CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

246. FORAMINIFERA OF THE CORSICANA MARL*  
By JOSEPH A. CUSHMAN and RUTH TODE

The Corsicana marl is one of the members of the Navarro group in northeastern Texas, overlying Nacatoch sand and underlying Kemp clay. In the present approved classification as set forth in the "Lexicon of Geologic Names of the United States" (Bull. 896, U. S. Geol. Survey, 1938), the pit of the Corsicana Brick Co. 2 miles S. of the court house at Corsicana, Navarro Co., Texas, is regarded as the type locality for the Corsicana marl (restricted). This locality is referred to in our paper as the Corsicana Clay Pit. We have available for study collections from five levels, representing 16 feet of section in the clay pit. We have included in the present study material collected by Cushman and Thomas from Mexia highway at forks of the Wortham road, 2.8 miles E.S.E. of Cooledge, Limestone Co., Texas, which carries a very rich fauna; and also the section on Onion Creek, collected by L. W. Stephenson, ¼ mile below Bastrop road crossing, 2½ miles W. of Old Garfield, Travis Co., Texas, with samples from eight levels including 38 feet of section in the bluff. As usual in localities at some distance from one another, ecologic factors probably enter into the problem and, while the faunas are consistent in most of their features, each locality has certain species not recorded in the others. For brevity in the explanations of plates the Corsicana Clay Pit is referred to as Loc. I; the locality 2.8 miles E.S.E. of Cooledge as Loc. II; and the section on Onion Creek as Loc. III.

By reference to an unpublished manuscript by the senior author on the Upper Cretaceous foraminifera of the Gulf Coastal region, we have added below a list of species from seven other localities definitely determined as Corsicana marl but not found in the three main localities dealt with in the present paper.

Additional Corsicana marl localities:
1. Base of marl. 2.6 miles N. by E. of Malta, Bowie Co., Texas.

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4. Jones Crossing on Onion Creek, just E. of Austin-Bastrop highway, 9 miles in a straight line S.E. of capital in Austin, Travis Co., Texas. Coll. by H. J. Plummer.

5. San Marcos River, left bank, 100 yards below ford, ¼ mile below Martindale, Caldwell Co., Texas. Coll. by L. W. Stephenson.


7. 3 feet below base of Exogyra-Gryphaea bed, San Antonio road, 6 miles E. of Castroville, Bexar Co., Texas. Coll. by L. W. Stephenson.

Additional Corsicana marl species:

(Numbers in parentheses refer to localities above)

- *Reophax texanus* Cushman and Waters (5)
- *Ammocidus penneyi* Cushman and Jarvis (5)
- *Haplophragmoides calcata* Cushman and Waters (2, 3, 5)
- *Haplophragmoides glabra* Cushman and Waters (2, 5)
- *Haplophragmoides excavata* Cushman and Waters (2, 5)
- *Ammobaculites coprolithiformis* (Schwager) (3, 5)
- *Ammobaculites texanus* Cushman (7)
- *Clavulinoides aspera* (Cushman) (6)
- *Heterostomella americana* Cushman (7)
- *Dorothia glabrata* Cushman (3)
- *Trochammina gyroidea* Cushman and Waters (5)
- *Marginulina navarroana* Cushman (7)
- *Dentatalina congruens* Reuss (3)
- *Frondicularia lanceola* Reuss (1)
- *Globulina lacrima* Reuss, var. *subpyrochera* (Bertiuna) (1)
- *Bulimina cushmani* Sandidge (6)
- *Valvulineria plummeriae* Loetelte (4)
- *Pullenia americana* Cushman (7)
- *Globotruncana canaliculata* (Reuss) (4)

The fauna is a rich one evidently deposited some distance from actual shore line as indicated by the fine material of the deposits and the fauna which is richest in foraminifera known to occur at medium depths.

A paper by Albritton and Phleger (Journ. Pal., vol. 11, 1937, pp. 347-354) lists numerous species from the Corsicana Clay Pit. We have examined their material and occasional changes in identification are recorded here.
Family AMMODISCIDAE

Genus AMMODISCUS Reuss, 1861

AMMODISCUS CRETACEUS (Reuss) (Pl. 2, fig. 1)

(For references see these Contributions, vol. 10, 1934, p. 45)

Typical specimens occur in material from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Coolege.

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES EGGERI Cushman (Pl. 8, fig. 2)


Specimens are rare in the American Cretaceous and the few records are mostly from the Navarro. It occurs in our material from 2.8 miles E.S.E. of Coolege.

Family TEXTULARIIDAE

Genus SPIROLECTAMMINA Cushman, 1927

SPIROLECTAMMINA SEMICOMPLANATA (Carmay) (Pl. 9, fig. 3)

(For references see these Contributions, vol. 17, 1941, p. 83)

The types of this species are from an exposure on Onion Creek. The species is characteristic of the Navarro but extends into the upper part of the Taylor group. As the wall is often thin, distortion may take place in fossilization. It seems to be absent in the Corsicana Clay Pit but occurs at the other two localities.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA BUDITA Sandtère (Pl. 9, fig. 4)

(For references see Special Publ. No. 7; Cushman Lab. Foram. Res., 1937, p. 46)

The only specimens in our Corsicana material are from 2.8 miles E.S.E. of Coolege.

