCK.

Immediately succeeding the Eagle Ford clays comes the Austin-Dallas chalk, which is the most persistent, and at the same time the most representative division of the whole Cretaceous system. The general character of this division has recently been described to the writer as follows:

"The rock of this formation is a massive, nearly pure, white chalk, usually free from grit, and easily carved with a pocket knife. Under the microscope it exhibits a few calcite crystals, and particles of amorphous calcite, and innumerable foraminiferæ. The air-dried indurated surfaces are white, but the subterranean mass has a bluish white color. The rock weathers in large conchoidal flakes, with an earthy fracture.

"In composition it varies from 85 to 94 per cent of calcium carbonate, the residue consisting of magnesia, silica, and a small percentage of ferric oxide, as can be seen from the following analyses of unselected specimens by the chemist of the Survey.

| | Texas. | Rocky Comfort. |
|---|---|---|
| Calcium carbonate | 82.512 | 88.48 |
| Silica and insoluble silicates | 11.451 | 9.77 |
| Ferric oxide alumina | 3.648 | 1.25 |
| Magnesia | 1.189 | trace. |

"The thickness of this chalk at Rocky Comfort is over 500 feet, 100 feet of which can be seen at the surface, the remaining 400 feet having been penetrated by bored wells. So far as observed in Texas it averages the same thickness at Austin, Sherman, and Dallas. It is of great uniformity throughout its massive thickness and extent, but it shows a few local differences in hardness, which are sometimes due to surface induration.

"It so closely resembles some of the beds of the underlying Comanche and of the overlying Upper Cretaceous that until recently they have not been differentiated. Upon close examination, however, it is noticeable that the Lower Cretaceous beds, as seen where Little River crosses the Choctaw boundary, are distinctly stratified and very much harder and generally more or less crystallized from pressure, solution, and redeposition of the carbonate of lime in the chalk. The topography of the Rocky Comfort beds is also of a milder type than that of the Comanche series, and is recognizable even at a distance. Above all, it is distinguished by its softness and by its entirely different fossil remains. The Rocky Comfort beds are also distingushed from the other chalky beds of the Upper Cretaceous by their greater firmness, different fossils, and by their higher percentage of calcium carbonate. With the exception of the White Cliff chalk, the other beds of the Upper Cretaceous seldom contain more than fifty per cent of calcium carbonate, the average being

twenty to forty per cent. The Rocky Comfort beds are also the only ones of considerable extent which have these peculiarities, those at White Cliff being the only others known to bear even a partial resemblance to them. The western border of this chalk commences a few miles west of the southwest corner of the State of Arkansas, in Indian Territory, crossing Red River (the exposures continuing up the south side of the valley of that stream to the north of Sherman, where it deflects southward), passing near Whitesboro, Sherman, McKinney, Dallas, Hillsboro, Waco, Belton, Austin, San Antonio, and Spofford's Junction, Texas, beyond which it bends northward, appearing in the disturbed mountains in the vicinity of El Paso and the New Mexican realm, and again in No Man's Land, Kansas, Nebraska, and Colorado, where it is closely related and probably identical with the Niobrara chalk of Meek and Hayden.

"A great portion of the former extent of this chalk has been destroyed by erosion, and its western border in Central Texas is now receding eastward under the influence of excessive atmospheric decomposition and denudation. From Austin to San Antonio it is more stable, but west of the latter place erosion again becomes great. That the whole group once continued far to the west, and perhaps entirely across the State, is not at all improbable.

"The characteristic topographic and physical features of this formation as seen at Rocky Comfort, such as the gently undulating topography, the white crumbling exposures, the intense blackness of the soil, are so nearly identical with those of the same formation in Texas that they are indistinguishable."[1]

In the vicinity of Austin the soft and chalky structure is somewhat destroyed by the volcanic disturbances of the vicinity, such as the co-deposition of volcanic ash, and excessive jointing and faulting, but it maintains its pure chalky aspect elsewhere.

### THE EXOGYRA PONDEROSA MARLS.

The Austin-Dallas chalk is succeeded by a remarkable deposit of clays, aggregating some twelve hundred feet in thickness, according to reported well borings and estimates of the normal dip. These clays occupy the whole of the main Black Prairie region east of the Austin-Dallas chalk, and form the basis of the rich black waxy soil. Notwithstanding their areal extent, good outcrops of the unaltered structure are seldom seen, owing to the quick decomposition into soil. However, at the Blue Bluffs of the Colorado, six miles east of Austin, a superb exposure is afforded, where these clays can be readily studied and diagnosed.

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[1] "The Neozoic Geology of Southwest Arkansas." Vol. 2 of the Annual Report of the State Geologist of Arkansas. Little Rock, 1888, pp. 90–95.

They are of a fine consistency, unconsolidated, and apparently unlaminated until exposed to weathering, when their laminated character is developed.

They are light blue before atmospheric exposure, but rapidly change into a dull yellow, owing to the oxidation of the contained pyrites of iron. Their chief accessory constituent is lime in a chalky condition, and they are more calcareous at their base than at the top. Near the top of these and other exposures there is to be seen a rapid transition into the black calcareous clay soil, characteristic of chalk and chalky clays, whenever their excess of lime comes in contact with vegetation.

The details of these clays have not been yet ascertained, and from the nature of the problem it is not evident that they can be discovered speedily, but the following facts are apparent: (1) That they are more calcareous and fossiliferous at their base, where they probably gradate into the Austin chalk. (2) That their middle portion is apparently void of well preserved fossils, yet impressions are abundant in places. (3) Toward the top, as seen one mile north of Webberville, ten miles east of Austin, they become slightly arenaceous and concretionary and very fossiliferous, indicating a gradation into the Glauconitic division.

The fauna of these concretionary clays at Webberville, Corsicana, and elsewhere begins to partake of the character of that of the Glauconitic division, and yields an abundance of species.

The Webberville beds are practically the uppermost exposure of the Upper series along the Colorado section, for they are overlaid at that point by the Lignitic or Basal division of the Eocene Tertiary. In East Texas, where the rivers have cut through these overlying Tertiary beds, and in Southwest Arkansas, which is but the northeastern termination of the Texas section, the Glauconitic or Arenaceous division is highly developed. This division is the upward continuation of the Ponderosa marls, its chief lithologic difference being that the clays gradate into sands and glauconite as we ascend, and there are conspicuous changes in the fossils, which become more plentiful, and the species assume a sub-littoral aspect, partaking of the same faunal characteristics that distinguish the Cretaceous of the New Jersey and Alabama regions. This division as it occurs in Southwest Arkansas has been minutely described in my Arkansas report, but its whole detail remains to be developed in Texas, its occurrence having only been affirmed in one or two places without specific detailed study[1].

### GENERAL CONCLUSIONS ON THE UPPER CRETACEOUS SERIES.

The Upper Cretaceous series, including all the Cretaceous strata in Arkan-

[1]See Am. Journal Science and Arts, December, 1889.

sas from the base of the Rocky Comfort chalk upward, and in Texas from the base of the Lower Cross Timber sands, is continuous and unbroken, both stratigraphically and faunally. In structure it is, with few exceptions, unconsolidated, and in composition it varies from sands to clays, from clays to chalk, and from a pure foraminiferal chalk at its base through a thousand feet of chalky clays to arenaceous beds at its top, all of which indicates a complete Ternary succession of conditions, as in the Lower series, from land to deep sea and back to land again, the elevation taking a much longer time than the subsidence, as evidenced by the great thickness of the Ponderosa marls and Glauconitic division. The strata are apparently continous and unbroken in deposition and merge gradually one into another, and are connected from top to bottom by a unique, characteristic, and unmistakable fauna of marine mollusca.

In fact, both stratigraphic and lithologic evidence attest the unity of the sediments of this series of beds and their gradual change from sands through clays into pure chalks at the base, and from chalks to clays and sands at the top.

# ANNOTATED CHECK LIST.

The first figure following the author's name refers to the full title of the original publication given in the bibliography at the end of the check list. The second figure gives the page of the original publication. The last figures are those of the year of publication. The capital letters refer to the formation and horizon. Species no longer considered valid, owing to previous description, are italicized. Comments are by the compiler. An * indicates that the species has not been figured. The localities are usually those given by the author of the species.

## PROTOZOA.

Although the cretaceous rocks of Texas are mostly of foraminiferal origin, including innumerable microscopic species now being studied in the geological laboratory of the survey, none of them have been recorded except the following conspicuous microscopic forms:

NODOSARIA TEXANA, Con., 2, 159, 1857. W. Between El Paso and Frontera.

Occurs also in vicinity of Fort Worth, 700 miles east of original locality.

ORBITULITES (TINOPORUS) TEXANUS, Roem. 1, 392, 1849; 2, 86, 1852. F. Between New Braunfels and Fredricksburg.

This form composes the mass of a well defined chalk horizon south of the Brazos, as seen in the bluffs of the Colorado near the mouth of Bull Creek.

TEXTULARIA, sp. ind., Hill 3. A. Austin chalk.

GLOBIGERINA, sp. ind., Hill 3. A.

## COELENTERATA. ANTHOZOA.

TROCHOCYATHUS (TURBINOLIA) TEXANUS, Con. 2, 144, 1857. W. Between El Paso and Frontera.

CLADOPHYLLIA FURCIFERA, Roem. 4, 1888. H. Barton Creek, [two miles] west of Austin.

ISASTREA DISCOIDEA, White. Geol. Mag. 1888, p. 662. N. "Navarro beds." Have found what is probably this species in the shales at Eagle Ford.

COELOSMILIA AMERICANA, Roemer 4, 1888. H. Barton creek, west of Austin.

PARASMILIA AUSTINENSIS, Roemer 4, 1888. H. Barton creek, west of Austin.

PLEUROCORA COALESCENS, Roemer 4, 1888. H. Barton creek, west of Austin.

PLEUROCORA TEXANA, Roemer 4, 1888. H. Barton creek, west of Austin.

ASTROCOENIA GUADALUPAE, Roemer 1, 391, 1849; 2, 187, 1852. V.? Hills north of New Braunfels.

## ECHINODERMATA.

OPHIODERMA, sp. nov., Hill 2, 1887. W. Fossil creek, six miles north of Fort Worth.

CIDARIS HEMIGRANOSUS, Shum. 2, 609, 1860. W. Bluffs of Red river, Lamar county, and ten miles above mouth of Kiamesha creek. Figured in White 2.

SALENIA MEXICANA, Schlut. 2, 1888. A.? Chihuahua, Mex.

HEMICIDARIS, sp. ind. An unstudied Hemicidaris, resembling *H. Crenularis*, Lam., is found in the Caprotina limestone west of Austin.

DIADEMA TEXANA, Roemer 1, 392, 1849; 2, 83, 1852; Fredericksburg, and San Saba river. F.

CYPHOSOMA TEXANA, Roemer 2, 82, 1852. F. Fredericksburg and San Saba river.

HOLECTYPUS PLANATUS, Roemer 1, 393, 1849; 2, 84, 1852. W. F. Fredericksburg and San Saba river.

PYRINA PARRYI, Hall, Con. 2, 144, 1857. W. Leon Springs.

CASSIDULUS AEQUOREUS, Shum. 1, 1858. A. Austin.

GALERITES (DISCOIDEA) sp. nov. Sierra Blanca district. A beautiful undescribed species collected by Prof. W. H. Streeruwitz, and now in the State collection.

HOLASTER COMANCHESI, Marcou 1, 1858. W.? Red river, near Denison.

HOLASTER SIMPLEX, Shum. 1, 84, 1854. W. Fort Washita, I. T.

TOXASTER TEXANA, Roemer 1, 393, 1849; 2, 85, 1862. F. Fredericksburg, Texas.

MACRASTER TEXANUS, Roemer 3, 181, 1888. W. Georgetown.

This conspicuous species is probably the same as the next. It is characteristic of and peculiar to the uppermost horizon of the Washita division, and extends from Fort Washita, through Denison, Fort Worth, Salado, Georgetown, Austin, and southwestward.

HEMIASTER (MACRASTER?) ELEGANS, Shum. 1, 1854. W. Fort Washita, Indian Territory.

This form, owing to indefinite figure and description, can not be positively determined, but there are strong reasons for considering it identical with the foregoing.

*Toxaster elegans*, Con. 2, 146, 1857. W. Eagle Springs .

HEMIASTER PARASTATUS, Shum. 1. A. Austin. .

HEMIASTER TEXANUS, Roem. 1, 3, 1849; 2, 85, 1852. A. New Braunfels waterfall.

This common species is characteristic of the upper beds of the Austin chalk.

## MOLLUSCOIDEA.

### BRYOZOA.

ESCHARA, sp. ind. Hill 3, 1888. T. Millsap, Texas, and Murfreesborough, Ark.

ESCHARA, sp. ind.

An unstudied *Eschara;* is frequently met upon the moulds of fossils in the Comanche Peak beds.

Other Bryozoa have been frequently observed throughout the lower Cretaceous formation, but, as yet, there has been no systematic study of them.

### BRACHIOPODA.

LINGULA, sp. ind. Shum. 2, p. 588.

TEREBRATULINA GUADALUPAE, Roem. 1, 408, 1840; 2, 182, 1852. E.P. Ford of Guadalupe, New Braunfels.

Also occurs at Austin and 200 miles north, in Dallas county. The original descriptions place the form in the genus Terebratula. Compare *T. Gracilis.* Sow.

*Terebratula choctawensis*, Shum. 1, 181, 1854. W. Near Fort Washita, I. T.

*Terebratula leonenis*, Con. 2, 164. W. Southwest Texas.

TEREBRATULA WACOENSIS, Roem. 2, 81, 1852. W. Waco Indian camp, west of New Braunfels.

This species occurs in great numbers in the uppermost layers of the Washita horizon, and I have traced its continuity from the Red river to the Rio Grande.

### LAMELLIBRANCHIATA.

#### OSTREIDAE.

The Cretaceous Ostreidae of Texas belong to three widely distinct types, to-wit: (a) the normal form as seen in the living species, (b) forms having deflected beaks, as seen in the old but inseparable genera *Gryphaea* and *Exogyra*, and (c) the alectryonate varieties. Only the normal form is found in the shallow water horizons, while the others are nearly all found in deeper water sediments. Each species has a well defined horizon of occurrence, and a restricted vertical, but a wide geographical range, which facts, although hitherto little appreciated, make them of great value in stratigraphic determination.

##### *a. Normal Forms.*

*Ostrea anomiaeformis*, Roem. 1, 1849; 2, 1852. F.B. Ford and waterfall, New Braunfels.

I am inclined to believe this form a true *Anomia.* Common at Austin.

O. BELLA, Con. 2, 1857. Western Texas.

O. CONGESTA, Con.

This is a doubtful species, to which can be referred the young attached valves of nearly all adult forms.

O. CORTEX, Con. 2, 157. Dry Creek, Mexico.

This form occurs abundantly in beds which I conditionally refer to the Fredericksburg division. Found in the Trans-Pecos region.

O. FRANKLINI, Coquand. Hill 4, 1889. T.

Characteristic fossil of Trinity beds in Arkansas and Texas.

*O. LYONI, Shum. 3, 200, 1862. Pine Bluff, Red River county.

*O. OWENANA, Shum. 3, 200, 1862. N. Chatfield Point, Navarro county.

*O. PLANOVATA, Shum. 3, 201, 1862. N. Near Dresden, Navarro county.

Have not seen the three last mentioned species.

O. SUBSPATULATA, Lyell and Sowerby, Con. 2, 155, 1857. A? Western Texas.

O. VELLICATA, Con. 2, 156, 1857. Rio Grande, between El Paso and Frontera. W?

*b. Gryphaeate and Exogyrate Forms.*

**Gryphaea aucella*, Roem. 1, 395, 1849. F. Ford of Guadalupe, near New Braúnfels.

It is strongly probable that all the oysters of this horizon belong to but one species.

G. CALCEOLA, Quenstedt var. *nebrascensis* M. & H., (4). F.

This species, distinguished from certain narrow forms of *G. Pitcheri* by its costate umbone, is occasionally found in the basal Comanche series.

*G. forniculata*, White 3, 293, 1879; 4, 13, 1880. Bexar county.

This is a variety of the naviate form of *G. Pitcheri* Morton, which according to Roemer and the type specimens, is the typical form of that species.

