NEOCOMIAN FAUNAS OF NORTHERN MEXICO

BY RALPH W. IMLAY

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ABSTRACT

Thick, clastic deposits of Neocomian age mark the margin of the former Coahuila Peninsula of northern Mexico. They contain a large fauna, consisting mainly of mollusks and brachiopods, the study of which has made possible correlations of the various facies of the Mexican geosyncline. The faunal assemblage is remarkably similar to that in the Neocomian deposits of France, England, and Switzerland, and belongs decidedly in the Mediterranean province. No species in common are known between the Neocomian deposits of Mexico and the Upper Jurassic Malone formation of Texas.

INTRODUCTION

Near-shore facies of Neocomian age have been noted in southern Mexico (Felix, 1891, p. 180-194; Burckhardt, 1930, p. 159-162; Sapper, 1937, p. 44), along the Sierra Madre Oriental (Böse and Cavins, 1927, p. 17-18, 56-58; Burckhardt, 1930, p. 142-144, 154-157; Imlay, 1937a, p. 552-574), around the margin of the Coahuila Peninsula in eastern Durango and eastern Coahuila (Kellum, 1936, p. 1053, 1057-1059, 1067-1070; Burckhardt, 1930, p. 144-147), and near Torcer, Texas (Albritton, 1938, p. 1764-1767). Similar facies of Neocomian age must have been formed along the western margin of the Mexican geosyncline but have not yet been discovered. The ages of the sections in eastern Durango have been discussed by the writer (1938b, p. 1684, 1687). The sections in eastern Coahuila have been studied in considerable detail by Wm. G. Kane and will be described by him in a forthcoming paper. The present paper deals mainly with the Neocomian faunas that inhabited the shallow seas bordering the Coahuila Peninsula, suggests correlations with previously described Neocomian deposits of other parts of Mexico, confirms the previous correlations based on ammonites in offshore facies (Imlay, 1938a, p. 550-552), and shows that the Neocomian deposits of Mexico contain an entirely distinct mollusk assemblage from the Malone formation of western Texas. Included are descriptions of a few new and especially interesting ammonites from the offshore Taraises formation of southern Coahuila (Pl. 21).
ACKNOWLEDGMENTS

The fossils described herein were obtained mainly by Lewis B. Kellum, Wm. G. Kane, T. S. Jones, and R. W. Imlay in the course of structural and stratigraphic studies in northern Mexico. All the collections from eastern Durango, southern Coahuila, and some from eastern Coahuila were made possible by financial support from The Geological Society of America. Most of the fossils from eastern Coahuila were obtained by Wm. G. Kane while in the employ of the Ohio-Mexican Oil Company and were subsequently donated to the Museum of Paleontology

FIGURE 1.—Neocomian paleogeography of Mexico
<table>
<thead>
<tr>
<th>European equivalents</th>
<th>Texas equivalents</th>
<th>Mountains west of Laguna district (modified after L. B. Kellum)</th>
<th>Sierra de Parras and Parras Basin (R. W. Imlay)</th>
<th>Barril viejo (After Wm. G. Kane)</th>
<th>Potrero de Menchaca (Wm. G. Kane)</th>
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of the University of Michigan. The writer is greatly indebted to Mr. Kane for preparing generalized descriptions of the sections in Barril viejo and Potrero de Menchaca. All new formation names mentioned in these sections were proposed by him. This paper completes the study of the Neocomian faunas in the University of Michigan collections.

STRATIGRAPHY

EASTERN COAHUILA

Lower Cretaceous rocks approximating 9000 feet in thickness are well exposed in the deeply eroded anticlinal uplifts of east-central Coahuila (Fig. 2). The Neocomian is represented by arkoses, shales, limestones, and minor amounts of gypsum; the Aptian by arkoses, shales, marls, dolomites, dolomitic limestone, and considerable gypsum; and the Alban in part by several thousand feet of thick-bedded limestone which forms escarpments and mountain crests. The Neocomian sediments become finer and more calcareous eastward, that is, away from the Coahuila Peninsula. Dolomites and gypsum of Aptian age occur in areas on, or near, the site of the Coahuila Peninsula. The limestones of the Alban appear to be somewhat thicker in areas around the margin than on the peninsula.

The generalized section in Barril viejo, measured by Wm. G. Kane, from top to bottom, is as follows:

1. Aurora limestone (in part)
   Thick-bedded, gray limestone. Basal marly beds contain *Dufrenoya texana* Burckhardt .......................... 3500
2. Patula arkose (Type locality Potrero de Patula)
   Green and brown graywackes and arkoses ..................................................... 1500
3. Padilla limestone (Type locality Potrero de Padilla)
   Dark blue, thick-bedded limestone, containing some arkosic impurities near base .................................................. 50
4. Barril viejo shale (Type section)
   Dark blue-gray, calcareous shale containing many fossils of middle Neocomian age .................................................. 100
5. San Marcos arkose (Type locality Cañón de San Marcos)
   Red, coarse, granitic arkose, contains red-stained, white granite boulders ranging up to 30 inches in diameter .............. 700

Total .................................................. 5850±

The generalized section in the Potrero de Menchaca, measured by Wm. G. Kane, from top to bottom, is as follows:

1. Aurora limestone (in part)
   Thick-bedded, gray limestone (not measured) probably ...................... 3500?
2. Cuchillo formation
   Bedded gypsum with intercalations of limestone and shale. Distinctive beds of compact, honey-combed yellow limestone. Several compact, gray limestone units similar to overlying Aurora limestone. Lowest member is a very resistant yellow-gray limestone .................. 1099
Figure 2.—Stratigraphic sections in eastern Coahuila
3. La Mula shales (Type locality Potrero de la Mula)
   Gray, green, pink, purple, and yellow shales and sandy shales. Easily
   eroded and forming valley topography ........................................ 794

4. Padilla limestone
   Thick-bedded, dark-blue-gray limestone. Contains large gastropods .. 50?

5. Barril viejo shale
   Dark blue, calcareous shale containing many fossils of middle Neo-
   comian age ................................................................. 843

6. San Marcos arkose
   Granitic arkose similar to that in the Barril viejo section but without
   granitic boulders and considerably finer-grained. Coarser-grained than
   equivalent arkosic beds at Padilla. Intercalations of limestone and
   dolomite as tongues feathering out toward the south and thickening
   toward the north. Upper and lower edges of calcareous units have
   arkosic impurities. Contains no volcanic material .......................... 410

7. Menchaca limestone (Type section)
   Dark blue-black limestone in beds averaging 18 inches in thickness.
   Lower part contains white calcite replaced Exogyras, namely, E. reedi
   Imlay and E. putnami Imlay .............................................. 1743

8. Unnamed shales
   Brown and gray shales and sandy shales with intercalated beds of
   brownish-gray, even-bedded limestone ranging up to several feet in
   thickness. Weather brownish-yellow. A marly bed at base contains
   Exogyra reedi Imlay, E. putnami Imlay, and Vermetus cornelioj Cast-
   tillo and Aguilera ...................................................... 557

Total ......................................................................................... 8996±

Sections in the Sierras de Azul and Oballos have been measured by
Müllerried (Burckhardt, 1930, p. 143-144). These sections, as well
as others, have been studied by Wm. G. Kane and will be described by
him. The formations are in general similar to those at Barril viejo and
Menchaca but somewhat more calcareous. At Potrero de Oballos there
are about 547 feet of Padilla limestone, 554 feet of Barril viejo shale,
204 feet of underlying shales and fine-grained sandy rocks, and 412 feet
of Menchaca limestone.

EASTERN DURANGO

The Neocomian deposits of eastern Durango comprise about 2000
feet of arkose, sandstone, shale, and limestone (Kellum, 1936, p. 1053,
1057-1059, 1067-1070; Imlay, 1938b, p. 1687). They show consid-
erable variation in lithology laterally and vertically but in general
constitute well-defined formations similar to the Neocomian formations
of southern Coahuila (Imlay, 1936, p. 1111-1119). Near their base
occurs a highly fossiliferous zone characterized by Exogyra reedi Imlay
and gigantic forms of Thurmannites. The sections will be briefly
summarized below.

The section on the west side of the Sierra de Mapimí about half
a mile south of Puerto Soldados, from top to bottom, may be summarized
as follows:

1. Parritas formation
   Unit 1 in part. Siliceous limestone, yellow to yellowish-gray, or less
   commonly pink. Beds from 1 to 5 feet thick. Some intercalated
   lenses of yellow, gray, or red sandstone and gray, yellow, or green shale .. 248
2. Las Vegas formation
   Unit 2. Sandstone, red, fine-grained, with interbedded reddish gray arkose and red or green sandy shale. .......................................................... 112

3. Taraises formation
   Unit 3. Limestone, light-gray, thin-bedded, weathering buff. Siliceous in lower half. A few beds of yellow quartz sandstone. .......................... 335
   Unit 4. Arkose, gray to reddish, interbedded with buff, gray, and green limestone which is siliceous at top and marly at the base. Some shale partings and quartz sandstone lenses. Arkose locally conglomeratic ...... 325

4. Carbonera formation
   Unit 5. Gray, quartz sandstone alternating with layers of shale and shaly sandstone. Coarse, greenish-gray arkose in basal part. Collection 34 obtained from lowest sandstone escarpment about 1000 feet below top. Formation includes the Cretaceous beds below the Taraises formation. Type locality is the Cuesta del Carbonera about 2 miles south of Las Cuevas, Durango. ........................................... 1300
   Total .................................................................................. 2320

The section across the Cuesta del Carbonera about 2 miles south of Las Cuevas ranch, from top to bottom, may be summarized as follows:

1. Taraises formation (lower member)
   Unit A. Upper part of measured section consists of gray and yellow, calcareous sandstones and shaly sandstones. Lower 180 feet consists of gray, siliceous limestone. At least .......................................................... 325

2. Carbonera formation (Type section)
   Unit B. Consists of interbedded gray sandy shale and shaly sandstone, which weathers buff. Collections A-4 and A-3 made about 340 and 363 feet respectively from top. ................................................... 738
   Total .................................................................................. 1063

The upper part of unit A above the part measured by Kellum (1936, p. 1053) consists of gray, siliceous limestone, according to observations made by the writer. It is overlain in Cañón de los Cabritos, immediately east of Cuesta del Carbonera, by light-gray, thin-bedded limestones lithologically like the upper member of the Taraises formation (Imlay, 1936, p. 1111). Directly above, on the east side of the canyon, occurs several hundred feet of sandstone and shale of Las Vegas formation which is overlain by yellowish limestones identified with the Parritas formation.

"COAHUILA GROUP," A NEW STRATIGRAPHIC TERM

During the course of studies in Mexico the writer has felt the need of a group term to designate Lower Cretaceous strata older than Trinity as that term is generally understood in Texas (Hill, 1901). Discussions with W. S. Adkins and John B. Reeside, Jr., have led to agreement as to the definition and usefulness of such a term. The Trinity becomes much too comprehensive for usefulness if extended to include all Lower Cretaceous rocks older than Fredericksburg as proposed by Adkins (1932,
p. 284-286). Consequently the writer herein proposes the "Coahuila group" to include all Lower Cretaceous strata older than the Dufrenoya texana zone which were deposited in the ancestral Gulf of Mexico, in the Mexican sea, and in closely connected waters.

John B. Reeside (personal communication, September 28, 1939) and other members of the United States Geological Survey have

"agreed that the single use of 'Coahuila' by Dallas Hanna for Pleistocene silts in the Imperial Valley, California, is not sufficient to bar its use as a group term to apply to Lower Cretaceous rocks in Coahuila, Mexico, and other areas."

