JOURNAL OF PALEONTOLOGY, VOL. 26, NO. 1, PP. 65–73, PLS. 13–16, JANUARY 1952

SOME ZONE MARKER FOSSILS OF THE GLEN ROSE FORMATION OF CENTRAL TEXAS

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ABSTRACT—Included are descriptions of 13 new species of pelecypods and gastropods characteristic of the transition zone between the lower and upper Glen Rose formation of the Comanche of Texas. Most important in this group is the small *Corbula* that occurs in a thin bed, which can be used as a shore-line marker over a wide area of the outcrop. Above this bed lithology and fauna change.

INTRODUCTION

THE Glen Rose formation is predominantly a sequence of limestone beds belonging to the Trinity group of the Comanche series of Texas. At its outcrop in central Texas, where most of the fossils described in this paper were collected, it is 740 feet thick. In north-central Texas about 16 miles northwest of Fort Worth, Texas it is about 10 feet thick. The formation thickens southwestward from central Texas, and was said by C. L. Baker (personal communication) to be several thousand feet thick in Mexico. Throughout most of the formation there is an alternation of hard and soft limestones. The basal portion consists largely of massive limestone, whereas the upper portion tends chiefly to be thin-bedded hard limestones alternating with thin-bedded soft limestones, the latter breaking down upon weathering into clays and shaley limestones. These are known as the alternating beds. They give rise to the very characteristic terraced hill topography of central Texas.

During the construction of the Mansfield dam on the Colorado River, three-foot cores were cut through more than 90 feet of the Glen Rose formation at the dam site. These showed the predominantly limestone character of the formation, but after about three months of weathering, sections of the cores began to break down into incoherent marly material like the softer beds along the outcrops.

In addition to the limestone and the marl there are several sand and anhydrite beds. There is sandstone in the basal portion of the formation and also in Comal County the upper 60 feet is quite sandy.

Not only does the general lithologic character of the upper Glen Rose differ from that of the lower, but the fauna also seems to be quite different. The alternating beds have fewer fossils than the lower limestones, but there are many lower beds barren of fossils, while others are highly fossiliferous. Preservation is usually in the form of casts.

Despite the fact that the Glen Rose is one of the most widespread and probably the thickest Cretaceous formation in central and southwest Texas very little has been published on it. Dr. F. L. Whitney, who collected the fossils described in this paper, has done extensive research on the Glen Rose, but has not yet published his findings. Several geologists have described a few fossils from the Glen Rose, but the vast majority of the fossils remain undescribed. In studying the extensive collections made in several central Texas counties by Dr. Whitney, I have found about 140 new species. It is the purpose of this paper to describe a few of the new species which are good zone markers.

At Austin, Texas, 275 feet above the base of the Glen Rose formation, is found *Salenia texana* Credner in a zone about 2 feet thick. Everywhere throughout central Texas this species seems to be restricted to this narrow and highly fossiliferous zone. Above the *Salenia texana* bed there are about 5 feet of marly material carrying a rather large assemblage of characteristic forms. Capping this is a bed about 1 foot thick containing tiny *Corbula* shells. This is one of the most distinctive zones in the Glen Rose formation. Nearly the entire rock in this horizon is made up of *Corbula* shells packed tightly together. This bed has been found in many places in Bandera, Comal, Hays, Travis,

and Blanco Counties and is perhaps the most useful horizon marker in the formation. This whole fossiliferous zone from the bottom of the *Salenia texana* bed to the top of the *Corbula* bed is normally about 8 feet thick and is referred to by F. L. Whitney as the *Salenia texana* horizon. Not only is this horizon useful to the stratigrapher, but it marks the transition point between the fauna of basal Glen Rose and that of the upper Glen Rose and, hence is of interest to the paleontologist. Many species characteristic of the lower Glen Rose do not cross this horizon into the upper part of the formation. Above the *Corbula* bed species are found which have not been reported from the basal Glen Rose. Within the horizon itself over 30 new species have been collected. It is the purpose of this paper to describe a few of the most characteristic species of this zone, and it is the intention of the writer to describe additional species at a later date.

Some geologists have believed that the Glen Rose is the equivalent of the Aptian of Europe and that the Albian began at the close of Glen Rose time. Dr. Gayle Scott (personal communication) believed that the whole of the Glen Rose was Albian on the basis of the cephalopods contained in the formation. There are many pelecypod and gastropod species, however, in the lower Glen Rose, which do not extend beyond the *Salenia texana* horizon and which bear close resemblance to similar species from the Aptian of Europe.

The type specimens here described are deposited in the museum of the University of Texas at Austin.

SYSTEMATIC PART

Family CORBULIDAE Fleming

Genus CORBULA Lamarck

CORBULA MARTINAE Whitney, n. sp.