G. PITCHERI, Morton 1, 55, 1834. E.A., and V. Kiamesha Plains, I. T. The same variety was beautifully figured in Marcou 1, as *var. tucumcarri.*

This form, described long years before the stratigraphy of the southwest was studied has been the cause of endless confusion. Its history up to the present year has been given in Vol. II of the Arkansas Geological Survey for 1888. Notes in this check list embody still newer facts. I can now assert with positiveness that the form figured under this name by Morton, Roemer, Conrad and Marcou, and *G. forniculata*, by White, is a greatly variable but persistent species, occurring principally in the *upper* beds of the Washita division of the lower formation, and also in the Comanche Peak horizon of the Fredericksburg. The larger *G. dilatata*, Marcou, of Tucumcarri Mesa, and the entirely different dilated species occurring with *O. carinata* in the Washita limestone horizon, which I mistook for the foregoing before seeing Mr. Marcou's species, both in his collection and at Little Tucumcarri, and a diminutive new form in the Fredericksburg division which I once considered identical are persistent species and entirely distinct from *G. pitcheri* Morton. These conclusions are arrived at after years of study, not only of the literature and museum specimens, but personal visits to nearly every locality mentioned, besides hundreds of others throughout their extent.

*G. pitcheri*, Mort. *var. dilatata*, Hill 1, 100, 1888.

This is a persistent form occupying a well defined horizon in the Washita limestone, extending southward continuously through Denison, Fort Worth, and Austin. It is a new and distinct species. It is broader than long, and is especially marked by its small size, its fragile shell, and conspicuous, widely extended wing. I propose for it the name

G. WASHITAENSIS, sp. nov., as above.

This form will be illustrated at an early day.

G. PITCHERI, var. Navia, Hall 1, 100, 1856. False Washita, I. T., Camp 3.

As shown by Roemer, this is also the original form of Morton's poorly figured types, as seen in the Philadelphia Academy's collections.

G. PITCHERI var. *tucumcarri*, Marcou 1. See remarks on G. forniculata, White.

G. VESICULARIS, Lamarck. A., E.P., N.

This form is found only in the upper formation, and is especially abundant in the upper beds, associated with *O. larva* and *E. costata.* Owing to the fact that the uppermost or glauconitic beds in Texas are overlapped by the Tertiary, this species is not so abundant as in the east. It has been seen by me in Dallas and Travis counties, however, and thorough exploration of the intervening area will doubtless show its continuity. The form has been almost inextricably confused with G. *pitcheri* in early literature of the region, especially in the writings of Buckley and G. G. Shumard.

G. VESICULARIS, var. AUCELLA, Roem. 2, 74, 1852.

See *G. aucella.*

*Exogyra aquilla*, (Goldfuss) White, 6. W.

This is a young variety of G. *sinuata.*

E. ARIETINA, Roem. 1, 397, 1849; 2, 68, 1852. E.A. Mission Hill, near New Braunfels; San Marcos Springs, and Brazos river 30 miles above Torrey's trading house.

This unique form is confined to the clays of its name, which outcrop continuously across the State, immediately above the Washita limestone.

*E. caprina*, Con. 1*a*, 273, 1853. San Felipe creek, near Rio Grande, and in New Mexico.

This species is the same as the foregoing.

*E. COSTATA, Say, Roem. 1, 396, 1849; 2, 72, 1852. E.P?

Three miles east of New Braunfels.

This is another of the species characteristic of the upper horizons of the upper formation. See remarks on *E. fragosa*, *E. pondersoa*, and *G. vesicularis.*

E. FIMBRIATA, Con. 1, 54, 1857. Western Texas.

Doubtful species founded on one specimen.

E. FLABELLATA, Goldfuss, Marcou 1, 41, 1858. F. Cross Timbers and Fort Arbuckle, I. T.

This name is used for the species called *E. texana*, by Roemer, and *O. matheroniana*, d'Orb., by Conrad. It is the characteristic oyster of the Fredericksburg or lower division of the lower formation.

E. FRAGOSA, Con. 2, 155, 1857. Between El Paso and Frontera. W. V.

This species deserves a more complete description than could be given by Mr. Conrad with the data he possessed. It belongs with the large, exogyrate forms like *E. costata* Say, and *E. ponderosa* Roemer, being flatter and less globose than either of them, and possessing the rugose and costate markings in a less conspicuous degree. The form occurs in the uppermost layers (Shoal creek limestone) of the lower formation at Austin, and in the Franklin mountains and elsewhere in the Trans-Pecos region. It is the biologic and stratigraphic antecedent of the forms above mentioned, and unless one is thoroughly acquainted with their varietal limitations they are apt to be confounded.

*E. læviuscula*, Roem. 1, 398, 1849; 2, 70, 1852. A. Bed of Cibolo river, on New Braunfels and San Antonio road.

Common in Austin chalk from Arkansas to New Mexico, and in Utah. Young of *E. ponderosa.*

*E. matheroniana*, d'Orb. Con. 1, 154, 1857. F.? Between El Paso and Frontera.

Same as *E. flabellatta*, Goldfuss, Marcou, and *E. Texana*, Roemer.

E. PONDEROSA, Roem. 1, 395, 1849; 2, 71, 1852. A. E.P. East of New Braunfels, three miles.

The distinguishing fossil of the thousand or more feet of clay marls, between the Austin chalk and the glauconitic beds, and underlying the main black prairie region. It is the predecessor of *E. costata.* Its young in the Austin chalk of Texas, New Mexico, and Utah, has been described under many names.

G. SINUATA, var. AMERICANA, Marcou, 1, 37, 1858. W. Border of Red river, near Denison, Texas.

One of the most beautiful of the Texas oysters. It occurs in the upper part of the Washita limestone, throughout its narrow extent from Denison to Austin. It was redescribed under the name of *E. walkeri*, by White, in 1879.

*E. texana*, Roem. 1, 396, 1849; 2, 69, 1852. Fredericksburg.

See *E. flabellatta*, as above.

*E. walkeri*, White 2, 278, 1879. Salado, Bell county.

See *G. sinuata*, as above.

*E. winchelli*, White 3, 295, 1879. A.? Collin county.

### *c. Alectryonate Forms.*

OSTREA BELLAPLICATA, Shum. 2, 608, 1860. F.B. Near Sherman, on the bluffs of Post Oak creek, and other localities in Grayson county.

Figured by White 2, 276, 1879. Occurs in upper part of Eagle Ford shales, from Grayson county southward.

*O. blackii*, White 3, 293, 1879; 4, 11, 1880. Collin county. Identical with foregoing.

O. CARINATA, Lam., Roemer 2, 75, 1852. W. Waco Indian camp eight miles above New Braunfels.

A characteristic fossil of the Washita limestone, throughout its extent.

O. CRENULIMARGO, Roemer 2, 76, 1852. F.? Fredericksburg.

O. DILUVIANA, Lam., White. V. and W.

Occurrence rare at Austin, Salado, and elsewhere.

O. LARVA, Lam. G., E.P.

I have seen this characteristic Cretaceous oyster from the uppermost beds at Manor, Travis county, and elsewhere.

O. MARSHII, Sow., Marcou 1, 43, 1858. Pyramid mountain, N. M.

After a personal inspection of the formation in which this species occurs, I feel no hesitancy in pronouncing it entirely different and older than any

horizon in my Texas section. There is some reason to believe that it is the same as the *O. subovata*, Shum., which extends from the Travis Peak (Trinity) sands to the Shoal creek limestone.

O. QUADRIPLICATA, Shum. 2, 608, 1860. W. Bluffs of Red river, Lamar county, and ten miles above mouth of Kiamesha creek.

Found in decreasing numbers southward, at Fort Worth. This form attains four or five times the size of specimens hitherto figured.

O. SUBOVATA, Shum. 1, 179, 1854. W. Fort Washita, I. T.

A very poorly figured species. Also occurs as far south as Austin, in the Washita limestone. There are some reasons for believing this species identical with the lower-occurring form of *O. Marshii*, Marcou.

O. VELLICATA, Con. 2, 156, 1827. W. Rio Grande between El Paso and Frontera.

## ANOMIIDAE.

The Anomiidae need revision. Species occur in the littoral beds of each formation in great abundance.

ANOMIA, sp. ind. Hill 4. A very small species occurring in great numbers throughout the Trinity beds in Arkansas and Texas.

A. ANOMIÆFORMIS, Roemer 1, 1849; 2, 1852.

See *O. anomiæformis.*

A. ARGENTARIA, Mort. Hill 4. E.P. Occurs in Arkansas abundantly.

ANOMIA *micronema ?* M. and H. An undescribed species, greatly resembling one of Meek's species from the northwest, occurs in the uppermost upper Cretaceous beds at Eagle Pass. It is specially marked by fine costae.

## SPONDYLIDAE.

PLICATULA INCONGRUA, Con. 2, 153, 1857. A. Locality not given. d'Orb.?

P. PLACUNEA ? W. A species indistinguishable from the European forms, occurring abundantly in the Washita beds from Fort Worth to Denison.

SPONDYLUS GUADALUPAE, Roem. 1, 400, 1849; 2, 62, 1852. A. Waterfall of Guadalupe at New Braunfels; bed of Cibolo, at crossing of New Braunfels and San Antonio road. Compare *P. dumosum*, Morton 1, pp. 59–60, and *P. spinosum*, Sowerby.

Found also at Austin, Watters, and other places. One of the most characteristic species of the Austin chalk.

SPONDYLUS, sp. nov.? The writer has found in the Washita limestone, two miles northwest of Austin, a larger and different species from any hitherto noted in Texas, which will be figured at an early day.

## LIMIDIDAE.

LIMA (RADULA) CRENULICOSTA, Roemer 1, 399, 1849; 2, 63, 1852. W.? Waterfall, New Braunfels.

L. KIMBALLI, Gabb 1, 1872, 26. F., W. Nugal, Mexico.

Greatly resembles and probably identical with following species.

L. WACOENSIS, Roemer 1, 399, 1849; 2, 63, 1852. W., E.A., and F. Waco camp, eight miles above New Braunfels.

*L. leonensis*, Con. 2, 151, 1857. W. Leon Springs.

Identical with preceding species.

**PECTENIDAE.**

*PECTEN ÆQUICOSTATUS, Lam'k. Roemer 1, 398, 1849. Upper Brazos and Cibolo creek.

Not rementioned in Roemer 2, and hence the inference that the species was abandoned by him.

*P. duplicosta*, Roemer 1, 398, 1849; 2, 65, 1852. V.? North branch of of Pedernales.

I suspect that this species, which was confessedly described from a single imperfect specimen, is the same as the magnificent Pecten in the Shoal creek limestone at Austin, which I have referred to as *P. fleuriaussiana*, d'Orb., and as *Vola quinquecostata*, Sow. To avoid further confusion I have figured and redescribed this form under the name of *P. Roemeri*.

P. (VOLA) ROEMERI, Hill 5, 1889. V. Characteristic fossil of Shoal creek (Vola) limestone. Shoal creek, Austin.

*Vola quinquecostata*, Sow., Hill 3, 1889. See foregoing.

P. NILLSONI, Goldfuss, Roemer 2, 67, 1852. A. Guadalupe river on New Braunfels-Seguin road.

Probably same as *Amusium simplicum*, Con.

P. QUADRICOSTATUS, Sow., Roemer 1, 398, 1849; 2, 64, 1852. F.? and W. Waco camp, west of New Braunfels.

Associated with Washita limestone fauna throughout its extent.

*Neithea occidentalis*, Con. 1, 369, 1851; 2, 150, 1857.

Same as foregoing.

*P. texanus*, Roemer 2, 65, 1852. W. Water rolled specimens from debris of the Cibolo, at crossing of San Antonio and New Braunfels road.

A form of extreme variation of *P. quadricostatus*. Comparison of numer. ous specimens shows every gradation between them.

AMUSIUM SIMPLICUM, Con.

Specimens which are provisionally referred to this species have been found by the writer at the top of the Ponderosa marls in Arkansas and east of Austin.

CAMPTONECTES VIRGATUS, Nils., Roem. 2, 66, 1852. A.? River drift of Guadalupe, below New Braunfels.

*VOLA (JANIRA) WRIGHTII, Shum. 2, 607, 1860. V. Found in the Caprina limestone, Shoal creek, Austin, and Barton creek, near Austin.

**AVICULIDAE.**

AVICULA CONVEXO-PLANA, Roem. 1, 400, 1849; 2, 61, 1852. F. Fredericksburg.

*Avicula irridescens, Shum. 3, 203, 1862. F.B. Head of Pine creek, Lamar county.

Avicula pedernalis, Roem. 1, 400, 1849; 2, 61, 1852. F. Fredericksburg.

Avicula planiuscula, Roem. 1, 401, 1849; 2, 62, 1852. F.B. Waterfall of the Guadalupe, at New Braunfels.

Avicula? stabilitatis, White 3, 296, 1879; 4, 15, 1880. F.B.? Collin county, Texas.

*Gervillia gregaria, Shum. 2, 606, 1860. D. and F.B. Bluffs of Red River, Lamar county. Probably same as next.

Aguillaria cumminsi, White 6. D. Timber creek, Denton county. Corresponds somewhat to *Gervillia gregaria*, Shumard. Types collected by me. R. T. H.

Gervillopsis ("Dalliaconcha") invaginata, White 6. F.B.? Fossil creek. W?

Inoceramus biformis, Shum. 2, 586, 1860. A. Austin.

*Inoceramus (*a*) capulus, Shum. 2, 606, 1860. F.B. Bluffs of Red River, Lamar county. Associated with *Ammonites swallovi*, Shum., and *Tapes hilgardi*, Shum.

Inoceramus confertim-annulatus, Roem. 1, 402, 1849; 2, 59, 1852. F.B. "Ford of Guadalupe, New Braunfels." Camp No. 4, Cross Timbers, Shum. 1, 180, 1854.

Inoceramus cripsii, Mant.? Roem. 1, 401, 1849; 2, 56, 1852. F.B.?, A.?, N. G. Con. 2, 152, 1857. Ford of Guadalupe, New Braunfels; bed of Cibolo, crossing of New Braunfels.

I have seen no specimens except from the Glauconitic division which could be satisfactorily referred to this species.

Inoceramus diverse-sulcatus, Roem. A. "Austin." Schlueter 1, 1888. Same as *I. diverse-digitatus*, Sow.

Inoceramus exogyroides, Meek. A. "Austin." Schlueter 1, 1888.

Inoceramus involutus, Sow., Schlueter 1, 1888. A. "Austin."

Inoceramus latus, Mant., Roem. 1, 401, 1849; 2, 60, 1852. A. F.B. Ford and waterfall, New Braunfels.

Inoceramus mytiloides, Mant., Roem. 1, 401, 1849; 2, 60, 1852. F.B. Ford and waterfall of Guadalupe at New Braunfels. Associated with *I. cripsii?*

Inoceramus mytilopsis, Con. 2, 152, 1857. A. "Southwest Texas."

Inoceramus problematicus ? Schloth. F.B. Fish beds near Austin.

Inoceramus striatus, Mant., Roem. 1, 402, 1849; 2, 60, 1852. A. Waterfall, New Braunfels.

Inoceramus subquadratus, Schlueter 1, 1888. A. "Austin."

Inoceramus texanus, Con. 2, 152, 1857. G.? Western Texas and Jacun, three miles below Laredo, Texas.

Inoceramus umbonatus, Meek, Hill. A. Austin chalk.

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(*a*) Note:—No revision of the Inoceraminae is here attempted. Thus far none of them are recorded from the Comanche series.

INOCERAMUS UNDULATO-PLICATUS. Roem. 1, 402, 1849; 2, 59, 1852. A. Waterfall of Guadalupe below New Braunfels.

AUCELLA?, sp. nov. H.

Several specimens of this genus from the Caprina limestone have recently been seen by the writer. Locality, west of Austin.

### MYTILIDAE.

MYTILUS SEMIPLICATUS, Roem. 1, 402, 1849; 2, 55, 1852. A. Ravine between New Braunfels and Seguin, three miles below New Braunfels.

MYTILUS TENUITESTA, Roem. 1, 403, 1849; 2, 55, 1852. F.? Fredericksburg.

MODIOLA COCENTRICA-COSTELLATA, Roem. 1, 403, 1849; 2, 54, 1852. F. Fredericksburg and San Saba valley.

MODIOLA GRANULATO-CANCELLATA, Roem. 2, 54, 1852. A. Ravine between New Braunfels and Seguin.

MODIOLA PARVA, Hill 3. T. West of Weatherford, and at Murfreesboro, Ark.

MODIOLA PEDERNALIS, Roem. 1, 403, 1849; 2, 53, 1852. F. Fredericksburg and San Saba valley.

### PINNIDAE.

*PIUNA LAQUEATA, Con. Whitf. 1, 1889. No locality given.

*PINNA, sp. ind., Roem. 1, 402, 1849. F. Fredericksburg.

*P. quadrangularis*, Goldf., tab. 127, fig. 8.

*PINNA, sp. ind., Roem. 2, 56, 1852. A. Chalk marls of ravine between New Braunfels and Seguin.