The Coahuila group is named after the Mexican State of Coahuila, wherein it is fully developed in both near-shore and off-shore facies which have been described in various publications by Burekhardt (1930), Böse (1923, 1927), Kellum (1936), and Imlay (1936, 1937a, 1937b, 1938a and 1938b). The head of Cañón Taraises in the western part of the Sierra de Parras (Imlay, 1936, p. 1111-1124, pl. 8, fig. 1; pl. 10) may be designated as a typical locality. Other localities in which the group is well exposed are La Casita Uplift in the middle part of the Sierra de Parras (Imlay, 1937b, p. 605-607), Valle Menchaca in eastern Coahuila (described herein), the Sierra de Mapimí in eastern Durango (Kellum, 1936, p. 1067-1071), and the valley south of Cañón de Santa Catarina near Monterrey, Nuevo León (Böse and Cavins, 1927, p. 17-18).

The Coahuila group crops out extensively in Mexico (Fig. 1), in small areas in southwestern Texas, and, as revealed by well drilling, undoubtedly underlies Louisiana, southern Arkansas, and eastern Texas. Compared with the younger groups of the Lower Cretaceous, it represents a time of rather restricted marine overlap on the continent. Its relations to these younger groups and to the European standard section are shown in Table 2.

PALEOGEOGRAPHIC RELATIONSHIPS

During the Upper Jurassic and Neocomian the Coahuila Peninsula projected southward from the main North American landmass as a persistent positive area which passed beneath the Mexican sea in southern Coahuila. At the beginning of the Neocomian the peninsula extended as far south as the Sierra de Parras in southern Coahuila and was probably somewhat broader than indicated on the paleogeographic map (Fig. 1). It was transgressed by the Mexican sea early in the Neocomian and eventually submerged in upper Aptian time. During the Neocomian the bordering sea bottoms received several thousand feet of sediments which, near shore, consisted mainly of arkoses and shales but which graded seaward into marls and limestones of lesser thickness. The
character and thickness of the lithologic units formed near-shore vary considerably from place to place, probably depending on the position of the rivers which drained the land or perhaps on local uplift, but the offshore units, comprising the Taraises formation, are remarkably simi-

<table>
<thead>
<tr>
<th>European equivalents</th>
<th>Gulf region and Mexican groups</th>
<th>Characteristic ammonites</th>
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<tbody>
<tr>
<td></td>
<td>Washita (in part)</td>
<td>See Adkins, (1932, p. 318, 327, 363)</td>
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lar over large areas. In general the deposition of coarse clastic sediments decreased in amount during the Neocomian and occurred mainly during the Berriasian, lower Valanginian, and Hauterivian stages. Limestone deposition near shore occurred during the upper Valanginian and Barremian stages. Burckhardt (1930, p. 164) considered that the arkosic deposits of Hauterivian age, comprising Las Vegas formation and its equivalents, marked a regressive phase. The writer considers it more likely that the main uplift of Coahuila Peninsula occurred at the end of Jurassic time and that the Hauterivian arkoses mark the beginning of a period of aridity which culminated in the Aptian.
Eastern Coahuila.—Most of the fossils were obtained from the Barril viejo shale at Barril viejo, Potrero de Oballos, Potrero de Menchaca, and

the Sierra de Azul (Fig. 3). At Potrero de Menchaca Exogyras occur in abundance in the Menchaca limestone and in the lowest beds of the section. The collecting localities at Barril viejo and Potrero de Menchaca are indicated on Figures 4 and 5.
Figure 4.—Index map of fossil localities at Barril viejo, Coahuila
**Eastern Durango.**—The positions of the fossil localities in eastern Durango are indicated on a map by Kellum (1936, pl. 14) and will be briefly described. All collections were made from the Carbonera formation.

**Locality A-4:** Cuesta del Carbonera about 2 miles south of Las Cuevas ranch. Collection obtained from shales about 400 feet above the base of unit B. Another collection was made by the writer at the northwest end of the cuesta at the same horizon as A-4.

**Locality A-34:** West side of the Sierra de Mapimí, about half a mile south of the western end of Puerto de Soldados. Collection obtained about 1000 feet below the top of unit 5 just above the lowest sandstone escarpment on the left side of the largest canyon.

**Localities K-96, 97, 98:** Northwest end of Sierra de Hispaña, about a mile northeast of La Goma station. Collections K-96, 97, and 98 were made 18, 38, and 60 feet respectively above the base of the exposed section of sandy shale.

**Locality A-37:** Puerto de Soldados, north of trail, about half a mile west of Cañón Colorado.

**Southern Coahuila.**—The positions of the fossil localities in the Sierra de Parras are indicated in published papers (Imlay, 1937b, fig. 3; 1938a, p. 546, 547). Fossils described herein were obtained from the Taraiases formation at localities 18, 20, 42, and 58, and from the contact beds of the Cupido limestone-La Peña formation at locality 32.

**Biological Analysis**

The faunal assemblage of the near-shore deposits consists dominantly of thick-shelled gastropods, pelecypods, and brachiopods. Corals, echinoids, and ammonites are comparatively rare. New species include 1 coral, 4 brachiopods, 16 pelecypods, 4 gastropods, and 2 ammonites. These species as well as others discussed herein are listed in Table 5. Nearly one-third of the recognizable species are too poorly preserved to merit description.

The corals are represented by *Astrocoenia hispaniensis* Imlay, n. sp., and by several imperfect specimens which probably belong to *Montlivaltia, Pleurosmilia*, and *Coelosmilia*. Most of the echinoids are crushed or fragmentary. The best preserved corals and echinoids were obtained from the Barril viejo shale of eastern Coahuila. The brachiopods are abundant and well preserved. They comprise five species distributed among three genera. The generic determinations should be considered tentative.

The pelecypods are represented by 15 families, 22 genera, and numerous species of which about half are described. The genera *Pinna,*
Ostrea, Alectryonia, Trigonia, Pecten, Camptonectes, Spondylus, and Cyprina are represented by a few fragmentary specimens. The distribution of families, genera, and species is shown in Table 3.

The gastropods are represented by seven genera and eleven species

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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Trapetium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lucinidae</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lucina</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corbidae</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sphaera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saxicavidae</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Panope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pholadomyidae</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pholadomya</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Spondylidae      |                         |                             |
| Plicatula        | 6                       | 4                           |
| Spondylus        | 2                       | 1                           |

of which six are discussed and illustrated. The genera include Harpagodes, Nerinea, Vermetus, Natica?, Trochus, Turbo, and Pleurotomaria. Harpagodes is especially interesting because of its giant size and similarity to forms in France. Turbo? coahuilensis Imlay, n. sp., probably belongs to an undescribed genus.

The ammonites found in the near-shore deposits are mainly thick-shelled members of the Neocomitidae, including Thurmannites, Leopoldia, and Acanthodiscus. One large form of Dichotomites is the sole representative of the Olcostephanidae.

Many of the ammonites found in the offshore Neocomian deposits have been described previously (Imlay, 1938a), but herein are added ten
species distributed among seven genera, as shown in Table 6. Of particular interest is the occurrence of *Oosterella?* in beds of lower Hauterivian age and of *Saynoceras* in beds of probable upper Barremian age.

**Figure 5.—Index map of fossil localities at Potrero de Menchaca, Coahuila**

*Hemihoplites? mexicanus* Imlay, n. sp., probably represents an undescribed genus of the Hemihoplitidae. Descriptions of two new species of *Mexicanoceras* and three new species of *Maderia* contribute to the knowledge of these genera (Imlay, 1938a, p. 557-568).

**CORRELATION**

In eastern Coahuila the key formations of the Lower Cretaceous are (1) The marly beds with *Dufreneya texana* Burckhardt at the base of
<table>
<thead>
<tr>
<th>Mexican species</th>
<th>Similar European species</th>
<th>Range of European species</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Terebratula&quot; coahuilensis Imlay</td>
<td>“T” carteroniana d’Orbigny</td>
<td>Middle Neocomian</td>
</tr>
<tr>
<td>Cucullaea gabrielis var. fraterna Imlay</td>
<td>C. gabrielis Leymerie</td>
<td>Valanginian to Aptian</td>
</tr>
<tr>
<td>Plicatula pulchra Imlay</td>
<td>P. strambergensis Boehm</td>
<td>Tithonian to Hauterivian</td>
</tr>
<tr>
<td>Neithia cf. atava (d’Orbigny)</td>
<td>N. atava (d’Orbigny)</td>
<td>Neocomian to Lower Aptian</td>
</tr>
<tr>
<td>Prohinnites ordonzei Imlay</td>
<td>P. leymerii Deshayes</td>
<td>Valanginian to Aptian</td>
</tr>
<tr>
<td>Exogyra reedi Imlay</td>
<td>E. latissima var. couloni (Defrance)</td>
<td>Neocomian</td>
</tr>
<tr>
<td>Trigonia cf. carinata Agassiz</td>
<td>T. carinata Agassiz</td>
<td>Lower Cretaceous</td>
</tr>
<tr>
<td>Gervilla alatior Imlay</td>
<td>G. alaeformis (Sowerby)</td>
<td>Neocomian and Lower Aptian</td>
</tr>
<tr>
<td>Cyprina cf. bernensis Leymerie</td>
<td>C. bernensis Leymerie</td>
<td>Middle Neocomian</td>
</tr>
<tr>
<td>Lucina kellumi Imlay</td>
<td>L. dupiniana d’Orbigny</td>
<td>Hauterivian</td>
</tr>
<tr>
<td>Sphaera americanus Imlay</td>
<td>S. corrugata Sowerby</td>
<td>Neocomian to Lower Aptian</td>
</tr>
<tr>
<td>Panope cf. gurgitis (Brongniart)</td>
<td>P. gurgitis (Brongniart)</td>
<td>Neocomian to Lower Albian</td>
</tr>
<tr>
<td>Pholadomya cf. sanctae-cruces Pictet and Campiche</td>
<td>P. sanctae-cruces Pictet and Campiche</td>
<td>Valanginian</td>
</tr>
<tr>
<td>&quot; cf. gigantea (Sowerby)</td>
<td>P. gigantea (Sowerby)</td>
<td>Valanginian to Aptian</td>
</tr>
<tr>
<td>Turbo n. sp. aff. mantelli Leymerie</td>
<td>T. mantelli Leymerie</td>
<td>Neocomian</td>
</tr>
<tr>
<td>Natica cf. hugardiana d’Orbigny</td>
<td>N. hugardiana d’Orbigny</td>
<td>Middle Neocomian</td>
</tr>
<tr>
<td>“ cf. neptuni d’Orbigny</td>
<td>N. neptuni d’Orbigny</td>
<td>Lower to middle Neocomian</td>
</tr>
<tr>
<td>Tylostoma cf. laharpri Pictet and Campiche</td>
<td>T. laharpri Pictet and Campiche</td>
<td>Valanginian</td>
</tr>
<tr>
<td>Harpagodes mexicanus Imlay</td>
<td>H. jaccardii Pictet and Campiche</td>
<td>Valanginian</td>
</tr>
<tr>
<td>“ americanus Imlay</td>
<td>H. desori Pictet and Campiche</td>
<td>Valanginian</td>
</tr>
<tr>
<td>Dichotomites multicosatus Imlay</td>
<td>D. terscius (von. Koenen)</td>
<td>Upper Valanginian</td>
</tr>
<tr>
<td>Acanthodiscus aff. radiatus Bruguière</td>
<td>A. radiatus Bruguière</td>
<td>Lower Hauterivian</td>
</tr>
<tr>
<td>Leopoldia crassicostata Imlay</td>
<td>L. dubisiensis var. bargemensis Kilian</td>
<td>Hauterivian</td>
</tr>
</tbody>
</table>
the Aurora limestone and (2) the Barril viejo shale with *Acanthodiscus* and *Leopoldia*. The former represents the upper Aptian, and the latter the lower Hauterivian of the European stages. The Barril viejo shale is correlated directly with the upper member of the Taraises formation of the central part of the Mexican geosyncline on the basis of the occurrence of *Acanthodiscus magnificus* Imlay, A. *cf. radiatus* Bruguière, *Leopoldia victoriensis* Imlay, and L. *cf. bakeri* Imlay. Numerous ammonites obtained from the upper member of the Taraises formation show that its age is lower Hauterivian (Imlay, 1938a, p. 551-552). Further age evidence is furnished by the remarkable similarities of the gastropods, pelecypods, and brachiopods of the Barril viejo shale to species occurring in the middle Neocomian beds of France, Switzerland, and England. The most striking faunal similarities with the European Neocomian are shown in Table 4.