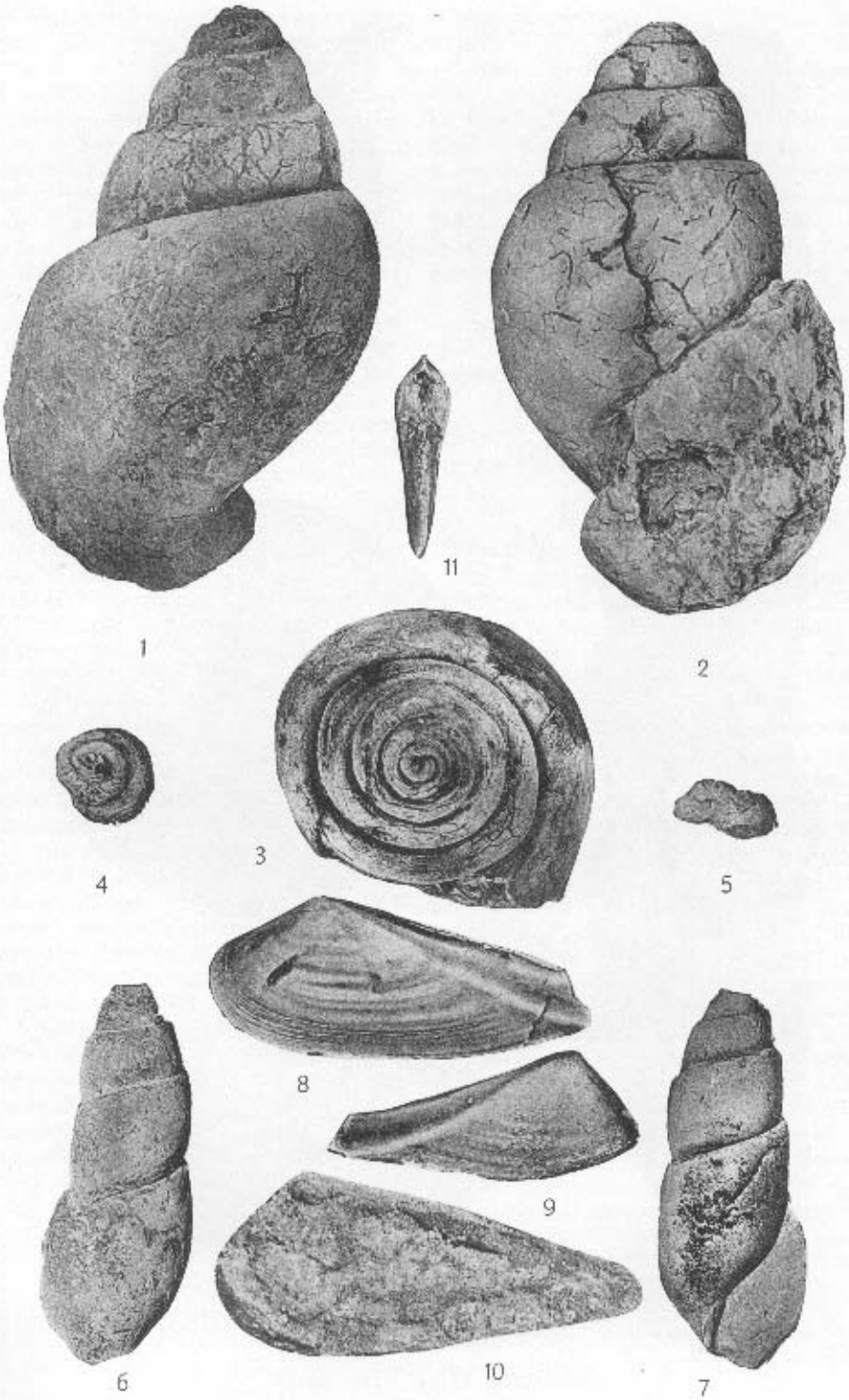
Plate 13, figures 8–11

Shell very small, from 3 to 9 mm. in length, very elongate, inequilateral, and inequivalve, the right valve being slightly larger than the left valve. This does not show where only the cast is preserved, but in the cases where the shell has been preserved it is very evident. The beaks are small, anterior, close together, incurved, pointed, directed anteriorly, prominent, and nearly terminal. The hinge shows distinct bending between the beaks. From the right valve just posterior to the beak there is a tongue-shaped projection which extends anteriorly and obliquely toward the opposite valve and terminates at the hinge. On either side of this projection there is a deep depression, and in the center there is a longitudinal groove. Right valve equipped with one large tooth, which usually can not be found.