*PINNA, sp. ind., Hill.

I have seen two indeterminate species of Pinna—one in the Washita limestone at Fort Worth, the other in the Shoal creek limestone at Austin.

### ARCIDAE.

ARCA GRATIOTA, Hill 3. T. Gypsum Bluff, Ark.

ARCA PARVA-MISSOURIENSIS, Hill 3. T. Gypsum Bluff, Ark.

*ARCA PROUTIANA, Shum. 2, 601, 1860. F. Comanche Peak, and Parker county, near Brazos river.

ARCA SUBELONGATA, Con. 2, 148, 1857. W.? Between El Paso and Frontera.

*ARCA, sp. ind., Roem. 1, 404, 1849. F. Fredericksburg and New Braunfels.

Probably same as *A. pholadiformis* d'Orb., l. c. III, pl. 315, figs. 1–5.

*CUCULLÆA MILLESTRIATA, Shum. 3, 202, 1862. T.? F.B.? Red river, Lamar county, Texas.

CUCULLÆA TERMINALIS, Con. 1, 148, 1857. F. A very persistent form in the Fredericksburg division.

CUCULLÆA MAILLEANA? d'Orb., Roem. 1, 403, 1849; 2, 52, 1852. A. Waterfall of Guadalupe, New Braunfels.

**NUCULIDAE.**

*NUCULA BELLASTRIATA, Shum. 3, 202, 1862. F.B.? Red river bluffs, Fannin county.

NUCULA HAYDENI, Shum. 2, 602, 1860. F.B.? Red river, Fannin county.

NUCULA SERRIATA, Shum. 2, 603, 1860. F.B.? Bluffs of Red river, Lamar county.

NUCULA SLACKIANA, Gabb. Whitf. 1, 1889. No locality given.

**TRIGONIIDAE.**

*TRIGONIA ALIFORMIS, Goldf. (Gabb, not Park.), Roem. 1, 404, 1849. A. Ford of Guadalupe, New Braunfels.

TRIGONIA CRENULATA, Lam. Roem. 2, 51, 1852; Shum. 1, 180, 1854. F. Fredericksburg and Cross Timbers.

TRIGONA EMORYI, Con. 2, 148, 1857. W. Between El Paso and Frontera.

TRIGONIA TEXANA, Con. 2, 148, 1857. W.? Leon Springs, Texas.

TRIGONIA THORACICA, Mort., Roem., 2, 52, 1852. A. Ravine between New Braunfels and Seguin.

Probably same as *T. aliformis* above.

*TRIGONIA, sp. ind., Hill. N. North of Webberville.

**ASTARTIDAE.**

CARDITA? EMINULA, Con. 1, 150, 1857. F. Leon Springs, Texas.

It is very doubtful whether this imperfect specimen is a *Cardita*.

ASTARTE LINEOLATA, Roem. 1, 404, 1849; 2, 51, 1852. F.B.? Ford of Guadalupe, New Braunfels.

ASTARTE ("STEARNSIA") ROBBINSI, White 6, 1887. W.

I collected the type specimens of this species in company with Prof. Robbins from the top of the Washita limestone, six miles north of Fort Worth.

ASTARTE TEXANA, Con. 2, 152, 1857. F. Western Texas.

This species is poorly figured and described.

ASTARTE WASHITAENSIS, Shum. 1, 180, 1854. F.? Camp No. 4., Cross Timbers.

**CRASSATELLIDAE.**

*CRASSATELLA LINEATA, Shum. 3, 201, 1862. N. Near Corsicana, Navarro county.

*CRASSATELLA? PARVULA, Shum. 3, 202, 1862. N.? Red river, Fannin county.

CRASSATELLA SUBPLANA? Con., Hill. N. Numerous specimens from two miles north of Webberville are here provisionally referred to this species.

**CHAMIDAE.**

*DICERAS, sp. ind., Roem, 1, 404, 1849; 2, 53, 1852. H. Edge of plateau near New Braunfels.

REQUIENIA (CAPROTINA) BICORNIS, Meek 1, 126, 1876. F. Fort Lancaster, Texas.

There is no reason for separating this from *R. texana*, Roem.

REQUIENIA PATAGIATA, White 5, 6, 1884. H. "Near Austin, Texas."

This and accompanying fauna comes from the Caprina limestone exposed in Barton creek and the bluffs of the Colorado west of Austin.

REQUIENIA (CAPROTINA) TEXANA, Roem. 2, 80, 1852; White 5, 7, 1884. F. C. and H. "Near Austin, Texas." C. Highlands between New Braunfels and Fredericksburg; Waco Camp, 8 miles above New Braunfels; Salado creek; Sabine creek.

Marcou, in 1, 42, 1858, reports this form at "Comet creek, on left bank of the False Washita, associated with *Gryphœa pitcheri*." I have found two distinct horizons where this fossil occurs in great plentitude—one at the base of the Fredericksburg, the other above the Caprina. Closer study may differentiate the species.

MONOPLEURA MARCIDA, White 5, 8, 1884. H. "Near Austin, Texas."

MONOPLEURA SUBTRIQUETRA, Roem. 2, 81, 1852. H. Valley of San Saba and upper arm of Pedernales river.

*Monopleura pingiuscula*, White 5, 81, 1884. H. "Near Austin, Texas."

A comparison of abundant material shows this is very near if not identical with *M. subtriquetra*, Roem.

MONOPLEURA TEXANA, Roem. 2, 81, 1852. C. H. Waco Camp on Gaudalupe river, 8 miles above New Braunfels. Associated with *Caprina Gaudalupae* and *C. crassifibra*.

CAPRINA CRASSIFIBRA, Roem. 1, 408, 1849; 2, 79, 1852. C. Waco Camp, upper arm Pedernales river; San Saba river.

CAPRINA GUADALUPAE, Roem. 1, 408, 1849; 2, 79, 1852. H. Waco Camp, 8 miles above New Braunfels. Associated with *C. crassifibra*.

CAPRINA PLANATA, Con. 1, 268, 1855; 2, 147, 1857. H.? Oak creek, near Pecos, Texas.

CAPRINA OCCIDENTALIS, Con. 1, 268, 1855; 2, 147, 1857. H. C. Pecos river, near mouth. (A. Schott.)

CAPRINA TEXANA, Roem 1, 409, 1849. H. C.? Road from Fredericksburg to New Braunfels.

PLAGIOPTYCHUS ("RUDISTES") CORDATUS, Roem. 4, 1888. H. C. Barton creek, west of Austin.

Have not seen this species.

ICHTHYOSARCOLITHES ANGUIS, Roem. 4, 1888. H. Barton creek, west of Austin.

## RUDISTAE.

**Hippurites austinensis*, Roem. 1, 410, 1849. A. Austin. This is *Radiolites*. Generic name corrected in Roem. 2.

**Hippurites sabinae*, Roem. 1, 410, 1849. "Sabine creek, between Austin (?) and Fredericksburg? A. *Radiolites*. Species abandoned in Roem. 2.

HIPPURITES TEXANUS, Roem. 1, 409, 1849; 2, 76, 1852. H. C. Ford of Gaudalupe River at New Braunfels. (Probably rolled.) Gabb. in 1, 263, 1872, reports from Nugal, Chihuahua, Mexico. They are rare and occur only in the Comanche series. I have found one perfect specimen (now in the museum of Cornell University) in the Caprina limestone. Fragments are frequently brought in.

RADIOLITES AUSTINENSIS, Roem. 2, 77, 1852. A. Austin. Characteristic of Austin chalk and Ponderosa marls. I have seen it also at Canon City, Col., in Arkansas, and in Mississippi. Probably closer study will show its identity with the Alabama species.

### LUCINIDAE.

LUCINA ACUTE-LINEOLATA, Roem. 4, 1888. H. Barton Creek, west of Austin. A beautiful and abundant species.

LUCINA PARVILINEATA, Shum. 3, 204, 1862. N. Near Corsicana, Navarro county.

*LUCINA SUBLENTICULARIS, Shum. 2, 602, 1860. F.B. Bluffs of Red river, in Lamar and Fannin counties. Associated with *Ammonites swallovi*, Shum.; *Inoceramus capulus*, Shum.; and *Gervillia gregaria*, Shum.

FIMBRIA STRIATO-COSTATA? d'Orb. III, p. 114, pl. 281, fig. 2; Roem. 1, 407, 1849; 2, 47, 1852. F. Fredericksburg.

### CARDIIDAE.

CARDIUM CHOCTAWENSE, Shum. 2, 599, 1860. F.B. Post Oak creek, Grayson county. Associated with *Ostria bellaragosa* fig. in White 2.

CARDIUM CONGESTUM, Con. 2, 149, 1857. N.? Rio San Pedro. Valley of Royo San Felipe, Texas.

CARDIUM MEDIALE, Con. 2, 149, 1857. F. The cast of this species is very common.

*Cardium transversale*, Roem. 1, 406, 1849. F.? Fredericksburg. Specific name retracted in Roem. 2, 50, 1852.

PAPYRIDEA? (CARDIUM) SANCTISABAE, Meek., Roem. 1, 405, 1849; 2, 48, 1852. F.? Fredericksburg. V.? Spanish Fort (Northern Mississippi).

LIOCARDIUM (PACHYCARDIUM) SPILLMANI, Con. N. G. This characteristic upper cretaceous fossil is quite common at Corsicana and other points in Navarro county.

*PROTOCARDIA (CARDIUM) BRAZOENSE, Shum 2, 600, 1860. F. Johnson county, at Comanche Peak, a few feet above level of Brazos river, and near Patrick's creek, Parker county.

*PROTOCARDIA (CARDIUM) COLORADOENSE, Shum. 2, 599, 1860. F. Burnet, Travis, Bosque, Johnson, and McLennan counties, and according to G. G. Shumard several hundred miles further westward.

PROTOCARDIA (CARDIUM) FILOSUM, Con. 2, 150, 1857. F.? Leon Springs, Texas.

PROTOCARDIA (CARDIUM) HILLANUM, Sow., Roem. 1, 406, 1849; 2, 49, 1852. F., W. Fredericksburg and San Saba valley. Most of the species above mentioned probably belong to this form.

PROTOCARDIA (CARDIUM) MULTISTRIATUM, Con. 2, 149, 1857; Shum. 1, 181, 1854. F. Leon Springs, Texas. Camp No. 4, Cross Timbers.

*Protocardia* (*cardium*) *texanum*, Con. 2, 150, 1857. W. Between El Paso and Frontera, Texas. Same as *P. hillanum*, Sow., above.

### CYRENIDAE.

CYRENA ARKANSAENSIS, Hill 3. T. Gypsum Bluff, Ark.

CYRENA, sp. nov. H. Barton's Creek west of Austin. Undescribed species in State collection.

CORBICULA PIKENSIS, Hill 3. T. Gypsum Bluff, Ark.

### CYPRINIDAE.

CYPRINA ? sp. ind. Roem. 1, 407, 1849; 2, 47, 1852. F. Upper branch of Pedernales river.

VENILIA (VENIELLA) CONRADI, Mort. Whitf. 1, 1889. No locality given.

*VENILIA (CYPRINA) LAPHAMI, Shum. 3, 204, 1862. F.B. ? Bluffs of Red river, Fannin county.

ISOCARDIA WASHITA, Marcou 1, 37, 1858. F.B. On banks of Red river, near Denison. I have found this species in Eagle Ford clays, four miles south of Denison.

ISOCARDIA, sp. ind., Roem. 1, 405, 1849; 2, 50, 1852. F. Fredericksburg.

### VENERIDAE.

TAPES HILGARDI, Shum. 2, 601, 1860; White 4, 22, 1880. F.B.? Bluffs of Red river, Lamar and Fannin counties.

*VENUS SUBLAMELLOSUS, Shum. 2, 598, 1860. F.B. ? Five miles north of Sherman, Grayson county. Associated with *Scaphites vermiculus.*

*Venus ? sp. ind., Roem. 1, 407, 1849; 2, 47, 1852. F. Fredericksburg.

CYTHEREA (DIONE) LAMARENSIS, Shum. 2, 600, 1860; Fig. in White 2. F.B. ? Red river, Lamar county. Probably same as *C. owena*, Meek & Hayden.

CYTHEREA (DIONE) LEONENSIS, Con. 2, 153, 1857. W.? Leon Springs, El Paso road, Texas.

CYTHEREA (DIONE) TEXANA, Con. 2, 153, 1857. W. Between El Paso and Frontera, Texas.

CYPRIMERIA CRASSA, Meek 1, 128, 1876. F.B. Pope's well, near Galisteo.

I have found this species in Eagle Ford shales at Denison, Texas. Often confused with *Arcopagia texana* Roemer by collectors.

### TELLINIDAE.

LINEARIA (ARCOPAGIA) TEXANA, Roem. 2, 46, 1852; Con. 2, 149, 1857. F. Fredericksburg. Leon Springs, Texas. Has been wrongly confused with *Cyprimeria crassa*, Meek.

LINEARIA ? (SOLEN ?) IRRADIANS, Roem. 2, 45, 1852. F. Fredericksburg.

GARI (PSAMMOBIA) CANCELLATO-SCULPTA, Roem. 2, 46, 1852. A. Waterfall of Guadalupe river. New Braunfels.

**PAPHIIDAE.**

TAGELUS (LEGUMEN) ELLIPTICUS, Con., Shum. 4, 1862. Navarro county.

**SOLENIDAE.**

*SOLEN ? ELEGANS, d'Orb, l. c. III, p. 322, pl. 351, figs. 3–5; Roem. 1, 407; 1849. F. Fredericksburg.

**PHOLADOMYIDAE.**

*PHOLADOMYA LINCECUMI, Shum. 3, 199, 1862. N. Corsicana, Navarro county.

PHOLADOMYA PEDERNALES, Roem. 2, 45, 1852. F. Fredericksburg.

PHOLADOMYA TEXANA, Con. 2, 152, 1857. F.? Turkey creek, Leon and Eagle Pass roads.

HOMOMYA ALTA, Roem. 2, 45, 1852. F.? V.? Fredericksburg.

*PANOPÆA[1] ? NEWBERRYI, Shum. 2, 605, 1860. F. Parker county, and Comanche Peak, in Johnson county. Probably same as *P. recta* d'Orb. "Pal. France," tom. 5, p. 384, pl. 356, figs. 1–2.

*Thracia ? myaeformis*, White. F.? Same species as above. Genus indeterminate.

*PANOPAEA ? SUBPARALLELA, Shum. 2, 605, 1860. F.B. ? Red river, Fannin county.

*PANOPAEA ? SUBPLICATA, Shum. 3, 199, 1862. N. Chatfield Point, Navarro county.

PANOPAEA ? TEXANA, Shum. 1, 181, 1854. F. Camp No. 4, Cross Timbers.

*PANOPAEA ? REGULARIS ? d'Orb., l. c. pl. 360, figs. 1–2; Roem. 1, 407, 1849; 2, 45, 1852. V.? F.? Pedernales river.

PACHYMA ? AUSTINENSIS, Shum. 2, 604, 1860; White 2, 298, 1879. W. Shoal creek, near Austin. Associated with *Terebratula wacoensis*, *Turrilites brazoensis*, and *Ostrea subovata*. Salado, Bell county. (Walker.) Probably same as *P. gigas*, Sow., "Min. Conch," vol. 6, p. 1, pl. 504–505.

PACHYMA ? (CYPRICARDIA ?) TEXANA, Roem. 1, 404, 1849; 2, 50, 1852. F. Fredericksburg.

*Pachyma ? compacta*, White 3, 297, 1879; 4, 22, 1880. W. Bell county, Texas. Same as foregoing.

**ANATINIDAE.**

*ANATINA SULCATINA, Shum. 3, 204, 1862. N. Chatfield Point, Navarro county.

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[1] It is doubtful if any of the following species should be called Panopaea or Pachyma, but as it is here impossible to revise the generic nomenclature, the authors' names are retained for this group. See Meek, "Invertebrate Paleontology," pp. 248–249.

LIOPISTHA (CARDIUM ?) ELEGANTULUM, Roem. 1, 405, 1849; 2, 48, 1852. A. Waterfall of Guadalupe, New Braunfels.

### MACTRIDAE.

MACTRA TEXANA, Con. 1, 269, 1855; 2, 148, 1857. G.? Prairie between Laredo and Rio Grande City.

### MYIDAE.

*CORBULA GRAYSONENSIS, Shum. 2, 603, 1860. F.B. Post Oak creek, Grayson county. Associated with *Ostrea bellaplicata*, Shum., and *O. congesta*, Con.

*CORBULA TUOMEYI, Shum. 2, 604, 1860. F.B. Four and one-half miles north of Sherman, Grayson county. Probably same as *C. caudata*, Tuomey.