As the Barril viejo shale of eastern Coahuila is the near-shore equivalent of the upper member of the Taraises formation, a tentative correlation may be made of the adjoining formations (Table 1). The Padilla limestone, overlying the Barril viejo shale, is probably equivalent to the Cupido limestone. The Patula arkose, the Cuchillo formation in part, and the marly beds at the base of the Aurora limestone in eastern Coahuila are correlated with La Peña formation. The Menchaca limestone and the underlying unnamed basal shales at Potrero de Menchaca contain *Exogyra reedi* Imlay and *E. putnami* Imlay which are common in the basal Cretaceous beds near Miquihuana, Tamaulipas. These formations are, therefore, of lower Neocomian age and are correlated with the lower member of the Taraises formation.

In most of the mountainous uplifts of east-central Coahuila the oldest outcropping beds are Lower Cretaceous. Jurassic strata have been reported by Bureckhardt (1930, p. 83, 84, 143) in the (1) Valle de San Marcos and (2) in the Sierra de Azul, and by Bureckhardt and Müllerried (1936, p. 313, 314) from (3) a well boring near Camarón, Nuevo León, at a depth of about 8700 feet.

In eastern Durango the key formations are La Peña with *Dufrenoya texana* Bureckhardt and the Carbonera with *Thurmannites* and *Exogyra reedi* Imlay. Correlations of the beds between La Peña and Carbonera formations have already been discussed elsewhere (Imlay, 1938b, p. 1687-1688). Collections A-4 and A-34 from the middle part of the Carbonera formation contain species of *Thurmannites* like *T. novihispanicus* Imlay and *T. miquihuanaensis* Imlay from Miquihuana, Tamaulipas (Imlay, 1937a, p. 563-564). These resemblances indicate an early Neocomian age. Several fragments probably represent *Blan-
fordiceras and Berriasella which suggest an age slightly older than the upper Valanginian.

Formerly the writer suggested (1938b, p. 1684-1685) that the Jurassic-Cretaceous boundary probably occurs in the middle of unit B of the Cuesta del Carbonera section. Reconsideration of the evidence, however, favors the location of the boundary at the base of unit B (and 5) (Kellum, 1936, p. 1067). The only ammonites which might have come from the lower part of unit B are generically undeterminable, and their stratigraphic positions are highly uncertain (Imlay, 1938b, p. 1685). One is probably a Spiticeras, and the other, referred formerly to Kossmatia, is probably a distorted Thurmannites. Kellum does not record any fossils below the horizon of Collection A-34 in unit 5 of the Sierra de Mapimi section. From a small knoll near Kilometer 719 on the Mazatlan highway, Kellum (1936, p. 1068) obtained Collection A-33 which contains pelecypods characteristic of the Malone fauna of west Texas. The collection was made several hundred feet lower stratigraphically than A-34 and might represent either the top of unit C or the base of unit 5. The matrix around the fossils is like that of other collections from unit C. In the absence of diagnostic fossils from the lower part of units 5 and B, it is preferable to consider the base of these units as the Jurassic-Cretaceous boundary.

All the Neocomian stages are represented in Mexico by described faunas. The Berriasian is represented by rich faunas from Cerro de la Virgin near Tlaxico, Oaxaca (Felix, 1891, p. 180-194), and from San Pedro del Gallo, Durango (Burckhardt, 1912, p. 172-195, 227-229). It is characterized by numerous species of Spiticeras, Berriasella, and Subthurmannia Spath (1939, p. 48). Himalayites has been recorded (Burckhardt, 1930, p. 93, 95) but is not common. The Valanginian is known by faunas from the Miquihuan region of Tamaulipas and Nuevo León (Imlay, 1937a) and from eastern Durango. The beds with Rogersites and Valanginites near San Lazaro, Nuevo León, are probably of upper Valanginian age. The writer suspects that careful collecting would show that the beds characterized by Thurmannites miquihuanensis Imlay and related giant forms occur somewhat lower stratigraphically than the beds characterized by Rogersites and represent the middle Valanginian. This is indicated by the collections from the section on the west flank of the San Lazaro anticline (Imlay, 1937a, p. 555, 558) where Rogersites, Valanginites, and Distoloceras were obtained from higher beds than the giant Thurmannites. A similar stratigraphic arrangement has been determined by Spath (1939, p. 128) for the cephalopods from the Salt Range of India. The lower part of the Cretaceous section in eastern Durango likewise contains gigantic Thurmannites similar to those near
Miquihuana and is probably about the same age. Curiously, these Mexican forms of *Thurmannites* bear strong resemblances to the Berri-asian-Tithonian group of *Berriasella chaperi* (Pictet) and *B. malbosi* (Pictet) (Mazenot, 1939, p. 80-102). These resemblances suggest to the writer that the Lower Cretaceous sections in the Miquihuana region should be restudied carefully. The lower Hauterivian is represented by an abundant fauna in both offshore and nearshore deposits. Most of the described species have been obtained from southern and eastern Coahuila (Imlay, 1938a) and southeastern Durango (Böse, 1923, p. 69-102), but some have been recorded from San Pedro del Gallo, Durango (Burckhardt, 1912, p. 196-197), and from the Mazapil region of Zacatecas (Burckhardt, 1906, p. 183-191). The lower Hauterivian is char-acterized by an abundance of the ammonites *Olocosthanus, Maderia, Mexicanoceras, Acanthodiscus* (s.s.), *Leopoldia, Neocomites, and Distoloceras. Thurmannites, Valanginites, Kilianella, and Dichotomites* are known but are more characteristic of the Valanginian. The upper Hauterivian and Barremian are poorly represented by fossils. Böse (1923, p. 102-118) has described a few Barremian species of *Pulchellia* and *Pseudohaploceras* from the Sierra de Symón in southeastern Durango. Felix (1891, p. 142-172) has described a reef fauna of Hauterivian or Barremian age from San Antonio de Las Salinas, Puebla (Burckhardt, 1930, p. 158-160). Müllerried (1936, p. 36) obtained a near-shore Neocomian fauna, apparently similar to that in the Barril viejo shale of Coahuila, from the upper part of the Todos Santos series of northern Chiapas. According to Sapper (1937, p. 44) the Metapan beds of middle Honduras and northwest Salvador contain a near-shore fauna which is predominantly Neocomian.

A small collection of ammonites of probable upper Barremian age was obtained at locality 32 in the Sierra de Parras, Coahuila (Imlay, 1937b, p. 610). It contains *Saynoceras mexicanum* Imlay, n. sp. (Pl. 21, figs. 1-4) and some small fragments definitely belonging to the Ancyloceratidae. Both *Parancyloceras* and *Ancyloceras* are probably represented. These might indicate either a Barremian or lower Aptian age but, as the fossils were obtained about a thousand feet below the top of La Peña formation, they most likely represent a horizon as old as upper Barremian.

Concerning the controversy about the age of the pelecypods of the Malone formation of Texas (see summaries in Adkins, 1932, p. 256, 290, 291; Albritton, 1938, p. 1749-1751), the writer can state that the known Neocomian faunas of Mexico are definitely distinct from the Malone fauna, whereas the Upper Jurassic faunas of Mexico contain many species which are identical with species in the Malone fauna. In the Neocomian beds of eastern Durango occur a few poorly preserved speci-
mens of *Pinna* and *Pecten* which have been compared with some of the Malone species but are not specifically identical. Forms identified by Kellum (1936, p. 1068) with *Vermetus cornejoi* Castillo and Aguilera, *Rhynchonella lacunosa* Castillo and Aguilera, and *Cucullaea catorcensis* Castillo and Aguilera from the Upper Jurassic beds near Catorce, San Luis Potosí, are described in this report as new forms under the names *Vermetus cornejoi* var. *varians* Imlay, "*Rhynchonella" durangensis* Imlay, and *Cucullaea striatiumbonata* Imlay. They do not indicate a correlation with the beds near Catorce.

**Table 5.—Distribution of submarginal Neocomian fossils**

<table>
<thead>
<tr>
<th>Species</th>
<th>Eastern Coahuila</th>
<th>Eastern Durango</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Barril viejo</td>
<td>Potrero de Menchaca</td>
</tr>
<tr>
<td><em>Astroconia hispaniensis</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>&quot;<em>Terebratula</em> cauhiensis* Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>T. kanei</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Antiptychina</em> formosa Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>A.? aff. mulleri</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>&quot;<em>Rhynchonella&quot; durangensis</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Cucullaea striatiumbonata</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>C. aff. striatiumbonata</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>C. gabrielis var. fraterna</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>C. sp.</em></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Grammatodon</em> sp.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Pinna</em> cf. quadrifrons* Cragin</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Pinna</em> sp.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Eozypura reidi</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>E. putnami</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
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<td><em>E. aff. tamaulipana</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>E. aff. latissima</em> var. <em>aquila</em> Brongniart</td>
<td>x</td>
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</tr>
<tr>
<td><em>Gryphaea</em> spp.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Aclytronia</em> sp.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Trigonia</em> cf. <em>caudata</em> Agassiz</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>T. cf. ingen</em> Lycectt</td>
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<td>x</td>
</tr>
<tr>
<td><em>T. cf. carinata</em> Agassiz</td>
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</tr>
<tr>
<td><em>Pecten</em> spp.</td>
<td>x</td>
<td>x</td>
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<td><em>Néethia</em> biangulata* Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>N. cf. ataca</em> (d'Orbigny)</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Prohinntes</em> ordoñesi Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Spondylus</em> oballosensis Imlay</td>
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<td>x</td>
</tr>
<tr>
<td><em>Pictatula</em> umbonata* Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>P. azulensis</em> Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Species</td>
<td>Eastern Coahuila</td>
<td>Eastern Durango</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Barril Viejo</td>
<td>Sierra de Azul</td>
</tr>
<tr>
<td>P. aff. azulensis Imlay</td>
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<td></td>
</tr>
<tr>
<td>P. torreónensis Imlay</td>
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<td></td>
</tr>
<tr>
<td>P. pulchra Imlay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. n. sp. ind.</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>P. aff. incongrua Conrad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lima (Plagiostoma) kanei Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Gerbillia alator Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Astarte durangensis Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>A, sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyprina cf. bernensis Leymerie</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>C, sp. ind</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Trapezium? subtriangulum Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>T. diversicostatum Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lucina kellumi Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Cyclorisma sp.</td>
<td>x</td>
<td></td>
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<tr>
<td>Sphaera americanus Imlay</td>
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<td>x</td>
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<tr>
<td>Panope cf. gurgits (Brongniart)</td>
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<tr>
<td>Pholadomya cf. sanctae-crucis Picket and Campiche</td>
<td>x</td>
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<td>P. cf. gigantea (Sowerby)</td>
<td>x</td>
<td>x x</td>
</tr>
<tr>
<td>Harpagoidea americanus Imlay</td>
<td>x</td>
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</tr>
<tr>
<td>H. mexicanus Imlay</td>
<td>x</td>
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<tr>
<td>Nerinea sp.</td>
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<tr>
<td>Natäca cf. neptuni d'Orbigny</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>N. cf. hugardiana d'Oribigny</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Tyliostoma cf. laharpit Picket and Campiche</td>
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<td></td>
</tr>
<tr>
<td>Vermetus corneojoi var. varians Imlay</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Trochus n. sp. ind.</td>
<td>x</td>
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<tr>
<td>Turbot gigas Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>T. n. sp. aff. mantelli Leymerie</td>
<td>x</td>
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<td>Leodolida crassicostata Imlay</td>
<td>x</td>
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</tr>
<tr>
<td>L. aff. crassicostata Imlay</td>
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<td></td>
</tr>
<tr>
<td>L. truncata Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>L. victoriensis Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>L. cf. bakeri Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Acanthodiscus magnificus Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>A. cf. radiatus Bruguierè</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Thurmannites cf. miquihuanensis Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>T. cf. novihispanicus Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>T. sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dichotomites mictocostatus Imlay</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lytoceras sp.</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Berriasella? sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blanfordiceras? sp.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 6.—Distribution of newly described ammonites from the offshore deposits of southern Coahuila

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality 18</th>
<th>Locality 20</th>
<th>Locality 32</th>
<th>Locality 42</th>
<th>Locality 58</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phylloceras cf. serum var. perlobata Sayn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Distoloceras sp. juv</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Oosterella? sp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Hemihoplites? mexicanus Imlay</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Mexicanoceras laticostatum Imlay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>M. multicostatum Imlay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Maderia marcosensis Imlay</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. coahuilensis Imlay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. casitensis Imlay</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saynoceras mexicanum Imlay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SYSTEMATIC DESCRIPTIONS

**Phylum COELENTERATA**

**Class ANTHOZOA**

**Genus Astrocoenia** Milne-Edwards and Haime 1848

*Astrocoenia hispaniensis* Imlay, n. sp.