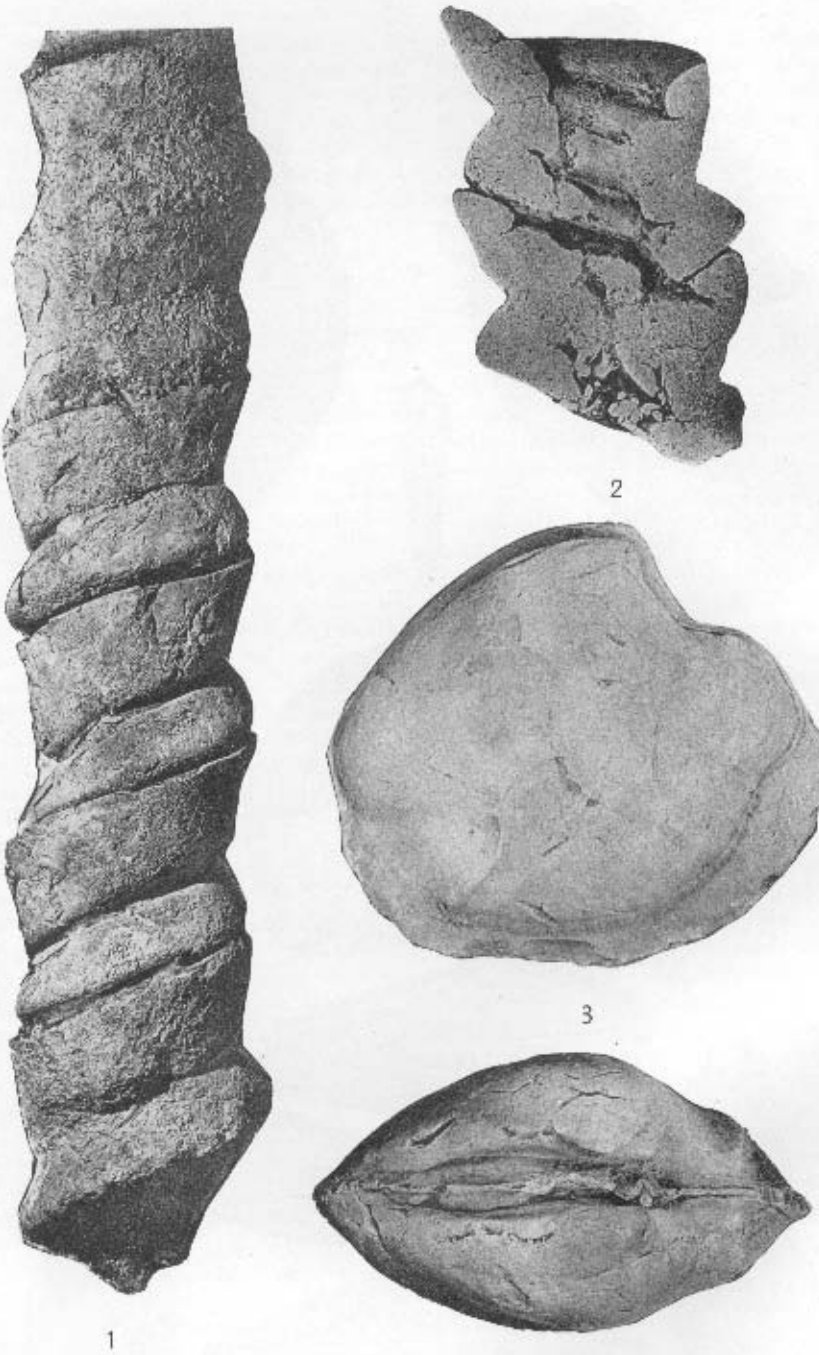
Posterior cardinal margin very long, sloping, and concave; accompanied in the lower extremity by a strong, narrow, rounded ridge which increases in width toward the posterior and decreases toward the anterior end. The anterior cardinal margin is short and concave. The anterior margin is very narrowly rounded. The ventral margin is long, curved at the extreme anterior end, but straightens out in some specimens and remains very slightly arcuate in others; frequently it is concave close to the posterior end. Posterior margin very attenuated and pointed. Possibly it is slightly gaping. Between the umbonal ridge and the ridge on the cardinal margin the shell is very narrow on the posterior end and usually very slightly notched. The umbonal ridge is long, oblique, and very gently curved downward in the middle. It extends from the umbones to the posteroventral angle. Between this ridge and the one along the cardinal margin there is a long depression which widens toward the posterior end, because the two ridges are slightly diverging. The sides are gently convex, flattening somewhat toward the posterior. The greatest thickness is be-

EXPLANATION OF PLATE 13

FIGS. *1–3—Tylostoma travisensis* Whitney, n. sp., lateral, apertural and end views, ×1. (p. 72)
4, 5—Pleurotomaria glenrosensis Whitney, n. sp., end and apertural views, ×1. (p. 72)
6, 7—Strombus beckleyi Whitney, n. sp., lateral and apertural views, ×1. (p. 72)
8–10—Corbula martinae Whitney, n. sp.; *8*, lateral view, right valve, holotype; *9*, lateral view view left valve, syntype; *10*, interior view showing tooth, syntype; *11*, dorsal view, syntype. All ×6. (p. 66)



Whitney, Glen Rose fauna



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Whitney, Glen Rose fauna

low the beaks, and the greatest height is at the beaks. The anterior end is thickened, but the posterior end is thin.

The pallial line is deep, long, entire, curved at the anterior end, straight along the ventral side, ending abruptly at the umbonal ridge. It is also quite high above the ventral margin. There are no muscle scars visible.

The exterior is marked by fine lines near the ventral margin. These lines do not often appear above the transverse mid-line and are curved on the anterior portion and end abruptly at the umbonal ridge. In the casts several coarse ridges can be seen on the sides.

Corbula martinae very closely resembles *C. picteti* (Recueil d'Études Paléontologiques Sur La Faune Crétacique du Portugal, vol. 1, Paul Choffat, 1883, p. 25, figs. 1–4). The lines on the sides are considerably finer and closer together, however, in the species from the Glen Rose. *C. picteti* is found in the Bellasian of Portugal which is in reality in the Albian and Cenomanian of Europe according to Haug (Traité de Geologie pt. 11, p. 1277). Since these forms appear to be closely related it is probable that they correspond in age also. Thus the presence of *C. martinae* along with other species related to Albian forms suggests that the equivalent of the Albian begins in the Glen Rose at this horizon 280 feet above the base of the formation as determined by core drilling at the Mansfield Dam site on the Colorado River.

Corbula martinae is very abundant in a constricted horizon 12 to 15 inches thick. It is an important horizon marker because it is so restricted. Nearly the entire bed is often made up of this species. It is so small that one slab of limestone an inch thick and only a few inches square contains thousands of specimens. To the naked eye they resemble a thick sprinkling of grains of wheat scattered upon the surface of the rock; but to examine them, the lens is necessary.

Dimensions: height 3 mm., length 7 mm., width 1 mm.