*CORBULA, sp. nov., Hill.

Seen in Caprina limestone from Gillespie county in collections of State Geological Survey of Texas.

*NEAERA ALAEFORMIS, Shum. 3, 203, 1862. F.B. Bluffs of Red river, Fannin county.

### PHOLADIDAE.

TEREDO TIBIALIS, Con., Whitf. 1, 1889. No locality given.

*TEREDO, sp. ind. Roem. 1, 408, 1849; 2, 44, 1852. F.B. Ford of Guadalupe, near New Braunfels.

## GASTROPODA.

### PLEUROTOMORIIDAE.

*PLEUROTOMARIA AUSTINENSIS, Shum. 3, 198, 1862. W. Near Austin, Texas.

A common characteristic species of the Washita limestone.

### PHASIANELLINAE.

*PHASIANELLA PEROVATA, Shum. 2, 597, 1860. F. Comanche Peak, in Parker county, near Brazos river.

A common characteristic species of the Fredericksburg division.

*PHASIANELLA, sp. ind., Roem. 1, 414, 1849; 2, 38, 1852. A. Waterfall of Guadalupe, New Braunfels.

### TROCHINAE.

TROCHUS TEXANUS, Roem. 4, 1888. H. Barton creek, west of Austin.

### NERITIDAE.

NERITINA NEBRASCENSIS? Meek and Hayden, Hill 3. T. Between Granbury and Weatherford.

*NERITOPSIS BIANGULATUS, Shum. 2, 598, 1860. F.B.? Alexander's Bend of Red river, Grayson county.

Associated with *Inoceramus problematicus* and *Hamites fremonti.*

**SOLARIIDAE.**

SOLARIUM PLANORBIS, Roem. 4, 1888. H. Barton creek, west of Austin.

**SCALARIDAE.**

*SCALARIA (SCALA) BICARINIFERA, Shum. 3, 197, 1862. A.? Bluffs of Red river, Lamar county.

*SCALARIA (SCALA) FORSHEYI, Meek, Shum. 3, 195, 1862. N. Chatfield Pt., Navarro county.

*SCALARIA LAMARENSIS, Shum. 3, 197, 1862. F.B.? N.? Bluffs of Red river, Lamar county.

*SCALARIA, sp. ind., Hill. North of Webberville.

**TURRITELLIDAE.**

*TURRITELLA CORSICANA, Shum. 3, 196, 1862. N. Near Corsicana and Chatfield Pt., Navarro county; also Webberville, 10 miles east of Austin. This is very near *T. tippana*, Con.

*TURRITELLA IRRORATA, Con. 1, 268, 1855. W.? Between El Paso and Frontera. Probably same as *T. seriatim granulata* Roem.

TURRITELLA? LEONENSIS, Con. 2, pl. 21, fig. 7. F. W. E.A. A persistent species whose generic identity is still doubtful.

TURRITELLA MARNOCHI, White 2, 314, 1879. W. Vicinity of Helotes, Bexar county. See remarks on *T. irrorata*, Con.

TURRITELLA PLANILATERIS, Con. 2, 158, 1857. W. Associated with *Lima leonensis* and *Astarte crassifibra?* See remarks on *T. irrorata*, Con.

TURRITELLA SERIATIM-GRANULATA, Roem. 1, 413, 1849; 2, 39, 1852. F.? Fredericksburg.

*TURRITELLA WINCHELLI, Shum. 3, 196, 1862. N. Near Chatfield Point and Corsicana, Navarro county.

**VERMETIDAE.**

VERMETUS (SERPULA), sp. ind., Hill 3. T., etc. Gypsum Bluff, Arkansas. Indeterminate species found throughout the two Cretaceous formations of Texas.

**NATICIDAE.**

The reference of many of the casts of the Comanche series to the genus *Natica* is of doubtful value, and none of the forms so assigned are satisfactory. I have seen no true *Naticas* in the Lower Cretaceous, but they are beautifully preserved in the Eagle Ford shales and in the Navarro beds, the latter being of the type of *N. rectilabrum*, Con.

NATICA? (AMAUROPSIS?) AVELLANA, Roem. 4, 1888. H. Barton creek, west of Austin.

The generic determination of this calcitè pseudomorph is very doubtful. Resembles the *Straparollus*-like *Solarium*.

NATICA COLLINA, Con. 2, 157, 1857. W.? Between San Pedro and Rio Pecos.

NATICA? TEXANA, Con. 2, 157, 1857. W.? Between Rio San Pedro and Pecos.

*LUNATIA? (NATICA) ACUTISPIRA, Shum. 2, 597, 1860. F. Parker county, near Brazos river.

TYLOSTOMA? (NATICA?) PEDERNALIS, Roem. 1, 410, 1849; 2, 43, 1852. F. Fredericksburg.

This common characteristic form of the Fredericksburg division is referred to the genus *Natica* with great doubt. It ranges from the Upper Jurassic into the Lower Cretaceous of Europe.

*TYLOSTOMA? (NATICA?) PRÆGRANDIS, Roem. 1, 410, 1849; 2, 44, 1852. F.? Fredericksburg, Pedernales river.

"This belongs near the form of the Portland chalk *N. gigas*, Bronn."—Roemer. Probably same as *N.? pedernalis*.

### PALUDINIDAE.

VIVIPARA? CASSATOTENSIS. Hill, 3. T. Ultima Thule, Arkansas.

Mr. Jules Marcou has referred this species to *Natica*, but I think incorrectly. See "American Geologist," Dec., 1889, and Jan., 1890.

VIVIPARA (PLEUROCERA) STROMBIFORMIS, Schloth., Hill 3. T. West of Weatherford.

### PYRAMIDELLIDAE.

*Eulima? subfusiformis*, Shum. 1, 182, 1854. F. A doubtful species.

EULIMA? TEXANA, Roem. 1, 413, 1849; 2, 40, 1852. A. Waterfall, New Braunfels.

CHEMNITZIA GLORIOSA, Roem. 1, 412, 1849; 2, 40, 1852. A. N. Waterfall, New Braunfels. Also occurs in Navarro beds.

CHEMNITZIA OCCIDENTALIS, Gabb 2, 186. F. W.? Choctaw Mission, I. T. Fredericksburg.

I have seen this beautiful species at Benbrook, Tarrant county.

CHEMNITZIA? (SCALARIA?) TEXANA, Roem. 2, 39, 1852. A. Waterfall of Guadalupe, New Braunfels.

### NERINEIDAE.

NERINEA ACUS, Roem. 1, 412, 1849; 2, 42, 1852. F.? H. Fredericksburg.

A characteristic species also of Barton creek or Caprina limestone.

NERINEA AUSTINENSIS, Roem. 4, 1888. H. Barton creek, west of Austin.

NERINEA CULTRISPIRA, Roem. 4, 1888. H. Barton creek, west of Austin.

NERINEA SCHOTTII, Con. 2, 158, 1857. H.? F.? Oak creek, near mouth of Pecos river. This species is beautifully preserved on the plains of the Pecos.

NERINEA SUBULA, Roem. 4, 1888. H. Barton creek, west of Austin.

NERINEA TEXANA, Roem. 2, 41, 1852. F. Fredericksburg. Pedernales river.

### CERITHIIDAE.

CERITHIUM AUSTINENSIS, Roem. 4, 1888. H. Barton creek, west of Austin.

*CERITHIUM BOSQUENSE, Shum. 2, 596, 1860. F. Near Bosque river, Bosque county, Texas. Associated with *Exogyra texana* and *Lima wacoensis.*

CERITHIUM OBLITERATO-GRANOSUM, Roem. 4, 1888. H. Barton creek, west of Austin.

*CERITHIUM, sp. ind., Roem. 1, 414, 1849; 2, 38, 1852. A. Waterfall, New Braunfels.

**APORRHAIDAE.**

ANCHURA (DREPANOCHEILUS) MUDGEANA, White 2, 312, 1879. F.B.? Denison, Texas.

I have seen only one specimen—the type—in the National Museum at Washington.

**STROMBIDAE.**

*PUGNELLUS DENSATUS, Con. N. Corsicana, Texas.

ROSTELLARIA? COLLINA (cast), Con. 1, 157, 1857. F. Between Rio San Pedro and Rio Pecos. Associated with *Natica collina.*

ROSTELLARIA MONPLEUROPHILA, Roem. 4, 1888. H.? Barton creek, west of Austin. I am doubtful about this locality.

*ROSTELLARIA, sp. ind., Roem. 1, 414, 1849; 2, 38, 1852. A. Waterfall, New Braunfels.

**FICULIDAE.**

FICUS (PYRIFUSUS) GRANOSUS, Shum. 3, 196, 1862. N. Chatfield Point, Navarro county. Also at Webberville, 12 miles east of Austin.

FICUS SUBDENSATUS, Con., Shum. 4, 1862. Navarro county.

**BUCCINIDAE.**

BUCCINOPSIS ? CONRADI, Hill 3. T. Gypsum Bluff, Ark.

BUCCINOPSIS ? PARRYI, Con. 2, 157, 1857. F. ? Between Rio San Pedro and Rio Pecos.

**PURPURIDAE.**

PURPURA CANCELLARIA, Shum. 4, 1862. N. Navarro county, Texas.

RAPELLA SUPRAPLICATA, Con., Shum. 4, 1862. N. Navarro county.

**FUSIDAE.**

FUSUS ? (TURRIS ?) PEDERNALIS, Roem. 1, 414, 1849; 2, 38, 1852. H. Fredericksburg. This beautiful species occurs in the Caprina or Barton creek limestone.

*FASCIOLARIA, sp. ind., Hill. N. North of Webberville.

*PYRULA, sp. ind., Roem. 1, 415, 1849; 2, 137, 1852. A. Waterfall, New Braunfels.

**VOLUTIDAE.**

VOLUTILITHES NAVARROENSIS, Shum. 3, 192, 1862. Near Corsicana, Navarro county.

VOLUTA (ROSTELLITES ?) TEXANA, Con. 1, 268, 1855; 2, 158, 1857. G. Eagle Pass, Texas.

**PLEUROTOMIDAE.**

*PLEUROTOMA PEDERNALIS, Roem., Gabb 1, 264, 1872. F.? Nugal, Chihuahua. I fail to find where Roemer described this species.

*PLEUROTOMA TEXANA, Shum. 3, 197, 1862. N. Near Red River, Lamar county. Associated with *Cucullœa millestriata* and *Scalaria lamarensis.*

PLEUROTOMA TIPPANA, Con., Shum. 4, 1862. N. Navarro county.

**ACTAEONIDAE.**

*ACTAEON (TORNATELLA) TEXANA, Shum. 3, 194, 1862. F.B. Red River, Lamar county.

SOLIDULA RIDDELLI, Shum. 3, 194, 1862. N. Navarro county, Texas.

ACTAEONELLA (VOLVULINA) DOLIUM, Roem. 1, 411, 1849; 2, 43, 1852. F. Fredericksburg.

*CINULIA (RINGINELLA) ACUTISPIRA, Shum. 3, 193, 1862. F.B.? Red River, Lamar county.

*CINULIA (RINGINELLA) PULCHELLA, Shum. 3, 192, 1862. N. Chatfield Point, Navarro county.

*CINULIA (AVELLANA) SUBPELLUCIDA, Shum. 3, 193, 1862. N. Bluffs of Red River, Lamar county.

*CINULIA (AVELLANA) TEXANA, Shum. 2, 597, 1860. F. Near Bosque river, Bosque county. Associated with *Exogyra texana* and *Ammonites pedernalis.*

**BULLIDAE.**

GLOBICONCHA ? CONIFORMIS, Roem. 1, 411, 1849; 2, 42, 1852. F.? Fredericksburg, Pedernales river.

GLOBICONCHA ? ELEVATA, Shum. 1, 182, 1854. F.? Cross Timbers, Texas.

GLOBICONCHA ? PLANATA, Roem. 1, 411, 1849; 2, 42, 1852. H.? or W.? Waco Camp, eight miles above New Braunfels.

GLOBICONCHA ? (TYLOSTOMA ?) TUMIDA, Shum. 1, 182, 1854. F.? "Cross Timbers," Texas.

*GLOBICONCHA ? sp. nov. V. A very large undetermined species of *Globiconcha ?* Occurs in the Shoal creek or Vola limestone.

*CYLICHNA MINUSCULA, Shum. 3, 195, 1862. N.? Red river, Lamar county.

*CYLICHNA (BULLA) sp. ind. A. Occurs in Austin chalk at San Antonio.

*CYLICHNA SECALINA, Shum. 3, 195, 1862. N. Corsicana, Navarro county.

*CYLICHNA STRIATELLA, Shum. 3, 194, 1862.

**SIPHONARIIDAE.**

ANISOMYON HAYDENI, Shum. 3, 198, 1862. N. Chatfield Point, Navarro county.

*ANISOMYON, sp. ind. A. I have seen an undetermined species of *Anisomyon* in the Austin chalk from San Antonio.

## CEPHALOPODA.

The *Cephalopoda* of the Texas region are greatly in need of biologic revision.

### NAUTILOIDEA.

NAUTILUS DEKAYI ? Mort., Shum. A.? G. Specimens from the Austin chalk, mostly moulds, can be referred to this species. It also occurs in the glauconitic beds of Southwestern Arkansas, as well as in other regions of the United States Also, N. Shum. 4.

*NAUTILUS ELEGANS, Sow., Roem. 1, 418, 1849; 2, 37, 1852. W.? Waterfall, New Braunfels. The identity of this specimen is uncertain, but I am inclined to believe it the same species as *N. texanus*, Shum.

*NAUTILUS SIMPLEX, Sow., Roem. 1, 418, 1849; 2, 37, 1852. A. Waterfall, below New Braunfels.

*NAUTILUS TEXANUS, Shum. 2, 590, 1860. W. "Near Austin." Also bluffs of Red river, Grayson county. Associated with *Macraster? elegans* and *Ostrea subovata:* Compare *N. elegans* and *N. pseudo-elegans*, d'Orb.

*NAUTILUS, sp. nov., Hill. A well defined species from the Shoal creek limestone at Austin.

CRIOCERAS (ANCYLOCERAS ?) TEXANUS, Hill 4, 1889. Fort Washita, I. T. (Reported.)

This supposed new species, described by me from a specimen alleged to have been taken from the cretaceous rocks of Fort Washita, Indian Territory, is pronounced by Prof. Alpheus Hyatt, of Boston, to be *Lituites bickmoreanus*, Whitfield, a nautiloid species originally found in the Niagara limestone of Wabash, Indiana. As I have been informed by other paleontologists that they have seen the same species from the Washita limestone, it is with the gravest doubts that I withdraw it from the cretaceous fauna, in deference to Prof. Hyatt's opinion as the authority on the *Ammonoidea.*

### AMMONOIDEA.

*Ammonites acuto-carinatus*, Shum. 1, 183, 1854. F. Cross Timbers, Texas. Same as *A. peruvianus*, Von Buch.

AMMONITES BELKNAPII, Marcou 1, 34, 1858. W. Near Denison, Texas. Resembles the outer whorls of *A. peruvianus*, Von Buch.

*AMMONITES BRAZOENSIS, Shum. 2, 594, 1860. W. Shoal creek, near Austin, and in Grayson and Fannin counties; also in McLennan county, and near Fort Washita, I. T.

"Attains a greater size than any species seen in the Cretaceous of Texas." Compare *A. leonensis*, Con.

AMMONITES DENTATO-CARINATUS, Roem. 1, 417, 1849; 2, 33, 1852. A. Waterfall of Guadalupe, New Braunfels. Occurs in upper part of Austin chalk, at Austin.

AMMONITES FLACCIDICOSTA, Roem. 2, 33, 1852. E. F. Waterfall of Guadalupe, New Braunfels.

Compare *A. geniculatus*, Con.

*Ammonites geniculatus*, Con. 2, 159, 1857. W. Bed of Rio San Pedro, and Leon Springs, Texas.

Same as above?

*Ammonites gibbonianus*, Lea, Marcou 1, 35, 1858. W. Elm Fork of Trinity, Fort Worth.

AMMONITES GRAYSONENSIS, Shum. 2, 593, 1860. F.B? Fannin county, near Lowell's Bluff; also 4 miles north of Sherman, Grayson county. Associated at latter locality with *Scaphites vermiculus*. Fig. in White 2, species indefinite.

AMMONITES GUADALUPAE, Roem. 1, 416, 1849; 2, 32, 1852. A.? Waterfall at New Braunfels.

*AMMONITES INEQUIPLICATUS, Shum. 2, 591, 1860. F.? Garnet's Bluff on Red river, Fannin county. Associated with *A. swallovii* and *A. meekianus*.