Genus GAUDRYINELLA Plummer, 1931

GAUDRYINELLA PSEUDOSERRATA Cushman (Pl. 9, fig. 5)


This species seems to be an index fossil for that part of the Navarro above the Macatoch sand. It is variable in the relative expansion of
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The later chambers and also in the toughness of the matrix it occurs at all three of our localities.

Genus PSEUDOCALVULINA Cushman, 1936
PSEUDOCALVULINA CLAVATA (Cushman) (Pl. 1, fig. 7)
(For references see these Contributions, vol. 18, 1942, p. 53)

This is a wide ranging species in the American Upper Cretaceous. Our only Corsicana specimens are from 2.8 miles E.S.E. of Coolidge.

Genus CLAVULINOIDES Cushman, 1936
CLAVULINOIDES TRILATERA (Cushman) (Pl. 2, fig. 1)
(For references see Special Publ. No. 7, 1937, p. 121)

The typical form of this species occurs in the Velasco and Mineral shales of Mexico, the Upper Cretaceous of Trinidad, the Satapot chalk of Arkansas, and the Corsicana marl of Texas. The var. compressa has a wider range including both the Navarro and Taylor Groups.

The typical form occurs at all three of our Corsicana marl localities.

CLAVULINOIDES INSIGNIS (Plummer) (Pl. 9, fig. 3)
(For references see Special Publ. No. 7, 1937, p. 124)

This species is a characteristic one in the upper beds of Navarro age. It occurs at all three of our localities.

CLAVULINOIDES COMPRESSA (Cushman) (Pl. 2, fig. 3)
(For references see Special Publ. No. 7, 1937, p. 123)

This species is an excellent index fossil for the upper part of the Navarro group above the Nacatoch sand. Although not found in the Corsicana Clay Pit, it is abundant at the other localities, especially 2.8 miles E.S.E. of Coolidge.

EXPLANATION OF PLATE 9

FOR FORAMINIFERAL RESEARCH

Family VALVULINIDAE

Genus DOROTHIA Plummer, 1931

DOROTHIA BULLETIA (Carey) (Pl. 9, fig. 10)

(For references see these Contributions, vol. 17, 1941, p. 85)

This is a widely distributed species but is especially abundant in typical form in the Navarro group. It occurs at all three of our localities.

Genus PLECTINA Marsson, 1878

PLECTINA WATERSI Cushman (Pl. 9, fig. 11)

(For references see Special Publ. No. 8, 1937, p. 107)

This species is apparently an index fossil for those portions of the Navarro group above the Nacatocb sand. It occurs in the Corsicana and in the section on Onion Creek.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA ANTIQUA Franke, var. ANGUSTA Franke

Miquelina (Quinqueloculina) antiqua Franke, var. angusta Franke, Abhandl. Preuss.


Quinqueloculina antiqua Franke, var. angusta Cushman, Tend. Div. Geol., Bull. 41,

1931, p. 23, pl. 2, fig. 6.


76, Art. 19, 1929, p. 17, pl. 2, figs. 8, 9 [by error for 11, 12].

Rare specimens occur in the Corsicana marl from the section on Onion Creek.

EXPLANATION OF PLATE 10

Fig. 1. Marginulina sp. Loc. III. X 18. 2. M. plummerae Cushman. Loc. I.


15. P. manifesta (Reuss). Loc. I. X 45. 16. Vaginulina navarroana Cushman,


26. F. archiaciana d'Orbigny. Loc. II. X 14. 27. Lagena cf. globosa

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1899

TROCHAMMINA DIAGONIS (Carsey) (Pl. 8, fig. 18)

(For references see these Contributions, vol. 18, 1942, p. 55)

This is a widely distributed species occurring especially in the Navarro and Taylor groups. It is often much distorted in fossil form.

In a list of Corsicana marl species, Albritton and Plieger (Journ. Pal., vol. 11, 1937, p. 350) include "Haplophragmoides coronata (H. B. Brady)" which, on examination of the original specimen, is considered to be TROCHAMMINA diagnostis (Carsey).

TROCHAMMINA TEXANA Cushman and Waters (Pl. 9, fig. 14)


This species seems to be confined to the Navarro group. It occurs at all three of our localities. It has fewer chambers than TROCHAMMINA diagnostis (Carsey) and the periphery is less lobulated.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS NAVARROENSIS (Plummer) (Pl. 8, fig. 17)


Lenticulina navarrensis PLUMMER, i. c., Bull. 3101, 1931, p. 141.


Cristellaria culttata CASEY, (not MONTFORT), Univ. Texas Bull. 2612, 1926, p. 21, pl. 6, fig. 3.

This is an excellent index fossil especially for that part of the Navarro group above the Nacatoch sand. It occurs at all three of our localities. The following variety is usually distinct but there are intermediate forms, especially in the Corsicana marl where both forms are abundant.

ROBULUS NAVARROENSIS (Plummer), var. Extrusus CUSHMAN (Pl. 9, fig. 16).

Robulus navarrensis (PLUMMER), var. extrusus CUSHMAN, Contr. Cushman Lab. Foramin. Res., vol. 14, 1938, p. 31, pl. 5, fig. 1; vol. 17, 1941, p. 58, pl. 15, fig. 2-3.

This variety is also an index fossil for that part of the Navarro...
FOR FORAMINIFERAL RESEARCH

The types are from the locality 2.4
miles E.S.E. of Coulidge and it also occurs at the Corsicana Clay Pit.
It appears to be absent in the section on Onion Creek.