Occurrence.—Several outcrops in Blanco, Travis, Hays, and Comal counties of Texas. In Travis County, it is found at Lohmann Ford on Colorado River and on both sides of the valley of Sandy Creek. It is also found in the cores taken at the site of the Mansfield dam on the Colorado River about 275 feet above the base of the Glen Rose. In Comal County it is about 284 feet above the base of the Glen Rose.

Type locality.—About 2½ miles south of Lone Man Mt., Hays Co., Texas on Dripping Springs-Wimberly road.

Family POROMYACIDAE Dall
Genus LIOPISTHA Meek
LIOPISTHA (PSILOMYA) BANDERAENSIS Whitney, n. sp.
Plate 16, figures 1, 2

Cast large, equivalve, inequilateral, high at the umbones, roughly triangular. Beaks bluntly pointed at the tip, greatly incurved near the anterior end, directed slightly toward the anterior. Umbones large, prominent, ventricose. Hinge slightly arched and possessing two teeth in each valve. The teeth in both valves are nearly horizontal and inequal. In the right valve the anterior tooth is quite wide but smaller than the posterior tooth which is large, wide and sloping. In the left valve the anterior tooth is conical and long. Posterior to this tooth is a deep, triangular fossette. The posterior tooth is rudimentary and oblique—directed anteriorly. Posterior cardinal margin long, gently sloping. Anterior cardinal margin very short and sloping. Anterior margin straight, sloping obliquely outward, bending abruptly toward the ventral margin at the lower portion of the muscle scar. Anterior end of the shell quite thick. Buccal slopes long, narrow, crescentic, almost vertical, ending at the muscle scar. Anterior umbonal ridge fairly sharp, narrow, low, ending also at the muscle scar. Ventral margin quite thin, curved at the ends and straight in the

EXPLANATION OF PLATE 14

FIGS. 1, 2—*Nerinea roemeri* Whitney, n. sp. *1*, lateral view, holotype; *2*, cross section showing plaits, syntype. Both ×1. (p. 71)

3, 4—*Meretrix hanseni* Whitney, n. sp., lateral and dorsal views, ×1. (p. 69)

middle. Posterior margin rounded at the ventral end but nearly straight above, very sloping, high, and slightly gaping. The posterior end is thin. Postumbonal ridge wide, rounded, long and oblique. Postumbonal slope wide throughout its length.

Anterior muscle scar very large, rounded on the ventral side, truncated on all other sides, raised, prolonged in a small point extending up the buccal margin, marked by several crescentic ridges. The scar is located quite near the ventral side. Posterior muscle scar nearly circular but flattened on top, placed obliquely on the upper umbonal slope near the umbonal margin, raised, marked by concentric rings. Pallial line distinctly marked by a wide, flat ridge on either side of which is a narrow, shallow groove with beaded edges. The pallial line is not parallel to the ventral margin but is high at the anterior muscle scar and slopes down toward the ventral margin in the posterior portion of the shell. At the postumbonal ridge it turns abruptly with a broad, rounded angle and follows up the umbonal ridge to the posterior muscle scar.

The surface of the shell does not present any markings. The sides are flattened. The umbones are rounded and thick. The highest portion of the shell is at the beaks and the thickest part is near the upper portion of the umbones.

Dimensions: height 90 mm., length in the ventral portion 100 mm., width 55 mm.

Type locality.—Salenia texana horizon nearly 1 mile east of Bandera, Tex.

LIOPISTHA (PSILOMYA) WALKERI
Whitney, n. sp.
Plate 16, figures 5, 6

Cast large, ventricose, wedge-shaped, equivalve, inequilateral. Beaks very terminal, inrolled, pointed, directed forward. Umbones large, inflated. Hinge with two teeth in each valve. In the right valve the posterior tooth is flattened and lower than the conical, anterior tooth. In the left valve the anterior tooth is large, while the posterior tooth is small and rudimentary. There is a fossette between these teeth. Posterior cardinal margin fairly long, straight and directed slightly upward. Anterior cardinal margin carinate, rounded, steeply sloping and short. Anterior margin very short and rounded. Ventral margin strongly arcuate. The posterior margin is bluntly rounded near the ventral side, but from the middle of the posterior side it rises in a straight, steeply sloping line to the high posterior cardinal margin. Umbonal ridge very prominent, high, wide, and straight. Postumbonal slope wide and concave. Posterior end is gaping but thinner than the rest of the shell. Anterior end wide but narrower than the very inflated and oblique umbonal region. Greatest height half an inch posterior to the beaks. Greatest width on the umbones near the posterior end.

The pallial line is entire, practically parallel to the ventral margin, slightly curved upward to the anterior muscle scar, but gently arcuate along its ventral extent. At the posterior end it makes a very sharp bend and extends obliquely up the umbonal ridge to the large, round, raised posterior muscle scar high on the posterior umbonal slope. The anterior muscle scar is also large and rounded with a small projection directed upward along the anterior cardinal margin. The scar is situated very near the anteroventral angle. No exterior ornamentation is apparent on the cast.

Liopistha walkeri resembles *L. jurafacies* in general outline, but its beaks are more terminal, its posterior cardinal margin and its posterior margin higher and differently shaped.

Dimensions: height 65 mm., slightly posterior to the beaks; length 95 mm.; width 70 mm.

Type locality.—Salenia texana horizon of the Glen Rose at Bandera, Tex.