*Ammonites* (*Placenticeras*) *lenticulare*, Meek 2, 475, 1876. See *A. pleurisepta*, Con.

AMMONITES LEONENSIS, Con. 2, 160, 1857. W. Occurs throughout extent of Washita at Fort Worth, Salado, Austin, and other localities.

AMMONITES MARCIANA, Shum. 1, 183, 1854. Cross Timbers, Texas.

Species poorly defined and figured, and locality indefinite. Of doubtful value.

*AMMONITES MEEKIANUS, Shum. 2, 592, 1860. W.? Near Post Oak creek, Grayson county. Associated with *A. swallovii*.

AMMONITES, of *noricus* type, Hill. T. Differs from *A. cordiformis* (Meek and Hayden, "Paleontology of the Upper Missouri," p. 122), by its flattened keel.

An abundant species in the arenaceous beds at the base of the Comanche series, Cow creek beds, near Travis Peak.

AMMONITES PEDERNALIS, Von Buch, Roem. 1, 418, 1849; 2, 37, 1852. F. Fredericksburg.

*Ammonites pedernalis*, Brinkhorst 1, not Von Buch. This is *A. pleurisepta*, Con.

AMMONITES PERUVIANUS, Von Buch, Marcou 1, 34, 1858. F. Elm Fork of Trinity, Fort Worth.

AMMONITES (PLACENTICERAS) PLACENTA, De Kay, Meek 2, 468, 1876. G.? Meek reports this species from Texas in his "Invertebrate Paleontology," without giving specific locality or horizon.

AMMONITES PLEURISEPTA, Con. 2, 159, 1857. Jacun, 3 miles below Laredo; also at Eagle Pass and other points.

This species has been confused with *A. pedernalis*, Roem., and with *A. lenticulare* by Meek.

AMMONITES SHUMARDI, Marcou 1, 33, 1858. W.? Near Denison, Texas.

AMMONITES SWALLOVII, Shum. 2, 591, 1860. N.? Four and one-half miles north of Sherman, Grayson county. Also, bluffs of Red River in Fannin and Lamar counties. Fig. in White 2.

*Ammonites texanus*, Roem. 1, 417, 1849; 2, 31, 1852. A. Waterfall, New Braunfels. Also at Austin. Same as *A. vespertinus*, Mort.

AMMONITES (MORTONICERAS) VESPERTINUS, Mort. 1, 40, 1834, pl. xvii, fig. 1. A. Plains of Kiamesha, I. T. Characteristic ammonite of Austin chalk. Beautifully figured in Roem. 2 under name of *A. texanus*. This species is the type of Meek's genus *Mortoniceras*, and I am inclined to think it identical with his *M. shoshonense*.

*Mortoniceras shoshonense*, Meek, Schlueter. F.B.? See remarks on preceding species.

AMMONITES WALCOTTI, Hill (not Sowerby). T. Murfreesboro, Ark.

AMMONITES (PRIONOCYCLUS) WOOLGARI, Mant. F.B. Smith's Branch, Texas. From near Heliotes, Bexar county, White. Ward's and Howell's College collection of Paleontology, Rochester, N. Y., 1882. Also, White 2?

ANCYLOCERAS? ANNULATUS, Shum. 2, 595, 1860. F.B.? Shawnee creek, Grayson county, in nodules of clay iron stone imbedded in indurated marly clay near base of Lower (Upper) Cretaceous. Fig. in White 2.

HAMITES FREMONTI, Marcou 1, 36, 1858. W.? Preston, on Red river, due north of Denison. I think I have collected the same species west of Fort Worth.

*HAMITES LARVATUS, Con. 1, 265, 1865. F.B.? Dallas county, Texas.

*HAMITES ROTUNDATUS, Con. 1, 266, 1855. F. B.? (Cast.) Dallas county.

*PTYCHOCERAS TEXANUS, Shum. 3, 190, 1862. N. Near Chatfield Point and Corsicana, Navarro county.

TURRILITES BRAZOENSIS, Roem. 1, 415, 1849; 2, 37, 1852. W. Brazos river, thirty miles above Torrey's trading house. Characteristic of the Washita limestone from Denison to Heliotes.

*TURRILITES HELLICINUS, Shum. 3, 191, 1862. N. Chatfield Point and Corscana, Navarro county, Texas. Associated with *Turrilites splendidus*.

TURRILITES IRRIDENS, Schluet. "Austin, Texas." F.B.? I have not seen this species, and the locality as given is indefinite, as all the horizons of the Cretaceous are within a short distance of Austin.

*TURRILITES SPLENDIDUS, Shum. 3, 191, 1862. N. Chatfield Point, Navarro county.

TURRILITES TRIDENS, Schluet. F.B.?

TURRILITES VARIANS, Schluet. 1. F.B.? "Austin, Texas."

*HELIOCERAS NAVARROENSIS, Shum. 3, 190. 1862. N. Chatfield Point, Navarro county. Associated with *Ptychoceras texanus*.

BACULITES ANCEPS, Lam., Roem., 1, 416, 1849; 2, 36, 1852. A. Waterfall, New Braunfels.

*BACULITES ANNULATUS, Con. 1, 265, 1855. N. Dallas county, Texas.

*BACULITES ASPER, Mort., Roem. 1, 416, 1849; 2, 36, 1852. A. Waterfall, New Braunfels.

BACULITES GRACILIS, Shum. 2, 596, 1860. F.B.? Shawnee creek, in Grayson county, in nodules of argillaceous iron stone with *Hamites* (*Ancyloceras*) *annulatus*.

BACULITES SPILLMANI, Con., Shum. 4, 1862. Navarro county.

BACULITES TIPPANA, Con., Shum. 4, 1862. Navarro county.

SCAPHITES SEMICOSTATUS, Roem. 2, 35, 1852. F.B. Ford of Guadalupe, New Braunfels.

SCAPHITES TEXANUS, Roem. 2, 35, 1852. F.B. Ford of Guadalupe, New Braunfels. Related to *S. vermiformis*, M. & H. See Meek 2, p. 424.

*SCAPHITES (MACROSCAPHITES) VERMICULUS, Shum. 2, 594, 1860. N. ? F.B. ? Marly clay, four miles north of Sherman, Grayson county. See Meek 2, p. 419.

*SCAPHITES VERMICOSUS, Shum. 3, 189, 1862. N. Near Dresden, Navarro county. Probably same as *S. iris*, Con.; "Journal Acad. Nat. Science, Philadel.," n. s., Vol. III, pl. 25, fig. 3.

### DIBRANCHIATA.

*BELEMNITELLA MUCRONATUS. G. Collected at Terrell, Texas, 1889.

## CRUSTACEA.

### CIRRIPEDIA.

*SCALPELLUM INEQUIPLICATUM, Shum. 3, 199, 1862. N. Chatfield Point, Navarro county.

### BRACHYURA.

PARAMITHRAX ? WALKERI, Whitf., White 4, 37, 1880. A.? Near San Antonio, Texas.

GRAPTOCARCINUS TEXANUS, Roem. V. "Neues Jahrbuch Mineralogie, Geolgie, und Paleontologie," 1887; 1st Band., 2d Heft., p. 175. Shoal creek or Vola limestone, erroneously attributed to Austin chalk.

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

NOTE.—All described species are given in this table without revision. For synonomy see Check List.

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trinity Division. | Fredericksburg Division. | | | | Washita Division. | | | | | | | | | |
| | Trinity Sands. | Lower Beds. | Comanche Peak Chalk. | Caprina Limestone. | Barren Flags. | Caprotina Limestone. | Washita Limestone. | Exogyra Arietina Clays. | Shoal Creek Limestone. | Lower Cross Timbers Sands. | Eagle Ford Shales. | Austin-Dallas Chalk. | E. Ponderosa Marls. | Navarro Beds. | Glauconitic Beds. |
| **PROTOZOA.** | | | | | | | | | | | | | | | |
| Nodosaria texana, Con | | | | | | | x | | | | | | | | |
| Orbitulites (Tinoporus) texanus, Roem | | | x | | | | | | | | | | | | |
| Textularia, sp. ind | | | | | | | | | | | | x | | | |
| Globigerina, sp. ind | | | | | | | | | | | | x | | | |
| **COELENTERATA. ANTHOZOA.** | | | | | | | | | | | | | | | |
| Trochocyathus (Turbinolia) texanus, Con | | | | | | | | | | | | | | | |
| Cladophyllia furcifera, Roem | | | | x | | | | | | | | | | | |
| Isastrea discoidea, White | | | | | | | | | | | x? | | | x | |
| Coelosmilia americana, Roem | | | | x | | | | | | | | | | | |
| Parasmilia austinensis, Roem | | | | x | | | | | | | | | | | |
| Pleurocora coalescens, Roem | | | | x | | | | | | | | | | | |
| Pleurocora texana, Roem | | | | | | | | | x | | | | | | |
| Astrocoenia guadalupae, Roem | | | | | | | | | | | | | | | |
| **ECHINODERMATA.** | | | | | | | | | | | | | | | |
| Ophioderma, sp. nov | | | | | | | | x? | | | | | | | |
| Cidaris hemigranosus, Shum | | | | | | | x | | | | | | | | |
| Salenia mexicana, Schluet | | | | | | | | | | | | x? | | | |
| Hemicidaris, sp. ind | | | | | | x | | | | | | | | | |
| Diadema texana, Roem | | | x | | | | | | | | | | | | |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trinity Division. | Fredericksburg Division. | | | | Washita Division. | | | | | | | | | |
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| Cyphosoma texana, Roem | | | x | | | | | | | | | | | | |
| Holectypus planatus, Roem | | | x | | | | x | | | | | | | | |
| Pyrina parryi, Hall | | | | | | | | | | | | | | | |
| Cassidulus aequoreus, Shum | | | | | | | | | | | | x | | | |
| Galerites (Discoidea) sp. nov | | | | | | | x | | | | | | | | |
| Holaster comanchesi, Marcou | | | | | | | x? | | | | | | | | |
| Holaster simplex, Shum | | | | | | | x | | | | | | | | |
| Toxaster texana, Roem | | | x | | | | | | | | | | | | |
| Macraster texanus, Roem | | | | | | | x | | | | | | | | |
| Hemiaster (Macraster?) elegans, Shum | | | | | | | x | | | | | | | | |
| Toxaster elegans, Shum., Con | | | | | | | x | | | | | | | | |
| Hemiaster parastatus, Shum | | | | | | | | | | | | x | | | |
| Hemiaster? texanus, Roem | | | | | | | | | | | | x | | | |
| **MOLLUSCOIDEA.** | | | | | | | | | | | | | | | |
| Eschara, sp. ind | x | | x | | | | | | | | | | | | |
| Lingula, sp. ind | | | | | | | | | | | x? | | | | |
| Terebratulina guadalupae, Roem | | | | | | | | | | | | x | | | |
| Terebratula choctawensis, Shum | | | | | | | x | | | | | | | | |
| Terebratula leonenis, Con | | | | | | | x | | | | | | | | |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
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| Terebratula wacoensis, Roem. | | | | | | | x | | | | | | | | |
| **MOLLUSCA.** | | | | | | | | | | | | | | | |
| **LAMELLIBRANCHIATA.** | | | | | | | | | | | | | | | |
| **Ostreidae.** | | | | | | | | | | | | | | | |
| Ostrea anomiæformis, Roem. | | | | | | | | | | | | x | | | |
| Ostrea bella, Con. | | | | | | | | | | | | | | | |
| Ostrea congesta, Con. | | | | | | | | | | | x | x | x | | |
| Ostrea cortex, Con. | | | x | | | | | | | | | | | | |
| Ostrea franklini, Coquand | x | | | | | | | | | | | | | | |
| Ostrea lyoni, Shum | x? | | | | | | | | | | | | | | |
| Ostrea owenana, Shum | | | | | | | | | | | | | | x | |
| Ostrea planovata, Shum | | | | | | | | | | | | | | x | |
| Ostrea subspatulata, Lyell | | | | | | | | | | | | x? | | | |
| Ostrea vellicata, Con | | | | | | | x? | | | | | | | | |
| Gryphæa aucella, Roem. | | | | | | | | | | | | | | | |
| Gryphæa forniculata, White | | | | | | | x | | | | | | | | |
| Gryphæa pitcheri, Mort. | | x | x | | | | x | x | x | | | | | | |
| Gryphæa pitcheri, Mort., var. dilatata, Hill, not Marcou. | | | | | | | x | | | | | | | | |
| Gryphæa washitaensis, Hill | | | | | | | x | | | | | | | | |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

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| Gryphæa pitcheri, Mort., var. Navia, Hall | ..... | .... | x | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... |
| Gryphæa vesicularis, Lam. | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | x | x? | x |
| Gryphæa vesicularis, Lam., var. aucella, Roem. | ..... | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Exogyra aquilla, Goldfuss | ..... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra arietina, Roem | ..... | ... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... |
| Exogyra caprina, Con | ..... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... |
| Exogyra costata, Say | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | x? | x | x |
| Exogyra fimbriata, Con | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra flabellata, Goldfuss | ..... | x | x | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra fragosa, Con | ..... | .... | .... | .... | .... | .... | .... | x | x | .... | .... | .... | .... | .... | .... |
| Exogyra læviuscula, Roem | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Exogyra matheroniana, d'Orb | ..... | x | x | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra ponderosa, Roem | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | x | x? | x? |
| Gryphæa sinuata, var. americana, Marcou | ..... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra texana, Roem | ..... | x | x | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra walkeri, White | ..... | .... | .... | ... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Exogyra winchelli, White | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Ostrea bellaplicata, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... |
| Ostrea blackii, White | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... |
| Ostrea carinata, Lam | ..... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

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| Ostrea crenulimargo, Roem | | | x? | | | | x | | | | | | | | |
| Ostrea diluviana, Lam | | | | | | | x | | | | | | | | |
| Ostrea larva, Lam | | | | | | | | | | | | ? | x | x | x |
| Ostrea marshii, Sow | | | | | | | | | | | | | | | |
| Ostrea quadriplicata, Shum | | | | | | | x | | | | | | | | |
| Ostrea subovata, Shum | x | | x | | | | x | | x | | | | | | |
| Ostrea vellicata, Con | | | | | | | x | | | | | | | | |
| **ANOMIIDAE.** | | | | | | | | | | | | | | | |
| Anomia, sp. ind | x | | | | | | | | | | x | | x | | |
| Anomia anomiæformis, Roem | | | | | | | | | | | | x | | | |
| Anomia argentaria, Mort | | | | | | | | | | | | | | | x |
| Anomia micronema? Meek | | | | | | | | | | | | | | | x |
| **SPONDYLIDAE.** | | | | | | | | | | | | | | | |
| Plicatula incongrua, Con | | | | | | | | | | | | x | | | |
| Plicatula placunea? d'Orb? | | | | | | | x | | | | | | | | |
| Spondylus guadalupae, Roem | | | | | | | | | x | | | x | | | |
| Spondylus, sp. nov.? | | | | | | | x | | | | | | | | |
| **LIMIDIDAE.** | | | | | | | | | | | | | | | |
| Lima (Radula) crenulicosta, Roem | | | | | | | ? | | | | | | | | |
| Lima kimballi, Gabb | | | ? | | | | ? | | | | | | | | |