(Plate 1, figures 21, 22)

**Description**: Corallum massive, irregularly rounded. Corallites polygonal, crowded, and joined directly by their walls. Wall very narrow, upper edge flattened. Calices extremely shallow; diameter ranging from 1.5 to 2 mm. Columella styliform, small, and low. Number of principal septa eight to ten, with smaller septa between. Septa of adjoining corallites may meet end to end or alternate with each other. About seven to nine dissepiments in a space of 5 mm.

**Remarks**: This species may be distinguished from *Astrocoenia maloniana* (Vaughan) Cragin (1905, p. 34, pl. II, figs. 1-3) by its consistently shallow calices, its flattened walls between corallites, and its numerous dissepiments.

**Type**: Holotype 19345, Museum of Paleontology, University of Michigan.

**Occurrence**: Carbonera formation, about 325 feet below top at northwest end of Cuesta del Carbonera, 2 miles south of Las Cuevas, Durango.

**Phylum BRACHIOPODA**

**Class ARTICULATA**

**Genus Antiptychina** Zittel 1880

*Antiptychina? formosa* Imlay, n. sp.

(Plate 2, figures 1-18; text figure 7)

**Description**: Shell ovate-pentagonal to elongate-pentagonal in outline. Pedicle valve more convex than brachial. Ventrally biplicate. Bipllication commences from one-fourth to one-half of the length of the valve from the umbo. Umbo of brachial valve incurved. Lateral commissure slopes dorsally at a slight angle and is then
abruptly recurved near the anterior margin. Linguiform extension not pronounced on most specimens. Umbo of pedicle valve prominent, rounded, incurved, projecting over and close to brachial valve. Beak ridges subangular, mesothyroid, extending about halfway to the postero-lateral margin and almost parallel to hinge. Apical angle 85 to 95 degrees. Shell densely punctate; marked by fine concentric growth lines which become coarser toward the anterior margin.

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20930</td>
<td>16.8</td>
<td>15.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Paratype 20931</td>
<td>15.1</td>
<td>12.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Paratype 20932</td>
<td>14.6</td>
<td>13.0</td>
<td>8.2</td>
</tr>
<tr>
<td>Paratype 20933</td>
<td>16.8</td>
<td>13.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Paratype 20934</td>
<td>13.2</td>
<td>13.3</td>
<td>6.6</td>
</tr>
<tr>
<td>Paratype 20935</td>
<td>17.2</td>
<td>14.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

The median septum is fairly stout, extends slightly more than one-half the length of the brachial valve, supports the hinge plates throughout their length, and bears connecting bands about 2 mm. from its anterior end. The septalium is moderately deep. Inner socket ridges prominent, overlapping sockets and interlocking with a sulcus on each tooth. Sockets fairly shallow. The loop was traced for 11 mm. in a brachial valve 13 mm. in length. Dental lamellae strong, subparallel.

Remarks: This species is represented by about 55 specimens which show some variation in dimensions and degree of bålification. It may be distinguished from Antiptychina? müllerriedi Imlay (1937, p. 568, pl. 82, figs. 9-24; text figure 4) by its thinner form, higher and less incurved beak, smaller apical angle, shorter beak ridges, and larger pedicle opening.

Type: Holotype 20930, paratypes 20931 to 20936, Museum of Paleontology, University of Michigan.

Occurrence: Barril viejo shale. Sierra de Azul near Candela, Coahuila.

Genus Rhynchonella Fischer von Waldheim 1809 (s. l.)

"Rhynchonella" durangensis Imlay, n. sp.

(Plate 2, figures 19-30)


Description: Shell ovate trigonal in outline. Brachial valve fairly highly convex, with a well-defined median fold anteriorly, which is distinctly demarcated from the convex flanks. Umbo of brachial valve much incurved. Pedicle valve moderately convex, bearing a moderately broad, flattened median sinus which develops from 10 to 11 mm. from the umbo and increases considerably in depth anteriorly. The linguiform extension is broadly U-shaped and tapers slightly forward. Umbo of pedicle valve acute, suberect. Beak ridges are subangular near the umbo and are traceable for a distance of about 5 mm. Interareas broad. Deltidial plates conjunct. Apical angle 80 to 90 degrees. Foramen hypothyrid.

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20947</td>
<td>17.0</td>
<td>15.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Paratype 20946</td>
<td>17.7</td>
<td>17.4</td>
<td>10.3</td>
</tr>
<tr>
<td>Paratype 20945</td>
<td>17.2</td>
<td>15.0</td>
<td>11.2</td>
</tr>
<tr>
<td>Paratype 20944</td>
<td>16.0</td>
<td>15.2</td>
<td>11.5</td>
</tr>
<tr>
<td>Paratype 20939</td>
<td>16.2</td>
<td>15.5</td>
<td>12.3</td>
</tr>
</tbody>
</table>
Shell ornamented with 11 to 14 rounded costae which begin from 6 to 8 mm. from the umbo, are slightly curved on the flanks, and are strong anteriorly. The species shows considerable variation in the strength of costation. The number of costae in the sinus ranges from two to four and on the fold from three to five. Among

![Figure 6: Transverse sections of "Terebratula" coahuilensis Imlay](image)

Length of shell, 21 mm. Distance of sections from beak of pedicle valve in millimeters. \( \times 2\frac{1}{2} \).

the 58 specimens in the collections, 42 specimens have four costae on the fold and three in the sinus, 13 specimens have five costae on the fold and four in the sinus, and three specimens have three costae on the fold and two in the sinus. In general the costation is coarsest on the specimens with fewest costae. The variation in costation might be considered as denoting specific differences except for the examples of gradual gradation from one variety to another. Rather inconspicuous growth lines occur on the anterior part of the shell.

The characters of the beak of the pedicle valve are well shown only on the holotype. Transverse sections show internal characters similar to those of "Rhyncho-nella" miquihuanensis Imlay (1937a, p. 570, text figure 6).

Remarks: This species may be readily distinguished from "Rhynchosella" lacunosa Castillo y Aguiler (not Quenstedt) (1895, p. 1, pl. I) by the absence of costae on the upper part of the shell.

Type: Holotype 20947, paratypes 20937 to 20939, 20944 to 20946, Museum of Paleontology, University of Michigan.


Genus *Terebratula* Müller 1776 (s. l)

*"Terebratula" coahuilensis* Imlay, n. sp.

(Plate 1, figures 1-16; text figure 6)

Description: Shell subpentagonal in outline, about as wide as long, pedicle valve more convex than brachial. Brachial valve fairly convex; anteriorly with a strong
median fold which is divided by a short but well-defined median sinus; flanks fairly strongly sulcate; umbo slightly incurved. Lateral commissure slopes dorsally at a slight angle and is then abruptly recurved ventrally near the anterior margin. Pedicle valve highly convex; anteriorly bearing a broad flattened sulcus which is divided by a low median ridge; umbo short, rounded, suberect, becoming slightly incurved in old age. Apical angle 85 to 90 degrees. Foramen circular. Permesothyrid. Symphytium exposed. Beak ridges short, poorly defined. Linguiform extension tapers forward and is about 8 mm. in length. Shell marked by lines of growth arranged at regular and fairly wide intervals; densely punctate.

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20926</td>
<td>24.0</td>
<td>25.3</td>
<td>15.0</td>
</tr>
<tr>
<td>Paratype 20927</td>
<td>18.6</td>
<td>17.0</td>
<td>10.7</td>
</tr>
<tr>
<td>Paratype 20928</td>
<td>18.0</td>
<td>16.0</td>
<td>11.5</td>
</tr>
<tr>
<td>Paratype 20929</td>
<td>22.0</td>
<td>21.5</td>
<td>13.2</td>
</tr>
</tbody>
</table>

The sockets are deep and narrow. They are overlapped by the inner socket ridges, which are well demarcated from the gently curved hinge plates. The crural bases are given off ventrally and project nearly at right angles to the hinge plates. The teeth are deeply inserted in the sockets, and the inner socket ridges fit into sulci on the teeth. A projection from the outer socket ridges fits into the denticular cavity. The median septum is low and very short. The dorsal adductor scars appear as low ridges.

Remarks: The species is represented by 22 specimens which show some variation in the relation of length to width and in the size of the apical angle. It bears a close resemblance to "Terebratula" carteroniana d'Orbigny (1847, p. 80, pl. 507, figs. 1-5; Pickett & Campiche, 1872, p. 60, pl. CCl, figs. 1-4) from the Neocomian of Europe but has a larger foramen and appears to be less elongate.

Type: Holotype 20926, paratypes 20827 to 20929, Museum of Paleontology, University of Michigan.
Occurrence: Barril viejo shale in Sierra de Azul, Barril viejo, and Potrero de Oballos, Coahuila.

"Terebratula" kanei Imlay, n. sp.

(Plate 1, figures 17-20)

Description: Shell subpentagonal in outline, longer than wide, pedicle valve more convex than brachial. Brachial valve fairly convex; bearing anteriorly a strong median fold which is divided by a short, rather shallow median sinus; flanks moderately sulcate; umbo incurred. Lateral commissure slopes ventrally at a fairly strong angle and is inflected strongly ventrally near the anterior margin. Pedicle valve highly convex, bearing anteriorly a broad, flattened sulcus which is divided by a low median ridge; umbo prominent, rounded, slightly incurred on adult. Apical angle about 75 degrees. Foramen circular, fairly large. Permesothyrid. Beak ridges very short and poorly defined. Linguiform extension tapers forward and is about 9 mm. in length. Shell marked by variable lines of growth which become conspicuous near the anterior commissure; densely punctate. Dimensions of holotype: Length 24.5 mm.; width 20 mm.; thickness 15 mm.

Remarks: The species is represented by three specimens of which the paratypes are partly corroded and deformed. It may easily be distinguished from "Terebratula" coahuilensis Imlay by its more elongate form, more prominent, incurved umbo, less developed folding, and rather blunt line of junction of the valves. The species is named in honor of Wm. G. Kane of Saltillo, Mexico.

Types: Holotype 20925, paratype 20940, Museum of Paleontology, University of Michigan.

Occurrence: Barril viejo shale. Portrero de Oballos near Hermanos and Sierra de Azul near Candela, Coahuila.

Phylum MOLLUSCA

Class PELECYPoda

Genus Cucullaea Lamarck 1801
Cucullaea striatiumbonata Imlay, n. sp.