LIOPISTHA (PSILOMYA) FLETCHERI
Whitney, n. sp.
Plate 16, figures 3, 4

Cast large, ventricose, equivalve, inequilateral, high on the anterior end, elongate, high, directed slightly forward. Umbones narrowed on top, quite convex. Hinge with two nearly horizontal teeth in each valve. On the right valve the anterior tooth is high, conical, pointed and slightly twisted. The posterior tooth is inferior and pointed. On the left valve the anterior tooth is large, directed anteriorly. The posterior tooth is rudimentary and directed posteriorly. There is a fossette between. The posterior cardinal

margin is long and slightly concave. The anterior cardinal margin is short and steeply sloping. Anterior margin very short and rounded. Anterior end of shell greatly inflated. Ventral margin long and strongly curved, carinate at the edge. Posterior margin bluntly rounded, high at the juncture with the umbonal margin. Posterior end of shell flared, gaping but quite constricted back of the margins. Middle portion of the shell inflated; thickest portion high on the umbones. The highest part of the shell is at the beaks. The umbonal ridge is not pronounced. The postumbonal slope is wide and concave. No surface markings are present on the cast. The muscle scars and pallial line are not visible on the material at hand.

Liopistha (Psilomya) fletcheri differs from *L. solida* Cragin chiefly in having a more prolonged posterior, a concave posterior cardinal margin and a more rounded ventral margin. It shows some resemblance to *L. gigantea* Sow. (1909, p. 43, figs. 3, 4; pl. 44, figs. 1, 2) but *L. fletcheri* does not have a straight posterior cardinal margin. The ventral margin swings up higher to meet the posterior margin and the posterior end is not similar to that of *L. gigantea* Sow.

L. fletcheri was found by Mr. Claude Fletcher.

Dimensions: height 75 mm., length 95 mm., width 55 mm.

Type locality.—Salenia texana horizon of the Glen Rose formation at Julian Creek, Bandera, Texas.

Family VENERIDAE Leach
Genus MERETRIX Lamarck
MERETRIX HANSENI Whitney, n. sp.
Plate 14, figures 3, 4

Cast large, high, ventricose, suboval, equivalve, inequilateral. Beaks high, pointed, close together, subcentral, directed anteriorly, convex on the posterior side, concave on the anterior side. Hinge arcuate, presenting the impressions of two teeth in each valve. Posterior cardinal margin long, arcuate, very sloping, evenly curved to the tip of the beaks. Anterior cardinal margin concave, short. Anterior and posterior margins nearly equal in shape and height; the posterior is a trifle higher, but both are broadly and evenly rounded and thin at the edge. The ventral margin is also thin at the edge and presents a long, arcuate, keel-like outline. The borders are thin for about one-fourth inch from the edge, and above the pallial line the shell thickens abruptly. There is a slight anterior umbonal ridge which is directed almost vertically downward, but swings anteriorly near the middle portion of the shell and fades out near the anterior muscle scar. The area between the ridge and the scar is depressed.

The shell is only slightly longer than high. The greatest height is about the center of the shell and at the beaks. The greatest thickness is slightly above the middle of the shell beneath the beaks. In the umbonal view the shape of the shell is like a very convex lens with a narrow, sharp rim at either side.

The pallial line is distinct, arcuate, approximately parallel to the ventral margin. The short vertical ridges and depressions which are found mostly above the pallial line stand out clearly. The pallial sinus is deep, wide and directed upward at a steep angle. The anterior end is narrow, rounded at the point. The sides are wavy and converging. The posterior muscle scar is large, oval, raised on the anterior side, covered with concentric rings. Anterior muscle scar elongate, elevated greatly on the posterior side, depressed on the anterior side. At the cardinal margin it turns and proceeds along the margin for a short distance and becomes very narrow—attenuating to about 1 mm. It expands below to nearly half an inch in width. It is covered with vertical, gently curved striae. The central portion of the scar is concave. None of the specimens at hand shows ornamentation.

This species differs from *M. texana* (Conrad) in being shorter, higher, and more ventricose. The cardinal margin rises at a steeper angle and is more arched. There is a more pronounced anterior umbonal ridge present, and the posterior and anterior ends are more nearly equal in size and shape. The posterior muscle scar is more distinct and the anterior muscle scar is depressed in the center while it is very slightly convex in *M. texana.*

Dimensions: height 55 mm., length 63 mm., width 34 mm.

Occurrence.—One mile east of Bandera, Tex; Cranes Mill at the big spring on Guadalupe River, Comal County, Tex.

Type locality.—One mile east of Bandera, Texas.

Family SAXICAVIDAE Gray
Genus PANOPEA Menard
PANOPEA SELLARDSI Whitney, n. sp.
Plate 15, figures 7, 8

Casts small, narrow, long, and attenuated at the ends; equivalve, inequilateral, quite thick below the beaks, usually thin at the ends. Beaks low, rounded, close together, and very slightly subcentral. A low ridge extends from the beaks to the pallial margin on the anterior side. Hinge unknown. Umbonal margin long and gently sloping on either side of the beaks. Anterior end is usually closed, while the posterior end is usually gaping, attenuated, and quite flaring. Ventral margin gently curved. Sides lined with irregular, concentric ridges. Pallial line indistinct, pallial sinus shallow and narrow. Anterior muscle scar small, oblique, and oval shaped.

Dimensions: height 28 mm., length 55 mm., width 23 mm.

Occurrence.—Middle Glen Rose 1 mile east of Bandera, Tex., and on Comfort-Boerne road, 10 miles from Boerne, Tex.

Type locality.—One mile east of Bandera, Texas, *Salenia texana* horizon.