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(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
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| Lima wacoensis, Roem. | ..... | .... | X | ... | ... | .... | X | X | .... | .. | .... | .... | .... | .... | .... |
| Lima leonensis, Con... | ..... | ... | X | ... | .... | .... | X | .... | .... | .... | .... | .... | ... | .... | .... |
| **PECTENIDAE.** | | | | | | | | | | | | | | | |
| Pecten æquicostatus, Lam | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Pecten duplicosta, Roem | ..... | .... | x? | .... | .... | .... | .... | .... | x? | .... | .... | .... | ... | .... | .... |
| Pecten (Vola) Roemeri, Hill | ..... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... |
| Vola quinquecostata, Sow | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x |
| Pecten nillsoni, Goldfuss | ..... | .... | .... | .... | .. | .... | .... | .... | .... | .... | .... | x | .... | .. | |
| Pecten quadricostatus? Sow | ..... | .... | x | .... | .... | .... | x | ... | ... | .... | .... | .... | .... | .... | .... |
| Neithea occidentalis, Con | ..... | .... | x | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Pecten texanus, Roem | ..... | .... | x | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | ... |
| Amusium simplicum, Con | ..... | .... | .... | .... | .... | ... | .... | .... | .... | .... | .... | .... | x | x? | x |
| Camptonectes virgatus, Nils | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... |
| Vola (Janira) wrightii, Shum | ..... | .... | .... | x? | .... | x | x? | .... | .... | .... | .... | .... | .... | .... | .... |
| **AVICULIDAE.** | | | | | | | | | | | | | | | |
| Avicula convexo-plana, Roem | ..... | .... | x | .... | .... | .... | .... | ... | .... | .. | .... | .... | .... | .... | .... |
| Avicula irridescens, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| Avicula pedernalis, Roem | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Avicula planiuscula, Roem | ..... | .... | .... | .... | .... | ... | .... | .... | .... | .... | x | .... | .... | .... | .... |
| Avicula? stabilitatis, White | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Gervillia gregaria, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... | .... |
| Aguillaria cumminsi, White | ..... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .. . | .... | .... |
| Gervillopsis (' Dalliaconcha!") invaginata, White | ..... | ... | .... | .... | .... | .... | .... | .... | .... | .... | x | x | .... | .... | .... |
| Inoceramus capulus, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| Inoceramus confertim-annulatus, Roem | ..... | .... | .... | .... | .... | .... | .... | .... | .... | ... | x | .... | .... | .... | .... |
| Inoceramus cripsii, Mant | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | x? | x | x | x |
| Inoceramus diverse-sulcatus, Roem | ..... | .... | .... | .... | .... | .... | .... | .... | .... | ... | .... | x | .... | .... | .... |
| Inoceramus exogyroides, Meek | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | x | .... | .... | .... |
| Inoceramus involutus, Sow | ..... | .... | .... | .... | .... | .... | .... | .... | .... | ... | x? | x | .... | ... | .... |
| Inoceramus latus, Mant | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | x | .... | .... | .... |
| Inoceramus mytiloides, Mant | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | x | .... | .... | .... |
| Inoceramus mytilopsis, Con | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | x? | .... | .... | .... |
| Inoceramus problematicus? Schloth | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | x | .... | .... | .... |
| Inoceramus striatus, Mant | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Inoceramus subquadratus, Schlueter | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Inoceramus texanus, Con | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? |
| Inoceramus umbonatus, Meek | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Inoceramus undulato-plicatus, Roem | ..... | ... | .... | .... | ... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Inoceramus sp. ind | ..... | .... | .... | x | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

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| **MYTILIDAE.** | | | | | | | | | | | | | | | |
| Mytilus semiplicatus, Roem | | | | | | | | | | | | x | | | |
| Mytilus tenuitesta, Roem. | | | x | | | | | | | | | | | | |
| Modiola concentrica-costellata, Roem. | | | x | | | | | | | | | | | | |
| Modiola granulato-cancellata, Roem | | | | | | | | | | | | x | | | |
| Modiola parva, Hill | | | | | | | | | | | | | | | |
| Modiola pedernalis, Roem. | | | x | | | | | | | | | | | | |
| **PINNIDAE.** | | | | | | | | | | | | | | | |
| Pinna, sp. ind., Roem. | | | | | | | | | | | | x | | | |
| Pinna quadrangularis? Goldf., Roem | | | | | | | | | | | | | | | |
| Pinna, sp. ind., Hill. | | | | | | | x | | x | | | | | | |
| **ARCIDAE.** | | | | | | | | | | | | | | | |
| Arca gratiota, Hill | x | | | | | | | | | | | | | | |
| Arca parva-missouriensis, Hill. | x | | | | | | | | | | | | | | |
| Arca proutiana, Shum | | x | | | | | | | | | | | | | |
| Arca subelongata, Con | | | | | | | x | | | | | | | | |
| Arca, sp. ind | | | x | | | | | | | | | | | | |
| Cucullæa millestriata, Shum. | | | | | | | | | | | x | | | | |
| Cucullæa terminalis, Con. | | | x | | | | | | | | | | | | |
| Cucullæa mailleana? d'Orb | | | | | | | | | | | x | | | | |

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| **NUCULIDAE.** | | | | | | | | | | | | | | | |
| Nucula bellastriata, Shum | | | | | | | | | | | x? | | | | |
| Nucula haydeni, Shum | | | | | | | | | | | x? | | | | |
| Nucula serriata, Shum | | | | | | | | | | | x? | | | | |
| **TRIGONIIDAE.** | | | | | | | | | | | | | | | |
| Trigonia aliformis, Goldfuss | | | | | | | | | | | x | | | | |
| Trigonia crenulata, Lam | | x | x | | | | x? | | | | | | | | |
| Trigonia emoryi, Con | | | | | | | x | | | | | | | | |
| Trigonia texana, Con | | | | | | | x | | | | | | | | |
| Trigonia thoracica, Mort | | | | | | | | | | | | | | | x? |
| **ASTARTIDAE.** | | | | | | | | | | | | | | | |
| Cardita? eminula, Con | | | x? | | | | x? | | | | | | | | |
| Astarte lineolata, Roem | | | | | | | | | | | x? | | | | |
| Astarte (Stearnsia) robbinsi, White | | | | | | | x | | | | | | | | |
| Astarte texana, Con | | | x | | | | | | | | | | | | |
| Astarte washitaensis, Shum | | | x? | | | | | | | | | | | | |
| **CRASSATELLIDAE.** | | | | | | | | | | | | | | | |
| Crassatella lineata, Shum | | | | | | | | | | | | | | x | |
| Crassatella? parvula, Shum | | | | | | | | | | | | | | x? | |
| Crassatella subplana? Con | | | | | | | | | | | | | | x | |

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| **CHAMIDAE.** | | | | | | | | | | | | | | | |
| Diceras, sp. ind | | x? | | | | x | | | | | | | | | |
| Requienia (Caprotina) bicornis, Meek | | x? | | | | x | | | | | | | | | |
| Requienia patagiata, White | | | | x | | | | | | | | | | | |
| Requienia (Caprotina) texana, Roem | | x | | x? | | | | | | | | | | | |
| Monopleura marcida, White | | x? | | x | | | | | | | | | | | |
| Monopleura subtriquetra, Roem | | x? | | x | | | | | | | | | | | |
| Monopleura pingiuscula, White | | x? | | x | | | | | | | | | | | |
| Monopleura texana, Roem | | x? | | x | | | | | | | | | | | |
| Caprina crassifibra, Roem | | | | x | | x | | | | | | | | | |
| Caprina guadalupae, Roem | | | | x | | | | | | | | | | | |
| Caprina planata, Con | | | | x? | | | | | | | | | | | |
| Caprina occidentalis, Con | | | | x | | | | | | | | | | | |
| Caprina texana, Roem | | | | x | | x? | | | | | | | | | |
| Plagioptychus ("Rudistes") cordatus, Roem | | | | x | | x? | | | | | | | | | |
| Ichthyosarcolithes anguis, Roem | | | | x | | | | | | | | | | | |
| **RUDISTAE.** | | | | | | | | | | | | | | | |
| Radiolites austinensis, Roem | | | | | | | | | | | | x | | | |
| Hippurites sabinae, Roem | | | | | | | | | | | | x | | | |
| Hippurites texanus, Roem | | | | x? | | x | | | | | | | | | |

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| **LUCINIDAE.** | | | | | | | | | | | | | | | |
| Lucina acute-lineolata, Roem | | | | x | | | | | | | | | | | |
| Lucina parvilineata, Shum | | | | | | | | | | | | | | x | |
| Lucina sublenticularis, Shum | | | | | | | | | | | x? | | | | |
| Fimbria striato-costata? d'Orb | | | x | | | | | | | | | | | | |
| **CARDIIDAE.** | | | | | | | | | | | | | | | |
| Cardium choctawense, Shum | | | | | | | | | | | x | | | | |
| Cardium congestum, Con | | | | | | | | | | | | | | | x? |
| Cardium mediale, Con | | | x | | | | | | | | | | | | |
| Cardium transversale, Roem | | | x? | | | | | | | | | | | | |
| Papyridea? (Cardium) sancti-sabae, Roem | | | x? | | | | | | x? | | | | | | |
| Liocardium (Pachycardium) spillmani, Con | | | | | | | | | | | | | | x | x |
| Proctocardia (Cardium) brazoense, Shum | | | x | | | | | | | | | | | | |
| Proctocardia (Cardium) coloradoense, Shum | | | x | | | | | | | | | | | | |
| Proctocardia (Cardium) filosum, Con | | | x? | | | | | | | | | | | | |
| Proctocardia (Cardium) hillanum, Sow | | | x | | | | x | | | | | | | | |
| Proctocardia (Cardium) multistriatum, Con | | | x? | | | | x? | | | | | | | | |
| Proctocardia (Cardium) texana, Con | | | | | | | x | | | | | | | | |
| **CYRENIDAE.** | | | | | | | | | | | | | | | |
| Cyrena arkansaensis, Hill | x | | | | | | | | | | | | | | |

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(CONTINUED)

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| Cyrena, sp. nov | ..... | .... | .... | x | .... | .... | .... | ... | .... | .... | .... | .... | .... | .... | .... |
| Corbicula pickensis, Hill | x | .... | .... | .... | .... | .... | .... | .. | .. | .... | .. | .... | .... | .... | .... |
| **CYPRINIDAE.** | | | | | | | | | | | | | | | |
| Cyprina? sp. ind | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Venilia (Cyprina) laphami, Shum | ..... | .... | .... | .. | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| Isocardia washita, Marcou | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | ... |
| Isocardia? sp. ind | ..... | .... | x | .... | ... | .... | .... | .... | .... | .... | .... | .... | ... | .... | .... |
| **VENERIDAE.** | | | | | | | | | | | | | | | |
| Tapes hilgardi, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .. | .... | .... |
| Venus? sublamellosus, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| Venus? sp. ind | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Cytherea (Dione) lamarensis, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| Cytherea (Dione) leonensis, Con | ..... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... | .... | .... | .... | .... |
| Cytherea (Dione) texana, Con | ..... | .... | x | .. | .... | .... | x? | .... | .... | .... | .... | .... | .... | .... | .... |
| Cyprimeria crassa, Meek | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... |
| **TELLINIDAE.** | | | | | | | | | | | | | | | |
| Linearia (Arcopagia) texana, Roem | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Linearia (Solen?) irradians, Roem | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | ... | .... | .... | .... |
| Gari (Psammobia) cancellato-sculpta, Roem | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

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| **PAPHIIDAE.** | | | | | | | | | | | | | | | |
| Tagellus ellipticum, Con. | | | | | | | | | | | | | | x | |
| **SOLENIDAE.** | | | | | | | | | | | | | | | |
| Solen? elegans? d'Orb, Roem. | | | x | | | | | | | | | | | | |
| **PHOLADOMYIDAE.** | | | | | | | | | | | | | | | |
| Pholadomya lincecumi, Shum | | | | | | | | | | | | | | x | |
| Pholadomya pedernales, Roem. | | | x | | | | | | | | | | | | |
| Pholadomya texana, Con | | | x? | x? | | | | | | | | | | | |
| Homomya alta, Roem. | | | x | | | | | | x? | | | | | | |
| Panopæa? newberryi, Shum. | | | x | | | | | | | | | | | | |
| Thracia myaeformis, White | | | x | | | | | | | | | | | | |
| Panopæa? subparallela, Shum | | | | | | | | | x? | | | | | | |
| Panopæa? subplicata, Shum. | | | | | | | | | | | | | | x | |
| Panopæa? texana, Shum. | | | x? | | | | | | | | | | | | |
| Panopæa? regularis, d'Orb | | | x? | | | | | | x? | | | | | | |
| Pachyma? austinensis, Shum | | | | | | | x | | | | | | | | |
| Pachyma? (Cypricardia)? texana, Roem | | | x | | | | | | | | | | | | |
| Pachyma? compacta, White | | | x | | | | x? | | | | | | | | |
| **ANATINIDAE.** | | | | | | | | | | | | | | | |
| Anatina sulcatina, Shum | | | | | | | | | | | | | | | |

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| Liopistha (Cardium?) elegantulum, Roem | | | | | | | | | | | | x | | | |
| **MACTRIDAE.** | | | | | | | | | | | | | | | |
| Mactra texana, Con | | | | | | | | | | | | | | | x? |
| **MYIDAE.** | | | | | | | | | | | | | | | |
| Corbula graysonensis, Shum | | | | | | | | | | | x | | | | |
| Corbula tuomeyi, Shum | | | | | | | | | | | x | | | | |
| Corbula, sp. nov., Hill | | | | x | | | | | | | | | | | |
| Neaera alaeformis, Shum | | | | | | | | | | | x | | | | |
| **PHOLADIDAE.** | | | | | | | | | | | | | | | |
| Teredo, sp. ind | | | | | | | | | | | x | | | | |
| **GASTEROPODA.** | | | | | | | | | | | | | | | |
| **PLEUROTOMARIIDAE.** | | | | | | | | | | | | | | | |
| Pleurotomaria austinensis, Shum | | | | | | | x | | | | | | | | |
| **PHASIANELLINAE.** | | | | | | | | | | | | | | | |
| Phasianella perovata, Shum | | | x | | | | x? | | | | | | | | |
| Phasianella, sp. ind., Roem | | | x | | | | | | | | | x | | | |
| **TROCHINAE.** | | | | | | | | | | | | | | | |
| Trochus texanus, Roem | | | | x | | | | | | | | | | | |
| **NERITIDAE.** | | | | | | | | | | | | | | | |
| Neritina nebrascensis?, M. & H. | x | | | | | | | | | | | | | | |

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| Neritopsis biangulatus, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| **SOLENIIDAE.** | | | | | | | | | | | | | | | |
| Solarium planorbis | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **SCALARIDAE.** | | | | | | | | | | | | | | | |
| Scalaria (Scala) bicarinifera, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... |
| Scalaria (Scala) forsheyi, Meek | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Scalaria lamarensis, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | x? | .... |
| Scalaria, sp. ind | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| **TURRITELLIDAE.** | | | | | | | | | | | | | | | |
| Turritella corsicana, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Turritella irrorata, Con | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Turritella? leonensis, Con | .... | x | .... | .... | .... | .... | x? | .... | .... | .... | .... | .... | .... | .... | .... |
| Turritella marnochi, White | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Turritella planilateris, Con | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... |
| Turritella seriatim-granulata, Roem | .... | .... | x? | .... | .... | .... | x? | x? | .... | .... | .... | .... | .... | .... | .... |
| Turritella winchelli, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| **VERMETIDAE.** | | | | | | | | | | | | | | | |
| Vermetus (Serpula), sp. ind | x | .... | x | .... | .... | .... | x | .... | x | .... | x | .... | .... | x | x |
| **NATICIDAE.** | | | | | | | | | | | | | | | |
| Natica? (Amauropsis?) avellana, Roem | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |

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| Natica? collina, Con | | | | | | | x | | | | | | | | |
| Natica? texana, Con | | | | | | | | | | | | | | | |
| Lunatia? (Natica) acutispira, Shum | | | x | | | | | | | | | | | | |
| Tylostoma? (Natica?) pedernalis, Roem | | x | | | | | | | | | | | | | |
| Tylostoma? (Natica?) prægrandis, Roem | | | x | | | | | | | | | | | | |
| **PALUDINIDAE.** | | | | | | | | | | | | | | | |
| Vivipara? cassatotensis, Hill | x | | | | | | | | | | | | | | |
| Vivipara (Pleurocera) strombiformis, Schloth | x | | | | | | | | | | | | | | |
| **PYRAMIDELLIDAE.** | | | | | | | | | | | | | | | |
| Eulima? subfusiformis, Shum | | | x | | | | | | | | | | | | |
| Eulima? texana, Roem | | | | | | | | | | | | x | | | |
| Chemnitzia gloriosa, Roem | | | | | | | | | | | | x | | x | |
| Chemnitzia occidentalis, Gabb | | | x | | | | x? | | | | | | | | |
| Chemnitzia? (Scalaria?) texana, Meek | | | | | | | | | | | | x | | | |
| **NERINEIDAE.** | | | | | | | | | | | | | | | |
| Nerinea acus, Roem | | x | x | x | | | | | | | | | | | |
| Nerinea austinensis, Roem | | x | | | | | | | | | | | | | |
| Nerinea cultrispira, Roem | | | | x | | | | | | | | | | | |
| Nerinea schottii, Con | | | | x | | | | | | | | | | | |
| Nerinea subula, Roem | | | | x | | | | | | | | | | | |