(Plate 3, figures 18-21)


Description: The species is represented by two specimens. Shell moderate in size, fairly ventricose, equivalve, inequilateral, subtrapezoidal in outline. Dorsal margin straight, making an angle of about 110 degrees with the nearly straight posterior margin; anterior margin regularly rounded, meeting the dorsal margin at nearly a right angle, rounding gradually into ventral margin; ventral margin gently convex, inclined somewhat oblique to dorsal margin, forming a subacute angle with the posterior margin. Beaks moderately separated, strongly incurved, situated about one-fourth the length of the shell from the anterior extremity. An angular carina extends from the beak posteriorly to the postero-ventral extremity. The carina is acute on the beak and becomes obtuse toward the ventral margin. It is paralleled dorsally by a gently concave area. Surface of cardinal area marked by about seven chevron-shaped ligamental grooves. Area elliptical in outline, about one-third as wide as long. Surface ornamented with strong, concentric growth lines and with radiating lines. The latter are raised and especially conspicuous on the umbo and on the anterior slope, becoming fine and inconspicuous on the posterior slope.
SYSTEMATIC DESCRIPTIONS

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Convexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20948</td>
<td>57</td>
<td>45</td>
<td>45 (?)</td>
</tr>
<tr>
<td>Paratype 15822</td>
<td>70</td>
<td>54</td>
<td>52</td>
</tr>
</tbody>
</table>

Remarks: This species greatly resembles C. catorcensis Castillo y Aguilera (1895, p. 5, pl. IV, figs. 1, 4, and 5) from the Sierra de Catorce of San Luis Potosí, but its beaks appear to be narrower, its anterior margin is more regularly rounded and meets the dorsal margin at a larger angle, its ventral margin is oblique rather than parallel to the dorsal margin, it is proportionately much higher, and its entire shell is covered with radial lines which are not mentioned in the description of the species from Catorce.

Type: Holotype 20948, paratype 15822, Museum of Paleontology, University of Michigan.

Occurrence: Carbonera formation. Locality A-34, Sierra de Mapimi, Durango.

*Cucullaea gabrielis* Leymerie var. *fraterra* Inlay

(Plate 4, figures 1, 2)

Description: The form is represented by five internal molds with portions of the shell material adhering. Shell large, inflated, equi valves, inequilateral, subtriangular in outline. Dorsal margin straight, making an angle of about 120 degrees with the nearly straight posterior margin; anterior margin regularly rounded; ventral margin straight, parallel to dorsal margin, curving up at both ends forming an acute angle with posterior margin. Beaks widely separated, prominent, strongly incurved, situated anterior to the center of the ligamental area and about one-fourth the length of the shell from the anterior extremity. A prominent angular ridge extends from the beak posteriorly to the postero-ventral extremity and bounds a conspicuous concave area on the side of the posterior margin. A much smaller, rounded ridge extends from the posterior side of the beak to near the anterior end of the posterior margin and bounds a small concave area lying next to the cardinal area. A poorly defined ridge extends from the anterior side of the beak to the antero-basal margin and encloses a shallow depression. Anterior and posterior margins near cardinal area rather strongly keeled. Surface of cardinal area marked by 16 or 17 strongly impressed chevron-shaped ligamental grooves and with several transverse grooves of which the most prominent are near the posterior end. Area elliptical in outline, about three-fifths as wide as long. Surface ornamented with strong, concentric growth lines and with radiating striae.

Dimensions of figured specimen: Length, 110 mm.; height, 65 mm.; convexity, 85 mm.

Remarks: The Mexican specimens described above are remarkably similar to *Cucullaea gabrielis* Leymerie (1842, p. 6; pl. 7, figs. 5a-c) from the Neocomian of Europe and South America. The latter species has recently been described in detail by Weaver (1931, p. 192-195; pl. 13, fig. 52; pl. 14, figs. 56, 57). Possibly the Mexican variety comes within the form range of *C. gabrielis* but judging from illustrations the Mexican variety has a more angular umbonal ridge, a shorter anterior margin, a more depressed and wider cardinal area, more ligamental grooves, and deeper concave areas on the sides of the posterior margin. In these respects it is more like the types figured by Leymerie. *C. gabrielis* Leymerie is placed by Gillet (1924, p. 17) in *Idonearca* Conrad.

Specimen No. 20728, Museum of Paleontology, University of Michigan.

Genus *Plicatula* Lamarck 1819

*Plicatula* *pulchra* Imlay, n. sp.

(Plate 3, figures 1-9, 14-17)

**Description:** The species is represented in the University of Michigan collection by several hundred well-preserved specimens from the Sierra de Mapimi, Durango. Shell subovate to trigonal-ovate in outline, slightly inequilateral, the height greater than the length; right valve moderately to strongly inflated, with small to medium attachment scars which do not obscure the ornamentation; left valve flat or concave; margins even.

Surface ornamented with numerous, fine, close-set radial ribs of nearly equal strength and with irregularly spaced growth lines which mark constrictions of variable strength. As a consequence of the variability of the growth lines, some shells are fairly even, and others are strongly rugose. Radial ribs slightly wavy and crenulated, spinate; increasing in number by bifurcation and implantation; about 120 to 150 on right valves. Exceptionally some specimens (Pl. 3, fig. 14) bear ribs of two sizes near the beaks.

**Dimensions in mm. are as follows:**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Convexity of both valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20606</td>
<td>18.5</td>
<td>21.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Paratype 20607</td>
<td>22.5</td>
<td>22.5</td>
<td>9.0</td>
</tr>
<tr>
<td>Paratype 20608</td>
<td>23.0</td>
<td>28.0</td>
<td>10.5</td>
</tr>
<tr>
<td>Paratype 20610</td>
<td>15.5</td>
<td>17.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Paratype 20611</td>
<td>20.0</td>
<td>18.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Paratype 20612</td>
<td>19.0</td>
<td>21.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Paratype 15803</td>
<td>18.5</td>
<td>20.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

**Remarks:** This species is characterized by its exceedingly fine, close-set ribs which have about equal strength on all parts of the shell. The degree of rugosity appears to be related to individual growth rather than to specific variation. A closely comparable European species is *Plicatula* (Atreta) *strombergensis* Boehm (see Gillet, 1924, p. 59, pl. 1, figs. 8a-c) which ranges from the Tithonian to the Hauterivian.

**Type:** Holotype 20606, paratypes 20607, 20608, 20609, 20610, 20611, 20612, 15803, Museum of Paleontology, University of Michigan.


*Plicatula* *torreonensis* Imlay, n. sp.

(Plate 2, figures 41, 42)

**Description:** The species is represented by one specimen. Shell trigonal-ovate in outline, slightly inequilateral, the height greater than the length; right valve weakly convex in early stages, becoming more convex in later stages, bearing small attachment scar; left valve slightly concave; margins even.

Surface of right valve in early stages marked with faint growth lines and with a few widely spaced, slender, moderately prominent, slightly sinuous, radial ribs which increase in number by intercalation until, at a height of 15.5 mm., there are eleven fairly long ribs and six short ribs. In later stages the surface is marked by several pronounced concentric constrictions and by numerous, fine, weakly spinate, ribs which are only slightly narrower than the interspaces. Surface of left valve ornamented similar to right, but ribs and constrictions are not as prominent.
SYSTEMATIC DESCRIPTIONS

Dimensions: Length 18 mm.; height 20.5 mm.; thickness 6 mm.

Remarks: This species may be distinguished from P. pulchra Imlay by its coarser ribbing and less convex right valve.

Type: Holotype 15815, Museum of Paleontology, University of Michigan.

Occurrence: Carbonera formation. Locality 34 on west side of Sierra de Mapimi, Durango.

Plicatula umbonata Imlay, n. sp.

(Plate 3, figures 10-13, 22)

Description: The species is represented by 12 specimens. Shell elongate, ovate to elongate trigonal in outline, slightly inequilateral, the height much greater than the length. Right valve strongly inflated, especially in the umbonal region; beak prominent, narrow, more or less strongly incurved; attachment scar small. Left valve slightly concave, surface uneven. Margins even.

Surface ornamented by numerous, close-set, flexuous, radiating striae of nearly equal strength and with irregularly spaced growth lines which mark constrictions of variable strength. Radial striae increase in number by bifurcation and implantation.

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Convexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20787</td>
<td>15.5</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>Paratype 20786</td>
<td>14.0</td>
<td>23+</td>
<td>11</td>
</tr>
<tr>
<td>Paratype 20784</td>
<td>17.0</td>
<td>30</td>
<td>11</td>
</tr>
</tbody>
</table>

Remarks: The shape of the shell and the incurved beak of the right valve at first suggested that this species belonged to the genus Gryphaea, but its ornamentation clearly indicates a position near Plicatula pulchra Imlay. It is distinguished from the latter by finer ornamentation and a more elongate, more convex shell.

Type: Holotype 20787, paratypes 20788, 20786, 20785, 20784, Museum of Paleontology, University of Michigan.


Plicatula azulensis Imlay, n. sp.

(Plate 2, figures 37-40)

Description: The species is represented by six specimens. Shell trigonal ovate in outline, slightly inequilateral, the height and length about equal; right valve weakly convex in early stages, becoming more convex in later stages, bearing moderately large attachment scar; left valve concave; margins even.

Surface of right valve ornamented with about 16 slender, moderately prominent, slightly sinuous, radial trending ribs which become coarser anteriorly. Between these ribs lie finer, radial ribs which number from one to three for each interspace near the posterior end of the valve and from five to eight at the anterior end. These finer ribs increase in number by intercalation and bifurcation and do not become coarser anteriorly. Both sets of ribs are crenulated and weakly spinate. Moderately pronounced, concentric growth constrictions occur at wide intervals. Surface of left valve ornamented similarly to right, but the two sets of ribs are more nearly equal in size and more spinate.

Dimensions of holotype: Length, 19 mm.; height, 19 mm.; thickness, 5.7 mm.

Type: Holotype 20942, paratype 20941, Museum of Paleontology, University of Michigan.

Occurrence: Barril viejo shale. Sierra de Azul, near Candela, Coahuila.
Genus *Spondylus* Linnaeus 1758

*Spondylus oballoensis* Imlay, n. sp.

(Plate 20, figures 1-3)

**Description:** The species is represented by one specimen. Shell fairly large for genus, inequivalve, inequilateral, obliquely ovate in outline, height greater than length, valves moderately and about equally convex; anterior part poorly preserved.

Right valve ornamented with strong, closely-spaced, spinate, radial ribs and by fairly strong concentric growth lamellae. Left valve ornamented with two sets of spinate ribs arranged alternately; stronger ribs somewhat narrower and weaker than ribs on the right valve and bearing smaller, more pointed spines; weaker ribs spinate near ventral margin. Concentric growth lamellae less developed on left than on right valve. Ears not preserved.

Dimensions of holotype: Length, 50 mm.; height (incomplete), 55 mm.; thickness of both valves, 26 mm.

**Remarks:** This species is characterized by its strong ornamentation and nearly equally convex valves. It does not bear a close resemblance to any Lower Cretaceous species known to the writer.

**Type:** Holotype 21129, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale, Potrero de Oballos, Coahuila.

Genus *Pecten* Müller 1776

*Pecten (Camptonectes) aff. insutus* Cragin

(Plate 3, figure 23)

**Remarks:** Two specimens approach closely to *P. insutus* Cragin (1905, p. 44, pl. IV, figs. 11, 12) but appear to have coarser ribbing and less pronounced concentric growth lines.

**Figured Specimen No. 20949,** Museum of Paleontology, University of Michigan.

**Occurrence:** Carbonera formation. Locality A-34, Sierra de Mapimi, Durango.

Genus *Neitheia* Drouet 1824

*Neitheia biangulata* Imlay, n. sp.

(Plate 4, figures 7, 8; Plate 20, figures 6, 7)

**Description:** The species is represented by six specimens which show only the right valve. Shell subtriangular in outline, slightly inequilateral. Ventral margin convex, with incisions between the main ribs. Upper margins of dorsal slopes diverge from the beak at an angle of 40 to 45 degrees and are slightly convex. Right valve highly convex; beak much incurved and sharp; ears partly defective, the anterior one separated from body of shell by a weak sulcus. Surface of right valve ornamented with 11 to 13 subequal, prominent, rounded ribs which are separated by somewhat broader, concave interspaces. The central seven ribs are much stronger than the ribs on the dorsal slopes, and the outermost of the central seven ribs are especially prominent. In the inner spaces and on the sides of the ribs may occur from one to three weak ribs. The entire surface is covered with extremely fine radial striae. Numerous extremely fine, equal, concentric growth lines cross both ribs and interspaces.