Robulus spiro-costatus Cushman (Pl. 9, fig. 10)
p. 32, pl. 5, fig. 2; vol. 17, 1941, p. 57, pl. 15, fig. 3.

The types of this species are from the locality 2.8 miles E.S.E. of
Coulidge where it is common. It occurs at the Corsicana Clay Pit but
is absent in the section on Onion Creek. The species is characteristic
of the Navarro group above the Nacatoch sand.

Very rare specimens of this species assume a Darbyella form.

In their list of Corsicana marl species, Albritton and Phleger (Journ.
Pal., vol. 11, 1937, p. 351) give “Cristallaria pseudomamilligera
Plummer” which, on examination of their original specimens, appears
to be Robulus spiro-costatus Cushman.

Genus LENTICULINA Lamarck, 1804
Lenticulina Jonesi Sandides (Pl. 9, figs. 19, 20)
Lenticulina jonesi Sandides, Journ. Pal., vol. 6, 1932, p. 273, pl. 42, figs. 1, 2.—Cush-

Specimens, seemingly referable to this species described from the
Hopple formation of Alabama, occur at all three of our stations. There
is some variation in the shape of the apertural face and in the curva-
ture of the sutures as well as in the amount of involution of the test.

Genus PLANULARIA Defrance, 1824
Planularia dissona Plummer, Univ. Texas Bull. 3101, 1931, p. 145, pl. 11, figs. 17,
18, pl. 15, figs. 2-7.

69, pl. 16, figs. 15-19.

Cristallaria reniformis Casev (not d’Orbigny), Univ. Texas Bull. 2612, 1926, p. 37,
fig. 2.

This species is variable in its form, particularly in the relative am-
ount of uncoiling. It is an excellent index fossil for the beds of
Navarro age above the Nacatoch sand, often especially abundant in
the Corsicana marl. It occurs at all three of our localities.

Genus MARGINULINA d’Orbigny, 1826
Marginulina silicula (Plummer) (Pl. 10, fig. 4)

For references see these Contributions, vol. 17, 1941, p. 88.

This is an index fossil for the upper part of the Navarro group and
formations of similar age in South America and Europe. Specimens
occur in two of the localities: the Corsicana Clay Pit and 2.8 miles E.S.E. of Coledge.

**Marginalina Plummerae Cushman** (Pl. 10, fig. 2)

*Homocristellaria ensis* Plummer (not Reuss), Univ. Texas Bull. 3101, 1951, p. 146, pl. 10, figs. 1-4.

*Cristellaria lineata* Carney (not *C. linearis* d'Orbigny), Univ. Texas Bull. 2612, 1928, p. 36, pl. 2, fig. 3.

This should be a good index fossil for the upper beds of Navarro age. It is present in material from the three localities.

**Marginalina Curvatura Cushman** (Pl. 10, fig. 3)

The types of this species are from the Corsicana marl of the section on Onion Creek. It also occurs at both of the other localities used here. It would be a good index fossil for the upper part of the Navarro group. Microspheric specimens closely resemble *M. bullata* Reuss but may be distinguished by the lack of a cylindrical neck.

**Marginalina sp.** (Pl. 10, fig. 1)

A single specimen from Onion Creek is here figured. The early portion is coiled with raised sutures while the later portion has depressed sutures and elongate, inflated chambers. In its early stages it bears what resembles *M. plummerae* Cushman but the later chambers are much more elongate.

**Genus Dentalina** d'Orbigny, 1826.

**Dentalina Basiplanata** Cushman (Pl. 10, fig. 7)
*Dentalina annulata* CUSHMAN (not Reuss), Tenn. Div. Geol., Bull. 41, 1931, p. 29, pl. 3, fig. 3.

*Dentalina reusi* PLUMMER (not Neugebauer), Univ. Texas Bull. 3101, 1951, p. 146, pl. 11, fig. 5.—SANDIDGE, Jour. Paleont., vol. 6, 1932, p. 274, pl. 42, fig. 10.

*Dentalina basiplanata* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 36, pl. 6, figs. 6-8; vol. 16, 1940, p. 82, pl. 14, figs. 1-6.—CUSHMAN and HENDERSON, I. c., vol. 17, 1941, p. 88, pl. 21, fig. 23.

This species often occurs in considerable numbers in the Corsicana marl. It occurs at all three of our localities. It has a wide range but is less common in the lower part of the Navarro group and in the Taylor group.

Some of the specimens which have been referred to *Dentalina megapolitana* Reuss probably belong here as do the specimens from the Corsicana Clay Pit referred to "*Dentalina gracilis* d'Orbigny" by Albritton and Pfleger (Jour. Paleont., vol. 11, 1937, p. 350).
This is a somewhat variable species with a wide range. It occurs in the Corsicana material only at the locality 2.8 miles E.S.E. of Coolidge.

**DENTALINA CRINITA** Plummer (Pl. 10, fig. 6)

This species occurs at all three of our localities. It has a wide range in the Navarro and Taylor groups.

**DENTALINA aff. CORSICANA** d'Orbigny

The only specimens referable to this species are from the section on Onion Creek.

**DENTALINA DELICATULA** Cushman (Pl. 10, fig. 9)

The types of this species are from the Corsicana marl of the Onion Creek section. It also occurs in material from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Coolidge. It seems to be characteristic of the Corsicana marl and occurs rarely in the Kemp clay.