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| | Trinity Sands. | Lower Beds. | Comanche Peak Chalk. | Caprina Limestone. | Barren Flags. | Caprotina Limestone. | Washita Limestone. | Exogyra Arietina Clays. | Shoal Creek Limestone. | Lower Cross Timber Sands. | Eagle Ford Shales. | Austin-Dallas Chalk. | E. Ponderosa Marls. | Navarro Beds. | Glauconitic Beds. |
| Nerinea texana, Roem | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **CERITHIIDAE.** | | | | | | | | | | | | | | | |
| Cerithium austinensis, Roem | .... | x | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Cerithium bosquense, Shum | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Cerithium obliterato-granosum, Roem | .... | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Cerithium, sp. ind., Roem | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| **APORRHAIDAE.** | | | | | | | | | | | | | | | |
| Anchura (Drepanocheilus) mudgeana, White | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| **STROMBIDAE.** | | | | | | | | | | | | | | | |
| Pugnellus densatus, Con | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Rostellaria? collina, Con | .... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Rostellaria monpleurophila, Roem | .... | .... | .... | x? | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Rostellaria, sp. ind., Roem | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| **FICULIDAE.** | | | | | | | | | | | | | | | |
| Ficus (Pyrifusus) granosus, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... |
| **BUCCINIDAE.** | | | | | | | | | | | | | | | |
| Buccinopsis? conradi, Hill | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Buccinopsis? parryi, Con | .... | .... | x | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| **PURPURIDAE.** | | | | | | | | | | | | | | | |
| Purpura cancellaria, Shum.? | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trinity Division. | Fredericksburg Division. | | | | Washita Division. | | | | | | | | | |
| | Trinity Sands. | Lower Beds. | Comanche Peak Chalk. | Caprina Limestone. | Barren Flags. | Caprotina Limestone. | Washita Limestone. | Exogyra Arietina Clays. | Shoal Creek Limestone. | Lower Cross Timber Sands. | Eagle Ford Shales. | Austin-Dallas Chalk. | E. Ponderosa Marls. | Navarro Beds. | Glauconitic Beds. |
| Rapa supraplicata, Con. | | | | | | | | | | | | | x | x | |
| **FUSIDAE.** | | | | | | | | | | | | | | | |
| Fusus? (Turris?) pedernalis, Roem | | | | x | | | | | | | | | | | |
| Fasciolaria, sp. ind | | | | | | | | | | | | | | x | |
| Pyrula, sp. ind., Roem | | | | | | | | | | | | x | | | |
| **VOLUTIDAE.** | | | | | | | | | | | | | | | |
| Volutilithes, navarroensis, Shum | | | | | | | | | | | | | x | x | |
| Voluta (Rostellites?) texana, Con. | | | | | | | | | | | | | | | x |
| **PLEUROTOMIDAE.** | | | | | | | | | | | | | | | |
| Pleurotoma? pedernalis, Roem. | | | x? | | | | | | | | | | | | |
| Pleurotoma texana, Shum | | | | | | | | | | | | | | x | |
| Pleurotoma tippana, Con | | | | | | | | | | | | | | x | |
| **ACTAEONIDAE.** | | | | | | | | | | | | | | | |
| Actaeon (Tornatella) texana, Shum. | | | | | | | | | | | x | | | | |
| Solidula riddelli, Shum | | | | | | | | | | | | | | x | |
| Actaeonella (Volvulina) dolium, Roem | | | x | | | | | | | | | | | | |
| Cinulia (Ringinella) acutispira, Shum | | | | | | | | | | | x? | | | | |
| Cinulia (Ringinella) pulchella, Shum | | | | | | | | | | | | | | x | |
| Cinulia (Avellana) subpellucida, Shum | | | | | | | | | | | x? | | | x? | |
| Cinulia (Avellana) texana, Shum | | | x | | | | | | | | | | | | |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| **BULLIDAE.** | | | | | | | | | | | | | | | |
| Globiconcha? coniformis, Roem | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Globiconcha? elevata, Shum | ..... | .... | x | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Globiconcha? planata, Roem | ..... | .... | .... | x? | .... | .... | x? | .... | .... | .... | .... | .... | .... | .... | .... |
| Globiconcha? (Tylostoma?) tumida, Shum | ..... | .... | x? | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Globiconcha?, sp. nov | ..... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... |
| Cylichna minuscula, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... |
| Cylichna (Bulla), sp. ind | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Cylichna secalina, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Cylichna striatella, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| **SIPHONARIIDAE.** | | | | | | | | | | | | | | | |
| Anisomyon haydeni, Shum | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Anisomyon, sp. ind | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| **CEPHALOPODA.** | | | | | | | | | | | | | | | |
| **NAUTILOIDEA.** | | | | | | | | | | | | | | | |
| Nautilus dekayi?, Mort | ..... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | x | x |
| Nautilus, elegans, Sow | ..... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | x? | .... | .... | .... |
| Nautilus simplex, Sow., Roem | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Nautilus texanus, Shum | ..... | .... | .... | .... | .... | .... | x | .... | x? | .... | .... | .... | .... | .... | .... |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
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| **AMMONOIDEA.** | | | | | | | | | | | | | | | |
| Ammonites acuto-carinatus, Shum | | | x | | | | | | | | | | | | |
| Ammonites belknapii, Marcou | | | | | | | x | | | | | | | | |
| Ammonites brazoensis, Shum | | | | | | | x | | | | | | | | |
| Ammonites dentato-carinatus, Roem | | | | | | | | | | | | x | | | |
| Ammonites flaccidicosta, Roem | | | | | | | | | | | x | | | | |
| Ammonites geniculatus, Con | | | | | | | x | | | | | | | | |
| Ammonites gibbonianus, Lea | | | x? | | | | x | | | | | | | | |
| Ammonites graysonensis, Shum | | | | | | | | | | | x? | | | | |
| Ammonites guadalupae, Roem | | | | | | | | | | | | x? | | | |
| Ammonites inequiplicatus, Shum | | | x? | | | | | | | | | | | | |
| Ammonites (Placenticeras) lenticulare, Meek | | | x? | | | | | | | | | | | | x |
| Ammonites leonensis, Con | | | | | | | x | | | | | | | | |
| Ammonites marciana, Shum | | | | | | | x | | | | | | | | |
| Ammonites meekianus, Shum | | | | | | | | | | | x | | | | |
| Ammonites, noricus type, Hill | x | | | | | | | | | | | | | | |
| Ammonites pedernalis, Von Buch | | | x | | | | | | | | | | | | |
| Ammonites pedernalis, Brinkhorst | | | | | | | | | | | | | | | x |
| Ammonites peruvianus, Von Buch | | | x? | | | | | | | | | | | | |
| Ammonites (Placenticeras) placenta, DeKay | | | | | | | | | | | | | | | x? |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

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| Ammonites pleurisepta, Con | | | | | | | | | | | | | | | x |
| Ammonites shumardi, Marcou | | | | | | | x? | | | | | | | | |
| Ammonites swallovii, Shum | | | | | | | | | | | x? | | | | |
| Ammonites texanus, Roem | | | | | | | | | | | | x | | | |
| Ammonites (Mortoniceras) vespertinus, Mort | | | | | | | | | | | | x | | | |
| Mortoniceras shoshonense, Meek | | | | | | | | | | | x? | x | | | |
| Ammonites walcottii, Hill, not Sowerby | x | | | | | | | | | | | | | | |
| Ammonites (Prionocyclus) woolgari, Mant | | | | | | | | | | | x | | | | |
| Ancyloceras? annulatus, Shum | | | | | | | | | | | x? | | | | |
| Hamites fremonti, Marcou | | | | | | | x? | | | | | | | | |
| Hamites larvatus, Con | | | | | | | | | | | x? | | | | |
| Hamites rotundatus, Con | | | | | | | | | | | x? | | | | |
| Ptychoceras texanus, Shum | | | | | | | | | | | | | | x | |
| Turrilites brazoensis, Roem | | | | | | | x | | | | | | | | |
| Turrilites hellicinus, Shum | | | | | | | | | | | | | | x | |
| Turrilites irridens, Schluet | | | | | | | | | | | x? | | | | |
| Turrilites splendidus, Shum | | | | | | | | | | | | | | x | |
| Turrilites tridens, Schluet | | | | | | | | | | | x? | | | | |
| Turrilites varians, Schluet | | | | | | | | | | | x? | | | | |
| Helioceras navarroensis, Shum | | | | | | | | | | | | | | x | |

## II.—Tabular View of the Stratigraphic Occurrence of the Invertebrate Fossils of the Cretaceous Formations of Texas.

(CONTINUED.)

| | Lower or Comanche Series (Austin Section). | | | | | | | | | Upper or Black Prairie Series. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Baculites anceps, Lam | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Baculites annulatus, Con | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Baculites asper, Mort | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... |
| Baculites gracilis, Con | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Baculites spillmani, Con., Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... | .... |
| Baculites tippaensis, Con | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| Scaphites semicostatus, Roem | .... | .... | .... | .... | .. | .... | .... | .... | .... | .... | x | .... | .... | .. | .. |
| Scaphites texanus, Roem | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... |
| Scaphites (Macroscaphites) vermiculus, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | x? | .... |
| Scaphites vermicosus, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| **DIBRANCHIATA.** | | | | | | | | | | | | | | | |
| Belemnitella mucronatus | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x |
| **CRUSTACEA.** | | | | | | | | | | | | | | | |
| **CIRRIPEDIA.** | | | | | | | | | | | | | | | |
| Scalpellum inequiplicatum, Shum | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x | .... |
| **BRACHYURA.** | | | | | | | | | | | | | | | |
| Paramithrax? walkeri, Whitf | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | x? | .... | .... | .... |
| Graptocarcinus texanus, Roem | .... | .... | .... | .... | .... | .... | .... | .... | x | .... | .... | .... | .... | .... | .... |

# LISTS OF FAUNAS.

## FAUNAS OF THE VARIOUS HORIZONS OF THE TWO CRETACEOUS FORMATIONS OF TEXAS.

All species are given. For revision see Check List.

A dagger (†) indicates those species which are doubtfully referred to the horizon in question.

### A.—COMANCHE SERIES.

#### FAUNA OF TRINITY SANDS.

*Eschara*, sp. ind.
*Ostrea franklini*, Coquand.
*Ostrea lyoni*,† Shumard.
*Ostrea subovata*, Shum.
*Anomia*, sp. ind.
*Arca gratiota*, Hill.
*Arca parva-missouriensis*, Hill.
*Arca proutiana*,† Shum.
*Cyrena arkansaensis*, Hill.
*Corbicula pikensis*, Hill.
*Neritina nebrascensis?* M. and H.
*Vermetus* (*Serpula*), sp. ind.
*Vivipara? cassatotensis*, Hill.
*Pleurocera strombiformis*, Schloth.
*Buccinopsis? conradi*, Hill.
*Ammonites*, noricus type, Hill.
*Ammonites walcottii*, Hill, not Sow.

And unstudied forms.

#### FAUNA OF LOWER OR FREDERICKSBURG DIVISION.

##### COMANCHE PEAK AND ALTERNATING BEDS.

*Orbitulites* (*Tinoporus*) *texanus*, Roem.
*Diadema texana*, Roem.
*Cyphosoma texana*, Roem.
*Holectypus planatus*, Roem.
*Toxaster texana*, Roem.
*Eschara*, sp. ind.
*Ostrea cortex*, Con.
*Gryphœa calceola*, Quencedt, M. and H.
*Gryphœa pitcheri*, Mort.
*Gryphœa pitcheri*, Mort. *var. Navia*, Hall.
*Exogyra flabellata*, Goldfuss.
*Exogyra matheroniana*, d'Orb.
*Exogyra texana*, Roem.
*Ostrea crenulimargo*,† Roem.
*Ostrea subovata*, Shum.
*Cyprina?* sp. ind.
*Isocardia?* sp. ind.
*Cypricardia texana*, Roem.
*Venus?* sp. ind.
*Cytherea* (*Dione*) *texana*, Con.
*Linearia* (*Arcopagia*) *texana*, Roem.
*Linearia* (*Solen?*) *irradians*, Roem.
*Solen? elegans*, d'Orb.
*Pholadomya pedernalis*, Roem.
*Pholadomya texana*,† Con.
*Homomya alta*, Roem.
*Panopœa? newberryi*, Shum.
*Thracia myœformis*, White.
*Panopœa? texana*,† Shum.
*Panopœa? regularis*,† d'Orb.

*Lima kimballi*,† Gabb.
*Lima wacoensis*, Roem.
*Lima leonensis*, Con.
*Pecten duplicosta*,† Roem.
*Pecten quadricostatus?* Sow.
*Neithea occidentalis*, Con.
*Pecten texanus*, Roem.
*Avicula convexo-plana*, Roem.
*Avicula pedernalis*, Roem.
*Mytilus tenuitesta*, Roem.
*Modiola concentrica-costellata*, Roem.
*Modiola pedernalis*, Roem.
*Arca*, sp. ind.
*Cucullæa terminalis*, Con.
*Trigonia crenulata*, Lam.
*Cardita? eminula*,† Con.
*Astarte texana*, Con.
*Astarte washitaensis*,† Shum.
*Diceras*,† sp. ind.
*Monopleura*, sp. ind.
*Requienia* (*Caprotina*) *texana*, Roem.
*Fimbria striato-costata?* d'Orb.
*Arcopagia texana*, Roem.
*Corbis*, sp. ind.
*Cardium mediale*, Con.
*Cardium transversale*,† Roem.
*Papyridea?* (*Cardium*) *sancti-sabæ*,† Roem.
*Protocardia* (*Cardium*) *brazoense*, Shum.
*Protocardia* (*Cardium*) *coloradoense*, Shum.
*Protocardia* (*Cardium*) *filosum*,† Con.
*Protocardia* (*Cardium*) *hillanum*, Sow.
*Protocardia* (*Cardium*) *multistriatum*,† Con.
*Pachyma?* (*Cypricardia?*) *texana*, Roem.
*Pachyma? compacta*, White.
*Pinna*, sp. ind,
*Phasianella perovata*, Shum.
*Phasianella*, sp. ind., Roem.
*Turritella seriatim-granulata*,† Roem.
*Vermetus* (*Serpula*), sp. ind.
*Lunatia?* (*Natica*) *acutispira*, Shum.
*Tylostoma?*(*Natica?*)*pedernalis*, Roem.
*Tylostoma?* (*Natica?*) *praegrandis*, Roem.
*Eulima? subfusiformis*, Shum.
*Chemnitzia occidentalis*, Gabb.
*Nerinea acus*, Roem.
*Nerinea texana*, Roem.
*Cerithium austinensis*, Roem.
*Cerithium bosquense*, Shum.
*Rostellaria? callira*, Con.
*Buccinopsis? parryi*, Con.
*Pleurotoma? pedernalis*,† Roem.
*Actaeonella* (*Volvulina*) *dolium*, Roem.
*Cinulia* (*avellana*) *texana*, Shum.
*Globiconcha? coniformis*, Roem.
*Globiconcha? elevata*, Shum.
*Globiconcha?* (*Tylostoma?*) *turrida*,† Shum.
*Fusus pedernalis*, Roem.
*Ammonites acuto-carniatus*, Shum.
*Ammonites gibbonianus*,† Lea.
*Ammonites inequiplicatus*,† Shum.
*Ammonites pedernalis*, Von Buch.
*Ammoniets peruvianus*, Von Buch.

### FAUNA OF CAPRINA LIMESTONE.

*Cladophyllia furcifera*,† Roem.
*Coelosmilia americana*, Roem.
*Parasmilia austinensis.*
*Pleurocora coalescens*, Roem.
*Hippurites texanus*,† Roem.
*Lucina acute-lineolata*, Roem.
*Cyrena*, sp. nov.
*Pholadomya texana*,† Con.

*Vola* (*Janira*) *wrightii*, Shum.
*Requienia patagiata*, White.
*Requienia* (*Caprotina*) *texana*, Roem.
*Monopleura marcida*, White.
*Monopleura subtriquetra*, Roem.
*Monopleura pingiuscula*, White.
*Monopleura texana*, Roem.
*Caprina crassifibra*, Roem.
*Caprina guadalupae*, Roem.
*Caprina planata*, † Con.
*Caprina texana*, Roem.
*Plagioptychus* ("*Rudistes*") *cordatus*, Roem.
*Ichthyosarcolithes anguis*, Roem.
*Corbula*, sp. nov., Hill.
*Trochus texanus*, Roem.
*Solarium planorbis*.
*Natica*? (*Amauropsis*?) *avellana*, Roem.
*Nerinea acus*, Roem.
*Nerinea austinensis*, Roem.
*Nerinea cultrispira*, Roem.
*Nerinea schottii*, Con.
*Nerinea subula*, Roem.
*Cerithium obliterato-granosum*, Roem.
*Rostellaria monpleurophila*, † Roem.
*Fusus*? (*Turris*?) *pedernalis*, Roem.
*Globiconcha*? *planata*, † Roem.

FAUNA OF CAPROTINA LIMESTONE.