Dimensions of holotype: Length (estimated) 60 mm.; height (incomplete) 63 mm.; convexity 32 mm. Dimensions of paratype U. M. 20731 given in same order are 21.5 mm., 24.5 mm., and 12 mm.
SYSTEMATIC DESCRIPTIONS

REMARKS: This species apparently belongs to the branch of *Neithsea aequicosta* (d'Orbigny) (Gillett, 1924, p. 53) in which the intercalary ribs are almost as strong as the principal ribs.

TYPE: Holotype 19365, paratype 20731, Museum of Paleontology, University of Michigan.

OCURRENCE: Barril viejo shale. Barril viejo and Potrero de Menchaca, Coahuila.

Genus *Prohinnites* Gillett 1921

*Prohinnites ordoñesi* Imlay, n. sp.

(Plate 5, figures 1, 2; Plate 6, figure 1; Plate 7, figure 1)

DESCRIPTION: The species is represented by 13 imperfect specimens. Shell large, subovate in outline, inequilateral, inequivale. Right valve convex, especially in umbonal region; beak (preserved only on one small specimen) small, not projecting beyond hinge line; ears poorly preserved, not distinctly separated from umbo. Left valve concave in its upper part, corresponding to an early *Pecten*-like stage; remainder of valve depressed convex or nearly flat; ears distinctly separated from umbo. Hinge and internal characters not known. Anterior and posterior margins sinuous due to curvature toward right valve.

Surface of right valve covered with rounded, knotted, radial ribs of several sizes and with concentric growth lines. Ribs coarsest on umbo and on immature specimens, becoming broader and lower toward the margins. Additional ribs arise by implantation and furcation. Near the peripheral zone of the holotype occur about 12 primary and 14 secondary ribs. Tertiary ribs occur only on the umbonal region. Concentric ornamentation is visible only on the peripheral zone.

Surface of left valve in early stages marked with fine radial ribs of two sizes. Later ornamented like right valve, but the ribbing is weaker and the growth lines more prominent.

Dimensions in mm. as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Convexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20442</td>
<td>145 (?)</td>
<td>140 (?)</td>
<td>50</td>
</tr>
<tr>
<td>Paratype 20390</td>
<td>150</td>
<td>140</td>
<td>50</td>
</tr>
</tbody>
</table>

REMARKS: This species is similar to *Prohinnites leymerii* Deshayes (Leymerie, 1842, p. 10, Pl. 14, fig. 1; Pictet and Campiche, 1870, p. 224, Pl. CLXXXIV, CLXXXV) from the Hauterivian of Europe but is distinguished by a smaller number of secondary ribs. *P. renevieri* (Coquand) (Pictet and Campiche, 1870, p. 227, pl. CLXXXVI) has coarser ribbing and nearly the same ornamentation on both valves. This species is named in honor of Ezequiel Ordoñez of Mexico City.

TYPE: Holotype 20442, paratype 20390, Museum of Paleontology, University of Michigan.

OCURRENCE: Barril viejo shale. Potrero de Oballos near Hermanos, Potrero de Menchaca, and just below Padilla limestone at Barril viejo, Coahuila.

Genus *Gryphaea* Lamarck 1801

*Gryphaea* sp. ind.

(Plate 8, figures 1-6)

DESCRIPTION: Thirteen specimens of *Gryphaea* apparently representing several species, were obtained from the lower Neocomian beds at Locality A-34 on the western side of the Sierra de Mapimí, Durango. Species of oysters should not be estab-
lished until large numbers of specimens are available. However, as *Gryphaea* (s. s.) is unknown from the Lower Cretaceous of Europe and has not been recorded from the lower Neocomian of Texas, these Mexican forms are worthy of brief description.

The form figured on Plate 8, figures 1 and 2, is semicircular in outline and depressed. The beak of the left valve is depressed and weakly incurved. The right valve is concave near the posterior margin and fits within the left valve. A faint sinus occurs near the antero-ventral margin. Several specimens which appear to belong to the same species as the above form have more convex umbos.

The form figured on Plate 8, figures 3 and 4, is ovate in outline. Its left valve is highly convex, has a moderately incurved beak, and somewhat resembles immature forms of *G. corrugata* Say. On Plate 8, figures 5 and 6, is shown a larger form which is distinguished from the preceding by a marginal flare and a weak sinus but possibly represents the same species.

**Specimen Nos.:** 15805, 15826, 15810, 15944, Museum of Paleontology, University of Michigan.

**Genus Exogyra** Say 1820

*Exogyra reedi* Imlay

(Plate 9, figures 4-6; Plate 12, figures 1, 2; Plate 13, figures 1-5)


**Remarks:** *Exogyra reedi* Imlay was based on specimens obtained near Miquihuanu, Tamaulipas, where it is associated with ammonites which indicate a Valanginian age for the enclosing strata (Imlay, 1937a, 557-558, 566). A similar form was noted as occurring in strata of uncertain age in the Sierra de Mapimí of eastern Durango and in the region of Cuatro Cienegas of east-central Coahuila. The age of the strata in question has subsequently been determined as Neocomian, those in eastern Durango being, probably, of Valanginian age (Imlay, 1938b, p. 1684-1685), and those in east-central Coahuila including horizons as young as lower Hauterivian. Studies of the faunas in these three regions show that *Exogyra reedi* Imlay is represented in all by numerous variations. In general the variations center around a stout or a slender form, but these are connected by many transitions. Stout forms are most common in eastern Durango, but slender forms predominate in the other two regions. Most of the specimens (approximately 200) in the University of Michigan collections are smoothly sculptured except for nodulations on the umbonal ridge (Pl. 12, figs. 1, 2). Only one (Pl. 13, figs. 2, 3) bears a weak wing-like expansion on its anterior margin, and only a few on their posterior margins. Several specimens bear weak folds antero-ventral to the umbonal ridge. The hinge is narrow (Pl. 13, fig. 4) and has a well impressed ligamental groove which is curved to conform with the twist of the shell. Posterior to the groove is a depression. The adductor scar is oval in outline, situated below the midheight and on the posterior side of the shell.

In its highly variable form *E. reedi* Imlay resembles *E. couloni* (Defrance) (d'Orbigny, 1847-1849, p. 698-701, pls. 466, 467, figs. 1-3; Bigot, 1903, fiche 9) from the Neocomian of Europe but can hardly be considered identical. Judging from the many published descriptions and figures of *E. couloni* (Defrance), the Mexican species may be distinguished by rarity of wing-shaped expansions and oblique folds, a higher and narrower umbonal ridge, more common concavity of the posterior side, and generally smooth sculpture. Undoubtedly some specimens of *E. reedi* would compare closely with some of *E. couloni*, but the characteristics of the majority
of specimens justify a separation. Certainly *E. reedi* is distinct from the larger, rounder, and more weakly carinated *E. aquila* (Brongniart, 1847-49, p. 706-708, pl. 470) which Pictet and Campiche (1871, p. 287-293) considered identical with *E. couloni* (Defrance), and Pervinquièr (1912, p. 176-179) considered synonymous with *E. latissima* (Lamarck) (Pervinquièr, 1910, fiche 194). Pictet and Campiche (1871, p. 290-292) showed that during the Neocomian the narrow, strongly carinate forms usually called *E. couloni* predominated but that large, less strongly carinate forms, like *E. aquila* were present. During the Aptian, however, large forms called *E. aquila* were common, and the narrow forms were rare. Finally, in the lower Albian existed even larger, flatter, more subcircular forms which were very weakly carinated. These conclusions were substantiated by Pervinquièr (1910, fiche 194; 1912, p. 176-179) and Woods (1913, p. 395-404). There appears, therefore, to have been in Europe a gradual development from a triangular, strongly carinated form in the lower Neocomian to a subcircular, nearly noncarinated form in the lower Albian. To this series of forms the name *E. latissima* (Lamarck) has been applied frequently in recent publications, whereas the names *E. aquila* and *E. couloni* designate the most common varieties.

A similar development apparently occurred during the Lower Cretaceous in the waters of the Mexican geosyncline. The Mexican Neocomian deposits contain an abundance of *Exogyra reedi* Imlay which corresponds to the European *E. couloni* (Defrance). The Mexican late Aptian, or early Albian, contains an undescribed form which may prove to be identical with the European *E. aquila* (Brongniart). It has been collected (1) By Wm. G. Kane in the Potro de Oballos near Hermanos, Coahuila, from beds below the "Glenrose" limestone, and (2) by the writer in Cañon de Santa Rosa a few miles southeast of El Tigre, Sonora.

**Hypotypes:** 15814, 20453, 20393, 20564, 20568, 20567, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale at Barril viejo, Sierra de Azul, and Potro de Oballos, Coahuila; Menchaca limestone and lowest beds of section at Potro de Menchaca, Coahuila; Carbonera formation at A-3, A-4, A-34, A-37, and K-96, K-98 in eastern Durango; basal Cretaceous beds near Miquihuana, Tamaulipas.

**Genus Trigonia** Bruguièrè 1789

**Trigonia** spp.

*(Plate 20, figures 4, 5)*

**Remarks:** Seven poorly preserved specimens of *Trigonia*, representing as many species, have been obtained from the Barril viejo shale at various localities in eastern Coahuila. The sections Clavellatae, Quadratae, Scabrae, and Byssiferae are represented by three, one, two, and one species respectively. One species from Potro de Oballos is similar to *T. ingens* Lycett (1872, p. 24, pl. VIII, figs. 1-3; 1877, p. 207, pl. XXXVI, figs. 5, 6). A species from Potro de Menchaca is similar to *T. caudata* Agassiz (Lycett, 1875, p. 129, pl. XXVI, figs. 5-7; d'Orbigny, 1843, p. 133, pl. 287). Another species (pl. 20, figs. 4, 5) from Potro de Oballos greatly resembles *T. carinata* Agassiz (Lycett, 1877, p. 179, pl. 35, figs. 3-6) but is not so high as is typical of that species.

**Figured Specimen No.:** 21130, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale, at Barril viejo, Potro de Oballos, Potro de Menchaca, and Sierra de Azul.
Genus *Lima* Bruguierè 1792

Subgenus *Plagioestoma* Sowerby 1814

*Lima* (*Plagioestoma*) *kanei* Imlay, n. sp.

(Plate 8, figure 7; Plate 9, figures 1-3)

**Description**: The species is represented by eight specimens. Shell subovate to subtrigonal in outline, oblique, equivaleve, considerably inequilateral, compressed. Antero-dorsal slope straight or slightly concave, steep, and moderately long; posterodorsal slope steeper and shorter. Ventral margin gently convex, rounding gently into posterior and anterior margins. Beaks small, close together. Apical angle 90 to 105 degrees. Posterior ear fairly large, triangular, elongate; anterior ear not seen. Anterior area depressed, long, fairly narrow, and marked with radial ribs. Surface ornamented by many low, concentric growth undulations and by broad, slightly rounded, radial undulating ribs which are separated by narrow grooves. Radial ribs present only on the anterior and posterior margins and on the umbones, but the extent of the rib bearing area varies on different specimens.

Dimensions in mm. as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20409</td>
<td>77(?)</td>
<td>58</td>
<td>26</td>
</tr>
<tr>
<td>Paratype 13848</td>
<td>66(?)</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Paratype 20427</td>
<td>88(?)</td>
<td></td>
<td>27(?)</td>
</tr>
<tr>
<td>Paratype 13861</td>
<td>70</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**: *Lima kanei* Imlay is characterized by its large size and the restriction of radial ribs to the margins. Its ornamentation is similar to that of the Upper Cretaceous *L. simplex* d’Orbigny (1847-1849, p. 545, pl. 418, figs. 5-7), but the two species differ considerably in the other respects. *L. difficilis* d’Orbigny (1847-1849, p. 560, pl. 423, figs. 10, 11) from the Senonian of France is more elongate and compressed. *L. aubersonensis* Pictet and Campiche (1870, p. 140, pl. 164, figs. 1, 2) from the Valanginian of Europe approaches the Mexican species even closer but has more extensive ribbing and a thicker form. However, variability in extent of ribbing is characteristic of the species similar to the Mexican form and is of doubtful aid in making specific distinctions. *L. multilinata* Stanton (1895, p. 36, pl. II, figs. 4, 5) from the lower Neocomian of California (Anderson, 1938, p. 111) is more obliquely elongated and more coarsely ribbed.