**DENTALINA ANGUSTICOSTATA** Cushman (Pl. 10, fig. 10)

The types of this species are from the Corsicana marl, 2.8 miles E.S.E. of Coolidge, and it occurs also in the Onion Creek section but was not found in the material from the Corsicana Clay Pit. It is not recorded elsewhere than in the Corsicana marl.

**Genus NODOSARIA** Lamarck, 1812

**NODOSARIA AFFINITIS** Cushman (Pl. 10, fig. 11)

Specimens of this large, wide ranging species occur at all three of our localities but are not common.

**NODOSARIA NAVARROANA** Cushman (Pl. 10, fig. 12)

Types are from the Corsicana Clay Pit. It occurs at all three of our localities and elsewhere in the Corsicana marl. The only other
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record is from the Prairie Bluff chalk of Mississippi. It should be a good index fossil for this part of the Upper Cretaceous.

**Nodosaria corsicana Cushman** (Pl. 10, fig. 10)


This seems to be a good index fossil for the Corsicana marl as it is not recorded elsewhere. It occurs in the material from 2.8 miles E.S.E. of Coolidge and from the Corsicana Clay Pit.

**Genus PSEUDOGLANDULINA Cushman, 1929**

PSEUDOGLANDULINA MANIFESTA (Reuss) (Pl. 10, fig. 16)


*Nodosaria manifesta* Cushman, Bull. Amer. Assoc. Petr., Geol., vol. 10, 1926, p. 572, pl. 18, fig. 8.—Sandige, Journ. Pal., vol. 6, 1932, p. 278, pl. 42, fig. 8.

*Nodosaria larvata* Carsey, Univ. Texas Bull. 2612, 1926, p. 31, pl. 2; fig. 2.

*Nodosaria humilis* Cushman (not Roemer), Tenn. Div. Geol., Bull. 41, 1931, p. 32, pl. 4, fig. 5.

This is a variable form with a wide range. There is considerable difference in the shape of the microspheric and megalospheric forms. It occurs rather rarely at all three of our localities.

PSEUDOGLANDULINA LAGENOIDES (Ottewiak) (Pl. 10, fig. 14)

(For references see these Contributions, vol. 17, 1941, p. 89)

Specimens are rare in the material from 2.8 miles E.S.E. of Coolidge and in the Onion Creek section.

**Genus SARACENARIA Defrance, 1824**

SARACENARIA^*^ ed. ITALICA Defrance. (Pl. 10, fig. 17)

Rare specimens may be referred to this species with some question. They are from 2.8 miles E.S.E. of Coolidge.

**Genus VAGINULINA d’Orbigny, 1826**

VAGINULINA MULTICOSTATA Cushman (Pl. 10, fig. 19)


*Vaginulina simondsi* Cushman (part) (not Carsey), Tenn. Div. Geol., Bull. 41, 1931, p. 33, pl. 4, fig. 7 (not fig. 8); Journ. Pal., vol. 5, 1931, p. 306, pl. 35, fig. 7.

Most of the records for this species are from the Navarro or its equivalents although it ranges into the Taylor. It occurs at all three of our localities.

VAGINULINA SIMONDSET Carsey (Pl. 10, fig. 18)

This species has been much confused with other somewhat similar ones. It is close to *V. webbervillensis* Carsey, but is smaller, less expanded toward the outer end and has costae over the entire surface. Its range seems to be confined to the Navarro group. Of our three localities it occurs only at the Corsicana Clay Pit.

**VAGINULINA CRETAEEA Plummer** (Pl. 10, fig. 20)

*Vaginulina gracilis* Plummer, var. cretacea Plummer, Univ. Texas Bull. 2644, 1926 (1927), p. 172, pl. 2, fig. 8.

*Vaginulina cretacea* Cushman, Bull. Geol. Soc. Amer., vol. 47, 1936, p. 417, pl. 1, fig. 3.

This seems to be a good index fossil for that part of the Navarro group above the Nacatoch sand, occurring in the Kemp clay and Corsicana marl of Texas, Arkadelphia marl and Saratoga chalk of Arkansas, Prairie Bluff chalk of Mississippi and Alabama, and Ripley formation of Mississippi. It also occurs in the Upper Cretaceous of Navarro age in the canyons of Georges Bank. It occurs at all three of our localities.

**VAGINULINA NAVARROANA Cushman** (Pl. 10, fig. 16)


The types of this species are from Cretaceous greensand of Navarro age from the canyons of Georges Bank. It has also been recorded from the Mito Juan and upper part of the Colon formation in Colombia. It is common in the Corsicana marl and occurs in the Kemp Clay of Texas, Prairie Bluff chalk of Mississippi and Alabama, and in the Nacatoch sand of Arkansas. There are specimens in all three of our localities. It should make a good index fossil for the upper part of the Navarro group.

**VAGINULINA WEBBERVILLENSIS Carsey** (Pl. 10, fig. 21)


This is a fine, large species and an index fossil for the Corsicana marl and other beds of Navarro age above the Nacatoch sand. It occurs at all three of our localities.

**VAGINULINA SUBGRACILIS Cushman** (Pl. 10, fig. 22)


*Vaginulina gracilis* Cushman (not Plummer), Tenn. Div. Geol., Bull. 41, 1931, p. 34, pl. 4, fig. 11.
The description of *Vaginulina* reussi is based on the holotype which is from the Corsicana marl. The figured type is from the Ripley formation, 1½ miles W. of Sardis on Sardis-Henderson road; Henderson Co., Tennessee. In our material *Vaginulina* reussi occurs only in the Corsicana Clay Pit.