Family ANATINIDAE Dall
Genus ANATINA Lamarck
ANATINA HANSENI Whitney, n. sp.
Plate 15, figures 3, 4

Cast large, quite high and thin, equivalve, inequilateral. Beaks practically central, small, angular, close together. Umbonal margin long and narrow, high; more steeply sloping and narrower on the anterior side than on the posterior side. Anterior margin wide, broadly curved. Pallial margin curving at ends, almost straight in the middle for about $1\frac{1}{4}$ inches. Posterior margin wide and gaping, slightly flaring but the shape indistinct on the specimens at hand because of erosion. Hinge unknown. Along the posterior umbonal margin there is a narrow groove on each valve which passes down from the beaks to the posterior side. Originating at the same point as the umbonal grooves there is a deep, narrow, short groove which extends obliquely downward from the umbonal region across the posterior end of the shell for the distance of about five-eighths of an inch. There does not seem to be any depression on the anterior side of the casts. Sides lined with irregular, concentric ribs, coarse on some specimens and fine on others. The pallial line does not show, but a faint suggestion of the pallial sinus can be found on one specimen. It appears to be very shallow and quite narrow.

Dimensions: height 38 mm., length 65 mm., width 21 mm.

Occurrence.—*Salenia texana* horizon on the Hansen ranch near Bandera. Also found 1 mile east of Bandera, Tex. A smaller specimen was found on Bull Creek near Austin, very close to the top of the formation.

Type locality.—*Salenia texana* zone, 9 miles west of Bandera, Texas.

ANATINA SIMONDSI Whitney, n. sp.
Plate 15, figures 5, 6

Cast long, narrow, generally quite thin, but sometimes thickened due to compression, equivalve, inequilateral. Beaks almost central, low, not prominent, angular particularly on the posterior side, close together. Umbonal margin very long; slightly curved and sharp anteriorly; long, straight and gently sloping posteriorly. Anterior margin narrow, sharply rounded. Ventral margin long, changing its curvature at the anterior depression, where it swings in a long, sweeping curve upward toward the very narrow, attenuated posterior margin. The posterior appears to be very slightly gaping and only slightly flared. The umbonal grooves are deep, narrow, and long. The grooves which extend obliquely downward poste-

EXPLANATION OF PLATE 15

FIGS. *1, 2—Anatina beckleyi* Whitney, n. sp., lateral and dorsal views, ×1. (p. 71)
3, 4—Anatina hanseni Whitney, n. sp., lateral and dorsal views, ×1. (p. 70)
5, 6—Anatina simondsi Whitney, n. sp., lateral and dorsal views, ×1. (p. 70)
7, 8—Panopea sellardsi Whitney, n. sp., lateral and dorsal views, ×1. (p. 70)

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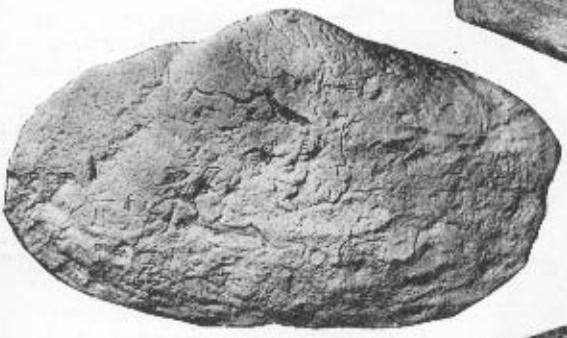

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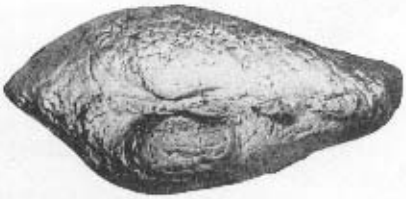

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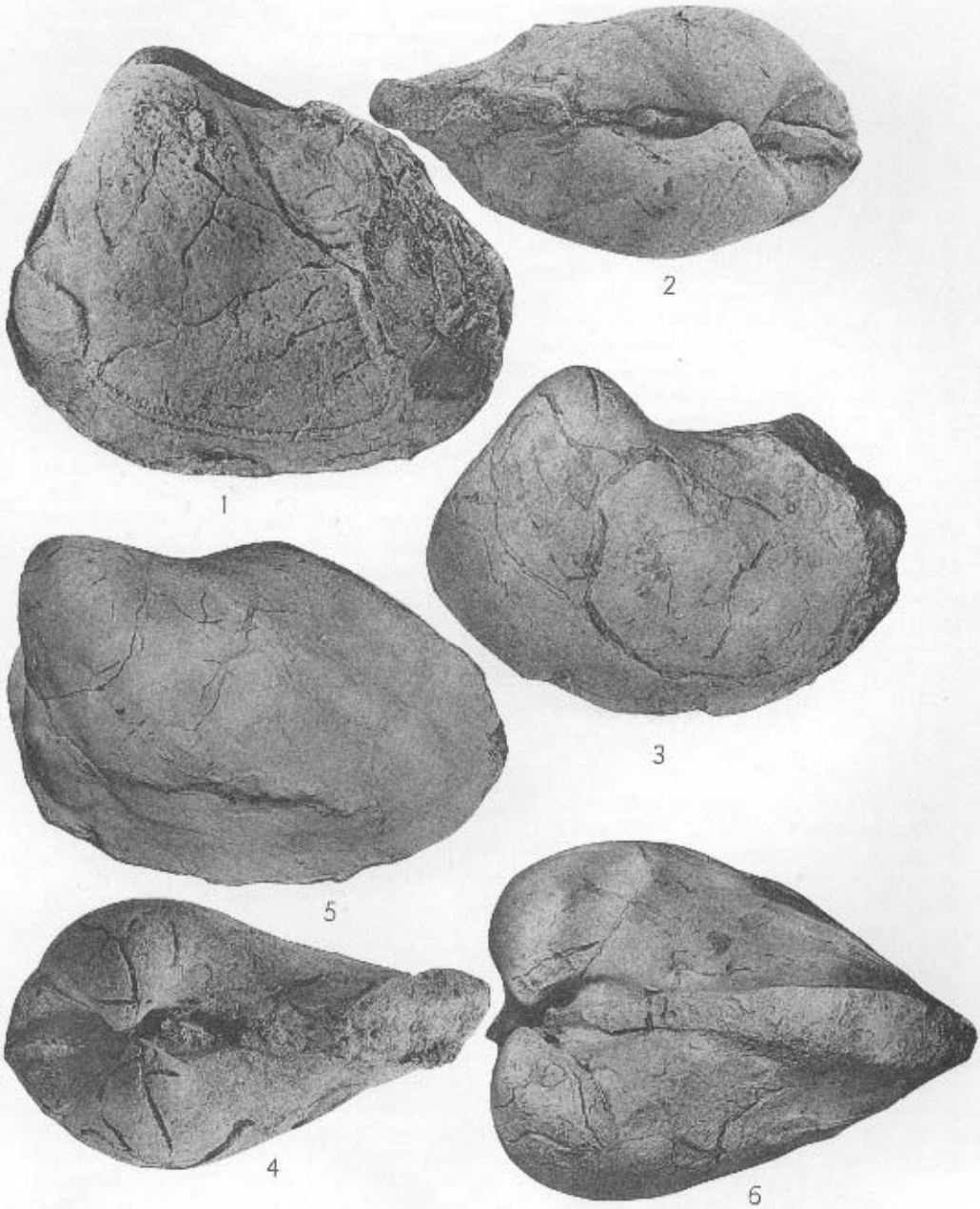
Whitney, Glen Rose fauna