**Type**: Holotype 20409, paratypes 13861, 20427, 13848, Museum of Paleontology, University of Michigan.

**Occurrence**: Barril viejo shales. Barril viejo and Potrero de Oballos, Coahuila.

Genus *Gervillia* Defrance 1820

*Gervillia alatior* Imlay, n. sp.

(Plate 10, figures 1, 2; Plate 11, figures 1-6)

**Description**: The species is represented by 64 specimens from Barril viejo, Coahuila.

Shell inequivaleve, inequilateral, obliquely elongated, triangular rhombic, anterior and posterior margins sigmoideal in outline. Left valve fairly convex, distinctly larger than right valve; its beak small, pointed, curved forward and downward and projecting slightly beyond the hinge line; its postero-ventral part turned backward
and a little upward; anterior wing small, projecting, separated from beak by an abrupt depression; posterior wing broad, triangular, strongly projecting, distinctly separated from body of shell. Right valve less convex and less developed than left valve; beak less prominent and barely reaching hinge line. Hinge line straight, apparently as long as the greatest antero-posterior diameter, and forming an angle of 55 to 70 degrees with the umbonal ridge; hinge area moderately wide, with seven or eight large cartilage pits of which most are narrower than the spaces between them.

Surface of shell ornamented with distinct growth lines and radial ribs which are invariably stronger on the left than on the right valve. The radial ribs vary greatly in prominence and spacing on different specimens. They are strongest on the umbones, become broader and fainter ventrally and posteriorly, and are lacking on the anterior wings and on some right valves. They are separated on the umbones by much finer radiating ribs.

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Estimated length</th>
<th>Estimated height</th>
<th>Thickness of both valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paratype 20622</td>
<td>66</td>
<td>67</td>
<td>39</td>
</tr>
<tr>
<td>Paratype 20377</td>
<td>75</td>
<td>77</td>
<td>45</td>
</tr>
<tr>
<td>Paratype 20624</td>
<td>60</td>
<td>65</td>
<td>..</td>
</tr>
<tr>
<td>Holotype 20625</td>
<td>..</td>
<td>100</td>
<td>66</td>
</tr>
</tbody>
</table>

Remarks: This species is similar to *G. corrugata* Cragin (1905, p. 46, pl. IV, figs. 8-10) but is more strongly ribbed, its wings are more distinctly set off from the body of the shell, and it is elongated less obliquely to the hinge line. The immature form of *G. alaeformis* (Sowerby) (1819, p. 93, pl. CCLI; Woods, 1905, p. 79, pl. XI, figs. 9a-d, 10a-d, 11, text figures 9-14) is similar to *G. alatior* Imlay, but the adult forms lack the radial ornamentation and wing-like projection of the posterior ear. A strongly ribbed form from the Neocomian of Argentina, described by Weaver (1931, p. 201, pl. 15, figs. 62-63) as *G. alaeformis* (Sowerby), appears to be nearly identical with the Mexican form.

Type: Holotype 20625, paratypes 20377, 20624, 20622, 20626, 20623, Museum of Paleontology, University of Michigan.

Occurrence: Barril viejo shale. Potrero de Oballos, just below Padilla limestone, west side of Barril viejo, and about 300 feet below Padilla limestone, center of Barril viejo Coahuila.

Genus *Astarte* Sowerby 1816

*Astarte durangensis* Imlay, n. sp.

(Plate 8, figures 10, 11)

Description: The species is represented by one specimen whose ventral part has been faulted laterally. Shell elongate, ovate in outline, moderately convex, most inflated slightly above the midheight, equivale, very inequilateral. Dorsal margins diverge from beaks at an angle of about 115 degrees. Anterior margin regularly rounded; ventral margin gently convex; posterior margin defective below at the extremity, meeting the dorsal margin at a wide subobtuse angle. Beaks fairly prominent, incurved, close together, situated above one-third the length of the shell from the anterior extremity. A weak umbonal ridge is restricted to upper part of the postero-dorsal slope. Lunule and escutcheon distinct. Margins of valves crenulated. Surface marked by strong, subequal, concentric ribs which are widely spaced.
on the umbo and closely spaced on the main body of the shell. Dimensions: Length, 30 mm.; height, 22 mm.; thickness, 14.5 mm.

REMARKS: This species is a little like A. elongata d'Orbigny (1847-1849, p. 68, pl. 263, figs. 8-11) from the Neocomian of Europe but has a much more prominent beak and is more inflated. A. californica Stanton (1895, p. 57, pl. VI, figs. 19-21) from the Neocomian of California has a narrower umbo, finer ribbing, and is less elongate.

TYPE: Holotype 15819, Museum of Paleontology, University of Michigan.

Occurrence: Carbonera formation. Locality 34 on west side of Sierra de Mapimi, Durango.

Genus Cyprina Lamarck 1818

Cyprina cf. bernensis Leymerie

REMARKS: Six more or less crushed internal molds with parts of the shell adhering gently resemble C. bernensis Leymerie (1842, p. 5, pl. 5, figs. 6a, b; d'Orbigny, 1847-1849, p. 98, 759, pl. 271) but are probably slightly more elongate and thinner.


Genus Trapezium Megerle v. Mühlfeldt 1811

Trapezium? diversicostulatum Imlay, n. sp.

(Plate 6, figures 2-4)

DESCRIPTION: The species is represented by one specimen whose postero-ventral extremity is defective. Shell moderately large for genus, ventricose, subtrapezoidal in outline, equivalent, very inequilateral. Antero- and postero-dorsal margins diverging from the apex at an angle of about 100 degrees, the former slightly concave, the latter long and gently convex. Anterior margin rather narrowly rounded; ventral margin broadly rounded. Beaks prominent, fairly small, incurved, prosogyrate, a little separated, situated in front of the midlength. An angular umbonal ridge extends from the beak toward the lower posterior extremity, forming the anterior limit of the steeply inclined, concave postero-dorsal slope. The ridge is paralleled anteriorly by a distinct, shallow depression which originates on the umbonal slope. Antero-dorsal slope abrupt, excavated toward the beak. Lunule cordate. Surface marked with concentric lines of growth which are of variable strength and irregularly spaced on the main body of the shell but are regularly spaced and similar in strength on the postero-dorsal slope. No radial ornamentation is observable on the type. Dimensions: Length (estimated), 24 mm.; height, 22 mm.; thickness, 17 mm.

REMARKS: As in most Cretaceous species assigned to Trapezium, the hinge is not known, and the generic determination is therefore uncertain. However the general form of the shell and the position of the beaks agree more closely with Trapezium than with similar genera such as Veniella and Cyprina. Trapezium truncatum Stephenson (1923, p. 267, pl. LXXIV, figs. 2-5) has less anteriorly placed beaks.

TYPE: Holotype 15830, Museum of Paleontology, University of Michigan.

Occurrence: Carbonera formation. Locality A-34 on west side of Sierra Mapimi, Durango.

Trapezium? subtriangulum Imlay, n. sp.

(Plate 6, figures 5, 6)

DESCRIPTION: The species is represented by one slightly deformed specimen. Shell large for genus, not very ventricose, subtrapezoidal in outline, equivalent, very inequilateral. Antero- and postero-dorsal margins diverging from the apex at an
angle of about 85 degrees, the former slightly concave, the latter long and gently convex. Anterior margin long, nearly vertical, rounding rather abruptly into ventral margin to which it lies at a right angle; ventral margin long and nearly straight, becoming slightly concave just posterior to its midlength; posterior margin truncated nearly vertically, meeting the ventral margin at an angle of about 80 degrees. Beaks fairly prominent, small, incurved, a little separated, situated near the anterior extremity. An angular umbonal ridge extends from the beak to the lower posterior extremity, separating the steeply inclined, concave postero-dorsal slope from the main body of the shell. The ridge is paralleled anteriorly by a very broad, shallow depression which originates on the umbonal slope. Anterior dorsal slope abrupt, slightly excavated below the beaks. Lunule ovate, depressed. Surface marked with fine, narrow, fairly regular lines of growth which become finer toward the dorsal margin. No radial marking present. Dimensions, Length, 26.5 mm.; height, 21.5 mm.; thickness, 13 mm.

Remarks: This species may be distinguished from *T. diversicostulatum* Imlay by its more elongate, less ventricose form and the nearly terminal position of the beaks.

Type: Holotype 20732, Museum of Paleontology, University of Michigan.

Occurrence: Carbonera formation. Locality 34 on west side of Sierra de Mapimi, Durango.

Genus *Lucina* Bruguière 1797

*Lucina kellemi* Imlay, n. sp.

(Plate 4, figures 3-6)

Description: The species is represented by two specimens. Shell fairly large for genus, equivalent, subequilateral, broadly subovate in outline, fairly convex. Anterior margin truncated above, passing by a subobtuse angle into the broadly convex ventral margin; posterior margin subtruncated, rounding broadly into the ventral and dorsal margins; dorsal margin slightly arched back of beak, slightly concave in front of beak. Beaks fairly low, incurved, close together, slightly prosogyrate, situated a little in advance of the midlength. Lunule ovate, depressed, limited by a carina. Escutcheon large, distinctly limited. Surface bears numerous concentric, irregularly spaced ribs which become smaller near the dorsal margin.

Dimensions in mm. as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20730</td>
<td>34</td>
<td>30</td>
<td>19.5</td>
</tr>
<tr>
<td>Paratype 20431</td>
<td>44</td>
<td>38</td>
<td>24.5(?)</td>
</tr>
</tbody>
</table>

Remarks: This species is similar in form and ornamentation to *Lucina dupiniiana* d’Orbigny (1847-1849, p. 117, pl. 281, figs. 6-8) from the Neocomian of Europe but may be distinguished by its lower beak, slightly less inflated form, and depressed lunule.

Type: Holotype 20730, paratype 20431, Museum of Paleontology, University of Michigan.


Genus *Sphaera* Sowerby 1822

*Sphaera americanus* Imlay n. sp.

(Plate 7, figures 2, 3; Plate 8, figures 8, 9)

Description: The species is represented by 14 specimens. Shell subovate in outline, equivalent, inequilateral, highly convex, most inflated slightly above midheight.
Anterior margin regularly rounded, passing gradually into broadly rounded ventral margin. Posterior margin rounding regularly below, rounding fairly abruptly above into gently convex dorsal margin. Beaks prominent, strongly incurved, close together situated from one-fourth to two-fifths the length of the shell from the anterior extremity. Lunule depressed. Escutcheon triangular, adductors scars large, moderately impressed.

The ornamentation consists of strong, concentric, unequal ribs with sharp summits separated by broader furrows, on both of which are numerous small concentric ribs. On some specimens occur radial striations.

Dimensions in mm. as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holotype 20421</td>
<td>62</td>
<td>59</td>
<td>51</td>
</tr>
<tr>
<td>Paratype 20445</td>
<td>78</td>
<td>71</td>
<td>66</td>
</tr>
<tr>
<td>Paratype 20414</td>
<td>94</td>
<td>80</td>
<td>76</td>
</tr>
</tbody>
</table>

Remarks: This species varies considerably in thickness and in the position of the beaks. It greatly resembles the highly variable *Sphaera corrugata* Sowerby (1822, p. 42, pl. 335) which ranges through the Neocomian and Aptian of Europe (Woods, 1907, p. 157, XXIV, fig. 24, pl. XXV, figs. 1, 2, text-fig. 26; Gillet, 1921a, p. 14, pl. 1, fig. 15; Gillet, 1924, p. 124) but is less globular, more inequilateral, and has weaker radial markings. Its generic position must remain uncertain until the character of the hinge plate is known. It possibly belongs to the genus *Mactromya* Agassiz (equals *Unicardium* d'Orbigny according to Arkell, 1934, p. 305).