**Genus PALMULA** Les., 1833

**Palmula reticulata** (Muenster) (Pl. 10, fig. 28)


*Palmula reticulata* Cushman, Foraminifera, their classification and study, 3rd. Ed., 1940, pl. 20, fig. 9.

*Flabellina favosa* Beisel, Abhandl. Preuss. Geol. Landes., n. ser., vol. 1, 1856, pl. 9, figs. 25-28; pl. 16, fig. 28.

*Frodinuloria cf. inter punctata* Cushman (not von der Marck), Bull. Amer. Acad. Petr. Geol., vol. 10, 1926, p. 598, pl. 20, fig. 3.

This species is found in the uppermost Cretaceous of Europe and characteristic of the American Cretaceous above the Nacatagh formation, although there are rare records below in the upper part of the Taylor marl. In our material it occurs in the Corsicana Clay Pit and 2 miles E.S.E. of Cooledge.

**Genus FRONDICULARIA** Defrance, 1826

**Frondicularia vertenuillana** d'Orbigny (Pl. 10, fig. 20)

(For reference see these Contributions, vol. 18, 1942, p. 61)

This species has a wide distribution in the Upper Cretaceous of Navarro, Taylor, and Austin groups. The only specimen of our material from the Corsicana marl is from 2.8 miles E.S.E. of Cooledge.

**Frondicularia archiaciana** d'Orbigny (Pl. 10, fig. 24)

(For reference see these Contributions, vol. 12, 1936, p. 19)

This species is most characteristic of the Taylor group, but occurs...
The species is found in the upper part of the Navarro group and its equivalents. It occurs at all three of our localities in the Corsicana sand.

**Genus LAGENA Walker and Jacob, 1798**

**LAGENA HISPIDA** Reuss (Pl. 10, fig. 34)

Many forms have been included under this name. Our only specimens are from the Onion Creek section where it is rare.

**LAGENA cf. GLOBOSA Montagu** (Pl. 10, fig. 27)

The only specimens referable to this species in our present material are from the Onion Creek section.

**Family POLYMORPHINIDAE**

**Genus GUTTULINA d'Orbigny, 1839**

**GUTTULINA ADHAERENS** (Olczewski) (Pl. 11, fig. 1)


**Poly morphina problematica** PLUMMER (not d'Orbigny), Univ. Texas Bull. 3101, 1931, p. 173, pl. 11, fig. L.—SANDIDGE, Amer. Midland Nat., vol. 19, 1932, p. 358, pl. 41, figs. 21, 22.

In the American Cretaceous this species seems to be limited to that part of the Navarro group above the Nacatoch sand. In our material it occurs at all three of the localities, but is rare.

**Genus GLOBULINA d'Orbigny, 1826**

**GLOBULINA LACRIMA** Reuss (Pl. 11, fig. 3)


**Poly morphina lacrima** Reuss, Hadinger's Nat. Abhandl., vol. 4, pt. 1, 1851, p. 43, pl. 4.

This species is widely distributed, but in America is confined mostly to the beds of Navarro and Taylor ages with rare occurrences in the upper beds of Austin age. It occurs at all three of our localities.

GLOBULINA LACRIMA Reuss, var. HORRIDA Reuss (pl. 11, fig. 3)

Globulina horrida Reuss, Verstein. böhm. Kreide, pt. 2, 1846, p. 110, pl. 43, fig. 2.


This variety differs from the typical form in having a finely spinose surface and the apertural end usually fistulose. It occurs in our material at only one station in the Onion Creek section.

Genus PYRULINA d'Orbigny, 1839

PYRULINA CYLINDROIDES (Roemer) (pl. 11, fig. 2)


This is a rather variable species and usually not found in any considerable numbers. It is mostly found in the Navarro group and upper part of the Taylor group. Our specimens are from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Cooledge.

Genus PSEUDOPOLYMORPHINA Cushman and Ozawa, 1928

Pseudopolymorphina cujleri Plummer (pl. 11, figs. 5–9)

Pseudopolymorphina cujleri Plummer, Univ. Texas Bull. 3101, 1931, p. 175, pl. 28, figs. 18–21.


This is an excellent index fossil for the upper portion of the Navarro group, being particularly well developed in the Corsicana marl. It is several times as large as P. mendezensis and, in the young stages,
lers in being broader and more compressed. It occurs in the material from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Coolidge. It also occurs in the Arkadelphia marl of Arkansas and in the Prairie Bluff chalk of Alabama and Mississippi.

Pseudopolymorphina mendezensis (White) (Pl. 11, fig. 5)


The types are from the Mendez shale of Mexico. A few specimens from the Corsicana marl seem to be identical. They are from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Coolidge.

Genus RAMULINA Rupert Jones, 1875
RAMULINA NAVARROANA CUSHMAN (Pl. 11, fig. 7)


This species is known only from the Corsicana marl, occurring in material from 2.8 miles E.S.E. of Coolidge and from the section on Onion Creek.

Genus BULLOPORA Quenstedt, 1856
BULLOPORA LAEVIS Sollas (Sollas) (Pl. 11, fig. 8)

Bullopora laevis Sollas, Geol. Mag., dec. 2, vol. 4, 1877, p. 103, pl. 6, figs. 1-3.


Bullopora laevis Wickenden, Journ. Pal., vol. 6, 1932, p. 206, pl. 29, figs. 6-8.—CUSHMAN; Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 24.—TAPPAN, Journ. Pal., vol. 14, 1940, p. 115, pl. 18, fig. 6.