Whitney, Glen Rose fauna

riorly from the beaks are deep and narrow for a short distance, but suddenly flatten out into a low depression which can be traced to the ventral margin on some specimens. The anterior depressions originate in the middle of the umbones and extend obliquely to the ventral margin, increasingly slightly in depth as they approach the margin. Hinge unknown. Sides lined by more or less regular concentric ribs which increase in size toward the ventral margin.

This species differs from *A. hanseni* chiefly in the fact that it is not so high and it has more attenuated ends. The ventral margin is also more sloping in *A. simondsi* and the anterior depression is noticeable, whereas it is not apparent in *A. hanseni*.

Dimensions: height 29 mm., length 66 mm., width 15 mm.

Occurrence.—Middle Glen Rose 1 mile east of Bandera, Tex.

Type locality.—Six miles SE of Bandera, Texas, *Salenia texana* horizon.

ANATINA BECKLEYI Whitney, n. sp.
Plate 15, figures 1, 2

Cast elongate, suboval, equivalve, inequilateral, compressed, high. Beaks central, small, rounded, Posterior cardinal margin sloping, concave, gaping. Anterior cardinal margin straight from the top of the beaks for about half an inch, curved gently from that point to the broadly rounded, high carinate anterior margin. The ventral margin is arcuate, lower on the anterior side than on the posterior side, carinate, and rises from the middle to the narrowed, gaping posterior. The anterior side is higher than the posterior side. The posterior groove is deep and narrow, about 19 mm. long. It extends obliquely downward onto the flank and suddenly disappears. Only a very faint suggestion of a depression exists in the middle of the shell below the beaks. The umbonal ridge is narrowly rounded and short. The greatest width is below and slightly posterior to the beaks. The greatest height is at the beaks. The sides are lined with coarse, irregular, concentric lines.

Anatina beckleyi differs from *A. hanseni* in being shorter, higher and straighter on the anterior cardinal margin, lower on the anterior ventral margin and narrower posteriorly. Also the posterior cardinal margin is more sloping and the posterior is less gaping and not flared.

Dimensions: height 38 mm., length 55 mm., width 13 mm.

Type locality.—About 275 feet above the base of the Glen Rose on the Blanco-New Braunfels road about 10 miles from Blanco, Tex. Collected by Mr. W. B. Beckley.

Family NERINEIDAE
Genus NERINEA Defrance
NERINEA ROEMERI Whitney, n. sp.
Plate 14, figures 1, 2

Nerinea sp. indt. ROEMER, Texas, p. 412. Bonn, 1849.

Nerinea sp. indt. Roemer, Die Kreidebildungen von Texas, p. 41, pl. 4, fig. 8. Bonn, 1852.

Original description (Roemer's *Nerinea* sp., 1852)

Shell elongate, turreted, the whorls of the cast consist of two parts separated in the middle by a groove in which two almost equally sloping surfaces come together. This species, of which there is, at hand, only a single, somewhat compressed specimen preserved as a cast, is related through the concave almost equally divided whorls of the cast to *Nerinea gosae* by A. Roemer (Nordd. Oolith. Geb. Tab. X1, Fig. 27) of the upper Jurassic, yet it seems in the Texas species the division of the whorl by the middle groove is not so complete as the former species. Under the species of the Cretaceous come the casts of *Nerinea Espaillaciana* d'Orbigny, (L. C., pl. 164, Fig. 2) that is very near to the cast, at hand, from Texas. But the whorls divided by the groove seem broader than in the Texas species.

Locality. With the former species on the upper course of the Pedernales.