*Hemicidaris*, sp. ind.
*Exogyra flabellata*, Goldfuss.
*Exogyra matheroniana*, d'Orb.
*Exogyra texana*, Roem.
*Vola* (*Janira*) *wrightii*, Shum.
*Diceras*, sp. ind.
*Requienia* (*Caprotina*) *bicornis*, Meek.
*Requienia* (*Caprotina*) *texana*, Roem.
*Caprina crassifibra*, Roem.
*Caprina texana*, † Roem.
*Plagioptychus* ("*Rudistes*") *cordatus*, † Roem.
*Hippurites texanus*, Roem.
*Nerinea*, sp. nov.

# FAUNA OF WASHITA DIVISION.

## WASHITA LIMESTONE SUBDIVISION.

*Nodosaria texana*, Con.
*Cidaris hemigranosus*, Shum.
*Holectypus planatus*, Roem.
*Galerites* (*Discoidea*), sp. nov.
*Holaster comanchesi*, † Marcou.
*Holaster simplex*, Shum.
*Macraster texanus*, Roem.
*Hemiaster* (*Macraster*?) *elegans*, Shum.
*Toxaster elegans*, Shum., Con.
*Terebratula choctawensis*, Shum.
*Terebratula leonensis*, Con.
*Terebratula wacoensis*, Roem.
*Ostrea vellicata*, † Con.
*Gryphœa forniculata*, † White.
*Gryphœa pitcheri*, Mort.
*Arca subelongata*, Con.
*Trigonia crenulata*, † Lam.
*Trigonia emoryi*, Con.
*Trigonia texana*, Con.
*Cardita*? *eminula*, † Con.
*Astarte* (*Sternsia*) *robbinsi*, White.
*Protocardia* (*Cardium*) *hillanum*, Sow.
*Protocardia* (*Cardium*) *multistriatum*, † Con.
*Protocardia* (*Cardium*) *texana*, Con.
*Cytherea* (*Dione*) *leonensis*, † Con.
*Cytherea* (*Dione*) *texana*, † Con.
*Pachyma*? *austinensis*, Shum.
*Pachyma*? *compacta*, † White.
*Pleurotomaria austinensis*, Shum.

*Gryphæa pitcheri*, Mort. *var. dilatata*, Hill. Same as next.
*Gryphæa washitaensis*, Hill.
*Exogyra aquilla*, Goldfuss.
*Gryphæa sinuata var. americana*, Marcou.
*Exogyra walkeri*, White.
*Ostrea carinata*, Lam.
*Ostrea crenulimargo*,† Roem.
*Ostrea subovata*, Shum.
*Ostrea vellicata*, Con.
*Plicatula placunea?* d'Orb?
*Spondylus*, sp. nov?
*Lima kimballi*,† Gabb.
*Lima wacoensis*, Roem.
*Lima leonensis*, Con.
*Pecten quadricostatus*, Sow.
*Neithea occidentalis*, Con.
*Pecten texanus*, Roem.
*Vola* (*Janira*) *wrightii*,† Shum.
*Pinna*, sp. ind., Hill.
*Phasianella perovata*,† Shum.
*Turritella irrorata*, Con.
*Turritella marnochi*, White.
*Turritella planilateris*, Con.
*Turritella seriatim-granulata*,† Roem.
*Vermetus* (*Serpula*), sp. ind.
*Natica? collina*, Con.
*Chemnitzia occidentalis*,† Gabb.
*Globiconcha? planata*,† Roem.
*Nautilus texanus*, Shum.
*Cephalopod* (*genus indeterminate*) *texanus*, Hill.
*Ammonites belknapii*, Marcou.
*Ammonites brazoensis*, Shum.
*Ammonites geniculatus*, Con.
*Ammonites gibbonianus*, Lea.
*Ammonites leonensis*, Con.
*Ammonites marciana*, Shum.
*Ammonites shumardi*,† Marcou.
*Hamites fremonti*, Marcou.
*Turrilites brazoensis*, Roemer.

### FAUNA OF EXOGYRA ARIETINA CLAYS.

*Ophioderma*, sp. nov.†
*Holectypus*, sp. nov.
*Gryphæa pitcheri*, Mort.
*Exogyra arietina*, Roem.
*Exogyra caprina*, Con.
*Neithea quadricostatus*, Roem.
*Turritella*, sp. nov.

### FAUNA OF SHOAL CREEK LIMESTONE.

*Gryphæa pitcheri, Mort. var. naria*, Hall. (at base only.)
*Exogyra fragosa*, Con.
*Ostrea subovata*, Shum.
*Pecten* (*Vola*) *roemeri*, Hill.
*Papyridea ?* ( *Cardium* ) *sancti-sabæ*,† Roem.
*Panopæa? regularis*,† d'Orb.
*Panopæa subparallela*,† Shum.
*Vermetus* (*serpula*) sp. ind.
*Globiconcha?* sp. nov.
*Nautilus texanus*,† Shum.
*Ammonites*, sp. ind.
*Cerithium*, sp. ind.
*Turritella*, sp. ind.
*Glycimeris*, sp. ind.
*Pinna*, sp. ind.
*Echinodermata.*
*Foraminiferæ.*

FAUNA OF THE DENISON BEDS.*

*Ostrea quadriplicata*, Shum.
*Inoceramus*, nov. sp.
*Inoceramus capulus.*
*Corbula tuomeyi.*
*Corbula graysonesis*, Shum.
*Panopœa subparallela*, Shum.
*Nucula haydeni.*
*Gervillia gregaria.*
*Tapes hilgardi.*
*Cytherea lamarensis.*
*Turitella*, sp. ind.
*Ammonites graysonesis*, Shum.
*Ammonites inequiplicatus*, Shum.
*Ammonites meekianus*, Shum.
*Ammonetes swallovii*, Shum.
*Ancyloceras annulatus*, Shum.
*Baculites gracilus*, Con.
*Scaphites vermiculus*, Shum.

## B.—UPPER OR BLACK PRAIRIE SERIES.

FAUNA OF LOWER CROSS TIMBER SANDS.

*Gervillia gregaria*, Shum.
*Aguillaria cumminsi*, White.
*Turritella*, sp. ind.
*Ammonites*, sp. ind.
*Scaphites*, sp. ind.
*Cerithium*, sp. ind.
*Ostrea*, sp. ind.
*Corbicula*, sp. ind.
*Arbacia*, sp. ind.
*Teredo*, sp. ind.
*Neritina*, sp. ind.

FAUNA OF EAGLE FORD SHALES.

*Isastrea discoidea*,† White.
*Lingula*,† sp. ind.
*Ostrea congesta*, Con.
*Ostrea bellaplicata*, Shum.
*Ostrea blackii*, White.
*Exogyra columbella*, Meek.
*Anomia*, sp. ind.
*Lima* (*Radula?*) *crenulicosta*,† Roem.
*Avicula irridescens*, Shum.
*Avicula planiuscula*, Roem.
*Avicula?? stabilitatis*,† White.
*Gervillopsis* ("*Dalliaconcha*"*!*) *invaginata*, White.
*Inoceramus capulus*,† Shum.
*Inoceramus confertim-annulatus*, Roem.
*Inoceramus cripsii*,† Mant.
*Inoceramus exogyroides*,† Meek.
*Inoceramus involutus*,† Sow.
*Inoceramus latus*,† Mant.
*Cyprimeria crassa*, Meek.
*Gari* (*Psammobia*) *cancellato-sculpta*, Roem.
*Corbula graysonensis*,† Shum.
*Corbula tuomeyi*, Shum.
*Neaera aliformis*, Shum.
*Teredo*, sp. ind.
*Neritopsis biangulatus*,† Shum.
*Scalaria lamarensis*,† Shum.
*Natica*, sp. ind.
*Vermetus* (*Serpula*), sp. ind.
*Anchura* (*Drepanocheilus*) *mudgeana*,† White.
*Aetaeon* (*Tornatella*) *texana*, Shum.
*Cinulia* (*Ringinella*) *acutispira*,† Shum.
*Cinulia* (*Avellana*) *subpellucida*,† Shum.
*Ammonites flaccidicosta*, Roem.

*These beds succeed the Washita limestone from Fort Worth northward. Some of these forms have been questionably placed in the Eagle Ford shales in the tables. These are quoted from Shumard, "Trans. Acad. Sci. of St. Louis," Vol. I.

*Inoceramus mytiloides*, Mant.
*Inoceramus mytilopsis*, Con.
*Inoceramus problematicus?* Schloth.
*Cucullæa millestriata*, Shum.
*Cucullæa mailleana?* d'Orb.
*Nucula bellastriata*, † Shum.
*Nucula haydeni*, † Shum.
*Nucula serriata*, † Shum.
*Trigonia aliformis*, Goldfuss.
*Astarte lineolata*, † Roem.
*Lucina sublenticularis*, † Shum.
*Cardium choctawense*, Shum.
*Venilia* (*Cyprina*) *laphami*, † Shum.
*Isocardia washita*, † Marcou.
*Tapes hilgardi*, † Shum.
*Venus? sublamellosus*, † Shum.
*Cytherea* (*Dione*) *lamarensis*, † Shum.
*Ammonites graysonensis*, † Shum.
*Ammonites meekianus*, Shum.
*Ammonites swallovii*, † Shum.
*Mortoniceras shoshonese*, † Meek.
*Ammonites* (*Prionocyclus*) *woolgari*, † Mant.
*Ancyloceras? annulatus*, † Shum.
*Hamites larvatus*, † Con.
*Hamites rotundatus*, † Con.
*Turrilites irridens*, † Schluet.
*Turrilites tridens*, † Schluet.
*Turrilites varians*, † Schluet.
*Scaphites texanus*, Roem.
*Scaphites semicostatus*, Roem.
*Scaphites* (*Macroscaphites*) *vermiculus*, † Shum.

FAUNA OF AUSTIN-DALLAS CHALK.

*Textularia*, sp. ind.
*Globigerina*, sp. ind.
*Cassidulus aequoreus*, Shum.
*Hemiaster parastatus*, Shum.
*Hemiaster? texanus*, Roem.
*Terebratulina guadalupae*, Roem.
*Ostrea anomiæformis*, Roem.
*Ostrea congesta*, Con.
*Ostrea subspatula*, † Lyell.
*Gryphæa vesicularis*, Lam.
*Gryphæa vesicularis*, Lam., *var. Aucella*, Roem.
*Exogyra columbella*, Meek.
*Exogyra costata*, † Say.
*Exogyra læviuscula*, Roem.
*Exogyra ponderosa*, Roem.
*Ostrea larva*, † Lam.
*Anomia anomiæformis*, Roem.
*Spondylus guadalupae*, Roem.
*Pecten nillsoni*, Goldfuss.
*Arca*, sp. ind.
*Gervillopsis* ("*Dalliaconcha*") *invaginata*, White.
*Inoceramus undulato-plicatus*, Roem.
*Mytilus semiplicatus*, Roem.
*Modiola*, sp. ind., Roem.
*Pinna*, sp. ind., Roem.
*Radiolites austinensis*, Roem.
*Radiolites sabinae*, Roem.
*Radiolites austinensis*, Roem.
*Psammobia cancellato-sculpta*, Roem.
*Liopistha* (*Cardium ?*) *elegantulum*, Roem.
*Phasianella*, sp. ind., Roem.
*Scalaria texana*, Roem.
*Scalaria* (*Scala*) *bicarinifera*, † Shum.
*Rostellaria*, sp. ind.
*Eulima? texana*, Roem.
*Chemnitzia gloriosa*, Roem.
*Chemnitzia?* (*Scalaria?*) *texana*, Meek.
*Cerithium*, sp. ind., Roem.
*Pyrula*, sp. ind.
*Cylichna* (*Bulla*), sp. ind.
*Anisomyon*, sp. ind.
*Nautilus dekayi?* Mort.
*Nautilus elegans*, Sow.

*Inoceramus cripsii,*† Mant.
*Inoceramus diverse-sulcatus,* Roem.
*Inoceramus exogyroides,* Meek.
*Inoceramus involutus,* Sow.
*Inoceramus latus,* Mant.
*Inoceramus mytiloides,* Mant.
*Inoceramus mytilopsis,*† Con.
*Inoceramus problematicus?*† Schloth.
*Inoceramus striatus,* Mant.
*Inoceramus subquadratus,* Schlueter.
*Inoceramus umbonatus,* Meek.
*Nautilus simplex,* Sow., Roem.
*Ammonites dentato-carinatus,* Roem.
*Ammonites guadalupae,*† Roem.
*Ammonites texanus,* Roem.
*Ammonites* (*Mortoniceras*) *vespertinus,* Mort.
*Mortoniceras shoshonense,* Meek.
*Baculites anceps,* Lam.
*Baculites asper,* Mort.
*Paramithrax? walkeri,*† Whitf.

### FAUNA OF EXOGYRA PONDEROSA MARLS.

*Ostrea congesta,* Con.
*Gryphæa vesicularis,* Lam.
*Exogyra costata,*† Say.
*Exogyra ponderosa,* Roem.
*Ostrea larva,* Lam.
*Anomia,* sp. ind.
*Amusium simplicum,* Con.
*Camptonectes virgatus,* Nils.
*Inoceramus cripsii,* Mant.
*Ficus* (*Pyrifusus*) *granosus,* Shum.
*Baculites,* sp. ind.

### FAUNA OF NAVARRO BEDS, OR UPPER FOSSILIFEROUS HORIZON OF THE PONDEROSA MARLS.

*Isastrea discoidea,* White.
*Ostrea owenana,* Shum.
*Ostrea planovata,* Shum.
*Gryphæa vesicularis,*† Lam.
*Exogyra costata,* Say.
*Exogyra ponderosa,*† Roem.
*Ostrea larva,* Lam.
*Pecten simplicus.*
*Pecton burlingtonensis.*
*Inoceramus cripsii,* Mant.
*Crassatella lineata,* Shum.
*Crassatella? parvula,*† Shum.
*Crassatella subplana?* Con.
*Lucina parvilineata,* Shum.
*Liocardium* (*Pachycardium*) *spillmani,* Con.
*Tagelus* (*Legumen*) *ellipticum,* Con.
*Tagelus* (*Siliquaria*) *biplicata.*
*Pholadomya elegantula.*
*Pholadomya lincecumi,* Shum.
*Chemnitzia gloriosa,* Roem.
*Pugnellus densatus,* Con.
*Purpura cancellaria,* Shum.?
*Rapa supraplicata,* Con.
*Fasciolaria,* sp. ind.
*Volutilithes navarroensis,* Shum.
*Pleurotoma rippleyana.*
*Pleurotoma texana,* Shum.
*Pleurotoma tippana,* Con.
*Solidula riddelli,* Shum.
*Cinulia* (*Ringinella*) *pulchella,* Shum.
*Cinulia* (*Avellana*) *subpellucida,*† Shum.
*Cylichna minuscula,*† Shum.
*Cylichna secalina,* Shum.
*Cylichna striatella,*† Shum.
*Anisomyon haydeni,* Shum.
*Nautilus dekayi?* Mort.
*Ptychoceras texanus,* Shum.
*Turrilites helicinus,* Shum.

*Pholadomya tippana*, Shum.
*Panopæa? subplicata*, Shum.
*Anatina sulcatina*, Shum.
*Scalaria* (*Scala*) *forsheyi*, Meek.
*Scalaria lamarensis*,† Shum.
*Scalaria*, sp. ind.
*Turritella corsicana*, Shum.
*Turritella winchelli*, Shum.
*Turritella tippana*, Con.
*Ficus subdensatus*.
*Vermetus* (*Serpula*), sp. ind.
*Turrilites splendidus*, Shum.
*Helioceras navarroensis*, Shum.
*Baculites annulatus*, Con.
*Baculites gracilis*, Con.
*Baculites spillmani*.
*Baculites tippaensis*, Con.
*Scaphites* (*Macroscaphites*) *vermiculus*,† Shum.
*Scaphites vermicosus*, Shum.
*Scalpellum inequiplicatum*, Shum.

## FAUNA OF THE GLAUCONITIC BEDS.*

*Gryphæa vesicularis*, Lam.
*Exogyra costata*, Say.
*Exogyra ponderosa*,† Roem.
*Ostrea larva*, Lam.
*Anomia argentaria*, Mort.
*Amusium simplicum*, Con.
*Inoceramus cripsii*, Mant.
*Inoceramus texanus*,† Con.
*Trigonia thoracica*,† Mort.
*Liocardium* (*Pachycardium*) *spillmani*, Con.
*Vermetus* (*Serpula*), sp. ind.
*Voluta* (*Rostellites?*) *texana*, Con.
*Nautilus dekayi*, Mort.
*Ammonites pedernalis*, Binkhorst, not Von Buch.
*Ammonites* (*Placenticeras*) *placenta*,† Dekay.
*Ammonites pleurisepta*, Con.
*Belemintella micronatus*, Meek.

*This division has been least studied of all the Texas beds, and hence this list does not at all approximate completeness.

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