Forms referred to this species are widely distributed in the Cretaceous. In the Corsicana marl it occurs in the material from 2.8 miles E.S.E. of Coolidge and at one station in the section on Onion Creek.

Family NONIONIDAE

Genus NONIONELLA Cushman, 1926
NONIONELLA ROBUSTA Plummer (Pl. 11, fig. 9)

Nonionella robusta Plummer, Univ. Texas Bull. 3101, 1931, p. 175, pl. 14, fig. 12.—CUSHMAN, U. S. Geol. Survey Prof. Paper 191, 1939, p. 27, pl. 7, fig. 3.

Nonionella scapha CASEY (not FITCHEL and MOLL), Univ. Texas Bull. 2612, 1926, p. 44, pl. 1, fig. 2.

This is an excellent index fossil for the Navarro group and is espec-
Family HETEROHELICIDAE

-Genus BOLIVINOPSIS Yakovlev, 1902

**BOLIVINOPSIS ROSULA (Ehrenberg)** (Pl. 11, fig. 9)


*Spirella rorula* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1922, pl. 62, fig. 9; p. 114, pl. 23, figs. 6, 7; Tenn. Div. Geol. Bull. 41, 1931, pl. 7, fig. 9; Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 21, fig. 4; Special Publ. No. 5, 1933, pl. 26, fig. 4; Contr., vol. 10, 1934, p. 39, pl. 9, fig. 4.


This species is widely distributed in the Cretaceous. It occurs in material from all of our localities in the Corsicana marl.

**Genus GÜMBELINA Egger, 1899**

**GÜMBELINA STRIATA (Ehrenberg)** (Pl. 11, fig. 11)

(For references see these Contributions, vol. 18, 1942, p. 63)

This species is rare in the Navarro group. It occurs in material from the Corsicana Clay Pit and from 2.8 miles E E. of Corsicana.

**GÜMBELINA GLOBULOSA (Ehrenberg)** (Pl. 11, fig. 12)

(For references see these Contributions, vol. 14, 1938, p. 6)

This is a widely distributed species ranging through both the Navarro and Taylor groups. It occurs at all three of our Corsicana marl localities.

**GÜMBELINA COSTULATA Cushman** (Pl. 11, fig. 13)


This species also ranges throughout the Navarro and Taylor groups and occurs at all of our localities.

**GÜMBELINA EXCOLATA Cushman** (Pl. 12, fig. 10)

(For references see these Contributions, vol. 17, 1941, p. 92)

Most of the records for this species are from the Corsicana and Kemp clay, and Arkadelphia marl-Navarro age but there are also records for it in the upper part of the Taylor marl. It also occurs in the Selma chalk of wells in Florida, and is recorded from the upper Cretaceous of Mexico and Colombia.

**GÜMBELINA GLABRATA Cushman** (Pl. 11, fig. 14)

(For references see these Contributions, vol. 17, 1941, p. 92)

This seems to be an index fossil for that portion of the Navarro group above the Nacatoch sand. It also occurs in Colombia and in the walls of the canyons in Georges Bank. It was found at all three of our localities in the Corsicana marl.
Genus CUMBELITRIA Cushman, 1933
CUMBELITRIA CRETAEAE Cushman (Pl. 11, fig. 16)

(For references see these Contributions, vol. 17, 1941, p. 91)

This is an index fossil for that part of the Navarro group above the Nacatoch sand. It occurs in the material from 2.8 miles E.S.E. of Coolege and from the section on Onion Creek.

Genus PSEUDOTEXTULARIA Rzechak, 1886
PSEUDOTEXTULARIA VARIANS Rzechak (Pl. 11, fig. 17)

(For references see these Contributions, vol 14, 1938, p. 21)

This species in the American Cretaceous occurs in Mexico, particularly in the Mendez shale. It occurs in the Kemp clay of Texas and was found at all three of our localities in the Corsicana marl.

Genus VENTILABRELLA Cushman, 1928
VENTILABRELLA CARSEYAE Plummer (Pl. 11, fig. 18)

(For references see these Contributions, vol. 17, 1941, p. 93)

This is an index fossil for that part of the Navarro group above the Nacatoch sand. It occurs at all three of our Corsicana marl localities.

Genus PSEUDOUVIGERINA Cushman, 1927
PSEUDOUVIGERINA SELIGI (Cushman) (Pl. 11; fig. 19)


This species seems to be characteristic of the Navarro group above the Nacatoch sand. It is found at all three of our Corsicana marl localities. It is recorded by Albritton and Phleger as "Ubigerina americana Cushman" (Journ. Pal., vol. 11, 1937, p. 351), as shown by examination of their original material.

Family BULIMINIDAE
Genus BULIMINELLA Cushman, 1911

BULIMINELLA CARSEYAE Plummer, var. PLANA Cushman and Parker (Pl. 11, fig. 20)


This variety is characteristic of the Navarro group above the Nacatoch sand and occurs in the Colon shale of Colombia. It occurs in our material from the Corsicana Clay Pit and from the section on Onion Creek.
This variety seems to be limited to beds of Navarro age and is particularly common in the Corsicana marl. It occurs at all three of our localities.

**Bulimina prolixa** Cushman and Parker (Pl. 11, fig. 28).


This species occurs in beds of Navarro age and in the upper beds of Taylor age. It occurs in the Corsicana marl only at the locality 2.8 miles E.S.E. of Cooledge.