Dimensions: width 35 mm., spiral angle 5°, sutural angle 15°.

EXPLANATION OF PLATE 16

FIGS. *1, 2*—*Liopistha* (*Psilomya*) *banderaensis* Whitney, n. sp., lateral and dorsal views, about ×2/3. (p. 67)

3, 4—*Liopistha* (*Psilomya*) *fletcheri* Whitney, n. sp., lateral and dorsal views, about ×2/3. (p. 68)

5, 6—*Liopistha* (*Psilomya*) *walkeri* Whitney, n. sp., lateral and dorsal views, about ×2/3. (p. 68)

Affinities.—The shell is very elongate and slender. The longest specimen, at hand, of which about one-half is preserved, measures over 20 cm. It is closely related to *Nerinea espaillaciana* d'Orb. except in the respect which Roemer pointed out, namely, that in *N. espaillaciana* the whorls are broader in proportion to their length than in *N. roemeri*. The pattern of the plaits in these species is very similar, there being one plait on the outer lip and two on the inner lip. D'Orbigny points out that the outer plait in *N. espaillaciana* is much more prominent than the others and is sharply truncated. This holds true for *N. roemeri*, but in addition to the three plaits there seems to be a faint notch about midway between the posterior and anterior plaits on the inner lip. Although the pattern of the plaits is, in general, similar in the two species, there is a difference in the proportion of the lobes. In *N. espaillaciana* the posterior lobe is larger than the anterior lobe, whereas in *N. roemeri* this condition is reversed. Both species are tightly coiled about small columellas. The spiral and sutural angles, and the angles of the whorls are practically the same for the two species.

Occurrence.—Near Wimberly on Dripping Springs road. Bandera, Smithson Valley, and Fischer Store, Texas.

Type locality.—About 2½ miles south of Lone Man Mt., *Salenia texana* horizon.

Family STROMBIDAE d'Orbigny
Genus STROMBUS Linn.
STROMBUS BECKLEYI Whitney, n. sp.
Plate 13, figures 6, 7

Cast small, very elongate, narrow, turriculate. The spire is high, composed of about five whorls which increase regularly in size. The last whorl is somewhat larger than the others. The sides are very gently rounded. The whorls are separated by a deep, fairly wide, canaliculate, oblique suture. The aperture is quite wide, slightly flared but not greatly expanded. The lip is somewhat expanded upward. The anterior canal is short and only a very faint depression in the lip indicates the position of the sinus. The posterior end of the aperture is acuminate, while the anterior end is broad, flattened and obliquely truncate. Spiral angle about 35°. Slight indications of varices can be seen on the sides. They are nearly 180° apart.

Strombus beckleyi was found by Mr. W. B. Beckley. It resembles *S. fischeri* Choffat in general appearance, but the body whorl is not so large as in *S. fischeri*. Choffat wrote that the body whorl of his species occupies about half the length of the shell. The body whorl in the specimens at hand occupies a little more than one-third the length of the shell.

Dimensions: length 50 mm., width 20 mm.

Occurrence.—*Salenia texana* horizon of the Glen Rose formation about 10 miles from Blanco City on the Blanco-New Braunfels road and in most of the outcrops of this horizon.

Type locality.—New Braunfels-Blanco road about 10 miles from Blanco near county line.

Family PLEUROTOMARIIDAE d'Orbigny
Genus PLEUROTOMARIA Defrance
PLEUROTOMARIA GLENROSENSIS Whitney, n. sp.
Plate 13, figures 4, 5

Cast small, depressed, orbicular. Spire low, consisting of four whorls which increase regularly in size. The last whorl is fairly large. The whorls develop a rather marked keel. They are flattened on top, and the side is short, steeply sloping and truncated at the keel. About six revolving lines decorate the upper side. A few traces of revolving lines can be seen on the flattened anterior side also. The shoulders are fairly wide. The suture is distinct and narrow. The umbilicus is wide and shallow. Angle of spire 121°.

Dimensions: length 7 mm., width 14 mm.

Occurrence.—Fischer Store, Tex., New Braunfels-Blanco road.

Type locality.—New Braunfels-Blanco road about 10 miles east of Blanco, *Salenia texana* horizon.

Family NATICIDAE Forbes
Genus TYLOSTOMA Sharpe
TYLOSTOMA TRAVISENSIS Whitney, n. sp.
Plate 13, figures 1–3

Cast medium size, subovate. Spire quite high, consisting of six gently convex whorls which increase rapidly in size. The mouth is semilunular in shape. It is rather sharply

pointed at the posterior end, gently curved at first, but the curvature becomes quite considerable at the anterior end. Here also the opening is much wider and flares over a constriction that is slightly posterior to the margin. The lip extends upward and swings outward at the posterior end. The varices are faint. The cast is smooth and no portion of the original shell has been preserved in any of the specimens. Spiral angle about 57°.

Tylostoma travisensis bears considerable resemblance to *T. chihuahuense* Böse, but the body whorl of the latter species is much broader in proportion to the height than in *T. travisensis*.

Dimensions: length about 76 mm., width at outer lip 38 mm.

Occurrence.—Abundant in the Glen Rose; found in Bandera, Comal, Travis, Kendal, Blanco and Hays Counties. Some specific points at which it is found are Sandy Creek, Travis County; Hansen ranch, Bandera County; Kuhn Hill on Cranes Mill-Fischer Store road, Comal County.

Type locality.—*Salenia texana* horizon, Hansen ranch north west of Bandera, Texas.

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MANUSCRIPT RECEIVED JANUARY 2, 1951.