The types are from the locality 2.8 miles E.S.E. of Cooledge and it occurs at both of our other localities. The variety often occurs abundantly and is an excellent marker for this part of the Navarro group occurring in, besides the Corsicana marl, the Kemp clay of Texas and the Prairie Bluff chalk of Mississippi.

**Bulimina aspera** Cushman and Parker (Pl. 11, fig. 29).

(For references see these Contributions, vol. 16, 1940, p. 44)

Specimens referable to this species occur in our Corsicana marl from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Cooledge. It is widely distributed in the Navarro and Taylor groups.

**Genus Neobulimina** Cushman and Wickenden, 1928

**Neobulimina canadensis** Cushman and Wickenden


This widely distributed species occurs in our material from 2.8 miles E.S.E. of Cooledge.

**Genus Virgulina** d'Orbigny, 1826

**Virgulina navarroana** Cushman (Pl. 11, fig. 24)

(For references see Special Publ. No. 9, 1937, p. 6)

This seems to be a good index fossil for the Kemp clay and Corsicana.
family of the upper part of the Navarro group. It occurs at all three of our localities.

Genus LOXOSTOMUM Ehrenberg, 1854
LOXOSTOMUM PLATUM (Caryey) (Pl. 11, fig. 26)
(For references see those Contributions, vol. 17, 1941, p. 95)
Specimens of this species occur at all three of our Corsicana localities.
LOXOSTOMUM PLATUM (Caryey) var. LIMBOSOM Cushman (Pl. 11, fig. 27)
(For references see Special Publ. No. 9, 1937, p. 170)
This variety is confined to beds of Navarro age. In our material it occurs at the locality 2.8 miles E.S.E. of Coolige.

Family ELLIPSOIDINIDAE
Genus ELLIPSONODOSARIA A. Silvestri, 1900
ELLIPSONODOSARIA STEPHENSONI Cushman (Pl. 11, fig. 28)
This species ranges through the Navarro and Taylor groups. In our Corsicana material it occurs at the Corsicana Clay Pit and from 2.8 miles E.S.E. of Coolige.

ELLIPSONODOSARIA ALEXANDERI Cushman, var. IMPENSIA Cushman (Pl. 11, fig. 29)
This form is a good index fossil for the upper part of the Navarro group and is especially abundant in the Corsicana marl. It occurs at all three of our localities.

ELLIPSONODOSARIA (?) GRANTI (Plummer) (Pl. 11, fig. 30)
Ellipsonodosaria granti Plummer, Univ. Texas Bull. 2641, 1926 (1927), p. 83, pl. 5, fig. 9.
Ellipsonodosaria (?) granti CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 31, pl. 9, figs. 3-5.
In the Cretaceous this species is largely confined to beds of Navarro age but there are a few specimens from the upper part of the Taylor marl. It occurs in our material from the Corsicana Clay Pit and from 2.8 miles E.S.E. of Coolige.

Family ROTALIIDAE
Genus VALVULINERIA Cushman, 1926
VALVULINERIA CRETACEA (Caryey) (Pl. 12, fig. 1)
Valvulinera cretacea CARYEY, Univ. Texas Bull. 2612, 1926, p. 48, pl. 5, fig. 1.—Sandidge, Amer. Midland Nat., vol. 13, 1932, p. 364, pl. 33, figs. 7, 8.
This species apparently belongs in the genus Valvulinera. It is often abundant and characteristic of beds of Navarro age with a few
occurrences in the Taylor group. It occurs at all three of our Corsicana localities.

**VALVULINERIA cf. UMBILICATULA (d'Orbigny)** (Pl. 12, fig. 2)

*Valvulineria cf. umbilicatula* Cushman, Tenn. Div. Geol., Bull. 41, 1931, p. 43, pl. 9, figs. 2-5.

*Gyroidina umbilicata* Cushman, Contr. Cushman Lab. foram. Res., vol. 7, 1931, p. 43, pl. 6, fig. 3.

This is a variable form possibly identical with d'Orbigny's species. It occurs in the Navarro group particularly above the Nacatoch sand. In the Corsicana marl it occurs at our locality 2.8 miles E.S.E. of Coolege and in the section on Onion Creek.

**Genus GYROIDINA** d'Orbigny, 1826

**GYROIDINA DEPRESSA** (Alth) (Pl. 12, fig. 4)

(For references see these Contributions, vol. 17, 1941, p. 97)

This species has a wide range nearly throughout the Upper Cretaceous. The only material from the Corsicana marl is from the Clay Pit where it is rare.

**GYROIDINA GIRARDAÑA** (Reuss) (Pl. 12, fig. 8)

*Rotulina girardana* Reuss, Zeitschr. deutsc. geol. Ges., vol. 3, 1851, p. 73, pl. 4, fig. 34.


**EXPLANATION OF PLATE 11**

This species has a wide range in the Upper Cretaceous. It occurs at all three of our localities. An examination of the specimens shows that Albritton and Phleger's "Gyroidina micheliniana (d'Orbigny)" (Journ. Pal., vol. 11, 1937, p. 352) should belong here.

Genus EPISTOMINA Terquem, 1883

EPISTOMINA CARACOLLA (Roemer) (Pl. 12, fig. 5)

Gyroidina caracolla Roemer, Verstein. norddeutsch. Kreide., 1840-41, p. 97, pl. 15, fig. 22.


This species is widely distributed in beds of Navarro and Taylor age. In the Corsicana marl it occurs only at the locality 2.8 miles E.S.E. of Coolidge.

Genus SIPHONINA Reuss, 1850

SIPHONINA PRIMA Plummer (Pl. 12, fig. 6)


The types of this species are from the Midway (Paleocene) of Texas.

EXPLANATION OF PLATE 12

Similar forms occur in the Navarro group above the Nacatoch sand in Texas, Arkansas, Mississippi, Alabama, Tennessee, and New Jersey. Our specimens from the Corsicana marl are from 2.8 miles E.S.E. of Coolidge and from the section on Onion Creek.

Family CASSIDULINIDAE

Genus CERATOBULIMINA Troua, 1920

Ceratobulimina Cretacea Cushman and Harris (Pl. 12, fig. 7)


The types of this species are from the Corsicana marl of Texas. It is characteristic of the beds of Navarro age above the Nacatoch sand. In our material it occurs only at the locality 2.8 miles E.S.E. of Coolidge.

Genus PULVINULINELLA Cushman, 1926

Pulvinulinella glabrata Cushman (Pl. 12, fig. 8)


The types of this species are from the Corsicana marl. It is almost entirely confined to the upper beds of Navarro age. Specimens occur at the locality on Onion Creek.

Family CHILOSTOMELLIDAE

Genus ALLOMORPHA Reuss, 1850

Alломорфа наварроана Cushman (Pl. 12, fig. 9)


The types are from the Corsicana Clay Pit and there are specimens also from the section on Onion Creek. The only other record is from the Kemp clay of Texas. It would seem, therefore, that this should be a good index fossil for this upper part of the Navarro group.

Genus PULLENIA Parker and Jones, 1862

Pullenia minuta Cushman (Pl. 12, fig. 10)


The types of this species are from the Corsicana marl and it occurs at all three of our localities. It is an index fossil for the upper beds of Navarro age, occurring in the Kemp clay and Corsicana marl of Texas and in the Prairie Bluff chalk of Mississippi.
Family GLOBIGERINIDAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA CRETACEA d'Orbigny

This group is under study at the present time and final determination of species has not been completed. At all three of our Corsicana marl localities there are specimens probably identical with those of d'Orbigny.

Family GLOBOROTALIIDAE

Genus GLOBOTRUNCANA Cushman, 1927

GLOBOTRUNCANA FORNICATA Plummer

(For references see these Contributions, vol. 17, 1941, p. 99)

A single specimen from the locality 2.8 miles E.S.E. of Cooledge seems to belong to this species. Its normal range is from the Neylandville marl member of the Navarro group down through the Taylor group.

GLOBOTRUNCANA ARCA (Cushman) (Pl. 12, fig. 11)


Globigerina rosetta Carney, Univ. Texas Bull. 2612, 1926, p. 44, pl. 5, fig. 3.

Specimens referable to this species occur at all three of our localities.

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA MEMBRANACEA (Ehrenberg) (Pl. 12, fig. 12)

Planulina membranacea Ehrenberg (part), Mikrogeologie, 1854, pl. 26; fig. 43 (not pl. 25, 1A, fig. 41).

Pulvinulina membranacea Cushman, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 608, pl. 21, fig. 10.


The Cretaceous records for this species have been confined to the upper part. Rare specimens from the locality 2.8 miles E.S.E. of Cooledge seem identical with Mexican specimens.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA NELSONI W. Berry (Pl. 12, fig. 13)

This species has a wide distribution in the Navarro group and the upper part of the Taylor group. In our Corsicana marl material it occurs in the material from 2.8 miles E.S.E. of Cooledge and in the section on Onion Creek.

Anomalina pseudopapillosa Carney (Pl. 13, fig. 14)
Anomalina pseudopapillosa Carney, Univ. Texas Bull. 2612, 1926, p. 47, pl. 1, fig. 6.

The range of this species is from the Midway (Paleocene) downward through beds of Navarro age to and including the Nacatoch sand. It occurs at all three of our Corsicana marl localities.

Genus PLANULINA d’Orbigny, 1826
Planulina correcta Carney (Pl. 12, fig. 16)
Discorbis correcta Carney, Univ. Texas Bull. 2612, 1926, p. 45, pl. 3, fig. 5.—Plummer, I. C., Bull. 3101, 1931, p. 188, pl. 14, figs. 1-4.

This species is a characteristic one for the upper part of the Navarro group, occurring in the Kemp clay and Corsicana marl of Texas, Arkadelphia marl of Arkansas, and Prairie Bluff chalk of Mississippi and Alabama. The types are from the Corsicana marl and the species occurs in all of our localities.

Genus CIBICIDES Montfort, 1808
Cibicides harbori (Sandliæ) (Pl. 12, fig. 16)
(For references see these Contributions, vol. 16, 1940, p. 38).

This species seems to be limited to the upper beds of Navarro age. In our material it occurs at 2.8 miles E.S.E. of Cooledge and in the section on Onion Creek.

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand:


Frizzell, Don L. Upper Cretaceous Foraminifera from northwestern Peru.—Journ. Pal., vol. 17, No. 4, July, 1943, pp. 331-353, pls. 55-57, text figs. 1, 2.—There are 52 species and varieties described from the Mal Paso shale, of which 15 are new.

Thalmann, Hans E. Bibliography and index to new genera, species, and varieties of Foraminifera for the year 1940.—L. C., pp. 388-408.

J. A. C.