Type: Holotype 20421, paratype 20445, 20414, Museum of Paleontology, University of Michigan.

Occurrence: Barril viejo shale. Potrero de Oballos and just below Padilla limestone, Barril viejo, Coahuila.

Genus *Panope* Menard 1807

*Panope cf. gurgitis* (Brongniart)

(Plate 6, figures 7, 8)

Description: The species is represented by one slightly deformed specimen which lacks a small part of its posterior end. It is subelliptical-elongate, equivale, inequilateral, moderately convex. Anterior margin rounded; posterior margin probably rounded; ventral margin gently convex; postero-dorsal margin nearly straight. Beaks broad, moderately prominent, incurved, situated about one-fourth the length of the shell from the anterior extremity. Shell in front of beaks depressed slightly.

Ornamentation consists of fairly strong, rounded, concentric growth undulations. Dimensions: Length 52 mm., height 30 mm., thickness 22 mm.

Remarks: This species is much like *P. gurgitis* (Brongniart) (see Woods, 1909, p. 222, pl. XXV, figs. 9-14; pl. XXXVI, figs. 1-8) which ranges through most of the Lower Cretaceous of Europe. It lacks the fine radial ornamentation commonly present on the latter and perhaps has a broader umbo. However the European species is highly variable in ornamentation, shape, and position and size of the umbo, and possibly includes varieties like the Mexican form.

Specimen No.: 20416, Museum of Paleontology, University of Michigan.

Genus *Pholadomya* Sowerby 1825

*Pholadomya* cf. *sanctae-crucis* Pictet et Campiche

(Plate 12, figures 3-5)

**Description:** The Mexican species is represented by four specimens. Shell fairly large, evolute, inequilateral, elongate, subelliptical to subrectangular in outline, ventricose. Valves not gapping. Hinge line long and straight. Anterior margin meeting the hinge line nearly at a right angle, rounding backward obliquely and gradually into the gently convex ventral margin; posterior margin broad, nearly vertical, rounding into ventral margin at a subobtuse angle, rounding abruptly into dorsal margin at nearly a right angle. Beaks large, moderately prominent, incurved, close together, situated at the anterior extremity or within one-eighth the length of the shell from the anterior extremity. Surface marked by fairly strong concentric growth lines and undulations. The three largest specimens, comparable in size with the largest figured, bear a wide, shallow radial groove on the anterior part of the shell below the umbo. A smaller specimen (Pl. 12, fig. 3) bears several broad, faint radial grooves.

Dimensions in mm. as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>15979</td>
<td>81</td>
<td>65 (?)</td>
<td>57</td>
</tr>
<tr>
<td>20417</td>
<td>53</td>
<td>40</td>
<td>38 (?)</td>
</tr>
</tbody>
</table>

**Remarks:** The variation in position of the beaks is shown by the figured specimens. The species greatly resembles *P. sanctae-crucis* Pictet et Campiche (1865, p. 82, pl. 105, figs. 6, 7; Moesch, 1874, p. 87, pl. 33, fig. 5) from the Valanginian of France. A similar form, identified by Weaver (1931, p. 317, pl. 36, figs. 202, 203) as *P. sanctae-crucis* occurs in the Neocomian deposits of Argentina. Judging from the published figures of *P. sanctae-crucis*, the Mexican form appears to have a broader posterior margin which rounds more abruptly into the hinge line, and its beaks are situated nearer the anterior extremity of the shell. But, as only a few specimens are available, these differences might be ascribed to deformation. Certainly the striking resemblances with forms as remote as Argentina and France are noteworthy. Compared with the Mexican form, *P. marcoui* Cragin (1905, p. 80, pl. XVI, figs. 1, 2) is much smaller, more elongate, and has narrower, more numerous radial ribs. *P. aff. paucicosta* Roemer (in Cragin, 1905, p. 81, pl. XVI, figs. 5, 6) has more elevated beaks and a deeper escutcheon.

**Specimen Nos.:** 15979, 20417, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale. Barril viejo, Coahuila.

*Pholadomya* cf. *gigantea* (Sowerby)

(Plate 18, figure 5)

**Remarks:** A dozen poorly preserved specimens are greatly similar to *P. gigantea* (Sowerby) (see Woods, 1909, p. 246, pl. XL, fig. 14; pl. XLI, fig. 1) which ranges through the Neocomian and Aptian of Europe. The shell is elongate, curved, and has numerous narrow, sharp, radial ribs except at the extreme anterior and postero-dorsal margins. Compared with *P. tosta* Cragin (1905, p. 79, pl. XV, figs. 2, 3) the Mexican form is more elongate, has a greater area covered with ribs, and the ribs are less elevated.

**Occurrence:** Barril viejo shale. Barril viejo, Potrero de Menchaca, and Potrero de Oballos, Coahuila.
Class GASTROPODA

Genus *Turbo* Linné 1758

*Turbo* n. sp. aff. *mantelli* Leymerie

**Remarks:** Five specimens from Locality A-34 in the Sierra de Mapimí, Durango, are too poorly preserved for illustration. They resemble *T. mantelli* Leymerie (1842, p. 13, pl. XVII, fig. 4; d'Orbigny, 1842-1843, p. 214, pl. 183, figs. 5-7) from the Neocomian of France but have a slightly wider apical angle, a more oblique aperture, and their main spiral ribs are narrower.

*Turbo? gigas* Imlay, n. sp.

(Plate 15, figures 1-4)

**Description:** The species is represented by three specimens of which the holotype retains much shell material on its last whorl but has a much corroded spire. The other two specimens are internal molds with fragments of shell material adhering and are about twice the size of the holotype.

Shell fairly large, turbinate, spire low, probably composed of four whorls; body whorl very large, forming about three-fourths of the total height, bluntly edged. Apparently nonumbilicated. Aperture probably ovate. Side of whors of spire gently convex, shouldered on mold, bearing a nodose carina on shell. Body whorl ornamented with four prominent, diverging, nodose carinae of which the two most posterior are strong, and the most anterior is weak. The second carina from the posterior margin marks the most inflated part of the outer whorl. The tubercles are prominent, elongate spirally, and roughly arranged in vertical rows. The carinae are separated by somewhat broader, smooth interspaces. Dimensions of holotype: Altitude (incomplete) 39 mm.; maximum diameter 43 mm.

**Remarks:** This species belongs to the genus *Turbo* in the broad sense although much larger than any Lower Cretaceous species of *Turbo* with which the writer is familiar. It possibly belongs in the subgenus *Sarmaticus* Gray 1847 whose known range is Upper Cretaceous to Recent (Wenz, 1938, p. 350-351).

**Type:** Holotype 20418, paratypes 20430, 20902, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale. Barril viejo, Coahuila.

Genus *Trochus* Linné 1758

*Trochus* n. sp. ind.

(Plate 19, figures 3, 4)

**Description:** One internal mold differs from any described species known to the writer. Shell large, regularly conical, apparently nonumbilicated. Apical angle about 55 degrees. Faces of whors flat. Umbilical face concave, bordered by a sharp carina. Ornamentation of the whorl faces consists of four or five fairly strong spiral ribs and of stronger transverse ribs which incline at an angle of about 30 degrees to the spiral ribs. Transverse ribs number about 25 to 30 per whorl and terminate in tubercles along the umbilical border. Umbilical face ornamented with spiral striae.

**Specimen No.** 20402, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale. Barril viejo, Coahuila.
SYSTEMATIC DESCRIPTIONS

Genus *Natica* Adanson 1777

*Natica* cf. *hugardiana* d’Orbigny

(Plate 14, figures 7, 8)

**Remarks:** Five internal molds represent a species which greatly resembles *N. hugardiana* d’Orbigny (1842-1843, p. 151, pl. 171, fig. 2) in its short spire, depressed form, and wide umbilicus. The latter species occurs in the middle Neocomian deposits of Europe.

**Specimen No. 20775,** Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale. Barril viejo, Coahuila.

*Natica* cf. *neptuni* d’Orbigny

**Remarks:** Two fragmentary molds from Barril viejo, Coahuila, have a spire of similar height to *N. neptuni* d’Orbigny (1850, p. 68; Cottreau, 1934, p. 12, pl. LXXI, figs. 1-4) and a little lower than *N. bulimoides* (Deshayes) (Leymerie, 1842, p. 12, pl. 16, fig. 9).

Genus *Tylostoma* Sharpe 1849

*Tylostoma* cf. *laharpi* Pictet et Campiche

**Remarks:** One mold from Barril viejo, Coahuila, is compared with *T. laharpi* Pictet et Campiche (1862, p. 350, pl. LXXIII, figs. 1, 2) rather than with *Natica? praelonga* Deshayes (Leymerie, 1842, p. 13, pl. 16, fig. 8) because of the presence of narices.

Genus *Vermetus* Daudin

*Vermetus? cornejoi* Castillo y Aguilera *varians* Imlay, n. var.

(Plate 14, figures 2-6; Plate 15, figures 5-8)

1895. *Vermetus (Burtinella) cornejoi* Castillo y Aguilera, Bol. Com. Geol. Mex., No. 1, p. 12, Pl. VI, figs. 5, 6, and 7.

**Remarks:** The Upper Jurassic and Neocomian deposits of the Mexican geosyncline contain locally an abundance of *Vermetus* which appear to belong to one long-ranging, highly variable species. The original specific description has been translated by Cragin (1905, p. 93). The Jurassic forms and some of the Neocomian forms in the University of Michigan collections agree in their characteristics with the original description. However, most of the Neocomian forms, which are represented by several hundred specimens, show considerable variation from the types. Among them about two-thirds are coiled dextrally instead of sinistrally; the whorls vary from nearly discoid to decidedly helicoid; the spiral carinae along the base of the tube are variably developed and become more prominent anteriorly; the upper part of the outer whorl tends to develop a shoulder; the growth lines become more pronounced anteriorly. The varietal name should include the Neocomian forms which show a tendency to develop a helicoid spiral and of which the majority are coiled dextrally.

**Types of Variety:** Holotype 20617, paratypes 20615, 20616, 20618 to 20621, Museum of Paleontology, University of Michigan.

**Occurrence:** Basal Cretaceous beds near Miquihuana, Tamaulipas; Carbonera formation at localities A-4, A-34, A-37, K-96, K-97 in eastern Durango; Barril viejo shale at Barril viejo and Potrero de Menchaca, Coahuila.
Genus *Nerinea* Defrance 1825

*Nerinea* sp. ind.

**Remarks:** *Nerinea* is represented from Barril viejo, Coahuila, by several fragments of which one resembles *N. marcousana* d’Orbigny (Pictet et Campiche, 1862, p. 226, pl. LXIV, figs. 1, 2) from the Valanginian of Europe.

Genus *Harpagodes* Gill 1870

*Harpagodes mexicanus* Imlay, n. sp.

(Plate 14, figure 9)

**Description:** This species is represented by one compressed internal mold. Shell large, subfusiform; spire moderate in height, probably composed of four or five whorls, but only three whorls preserved, apical angle about 45 degrees; body whorl very large, forming about three-fifths of the total height. Side of whorls of spire gently convex; ornamented with a number of indistinct spiral ribs; suture moderately impressed. Body whorl ornamented with four prominent diverging carinae whose tips project forward and outward. Middle carinae largest. Carinae separated by broader, flat, smooth interspaces. Between the posterior carina and the suture are two weak spiral ribs. Anterior canal broken, finger-like, apparently not curved much posteriorly.

**Dimensions:** Altitude (incomplete) 110 mm.; maximum diameter 95 mm.

**Remarks:** This species resembles *H. jaccardi* (Pictet et Campiche) (1864, p. 557, pl. XCI, figs. 3, 4) from the Valanginian of Europe in the height of its spire and in its ornamentation but is much larger, apparently lacks small ribs between the carinae on the body whorl, and its anterior canal is not curved strongly posteriorly.

**Type:** Holotype 15976, Museum of Paleontology, University of Michigan.

**Occurrence:** Barril viejo shale. Barril viejo, Coahuila.

*Harpagodes americanus* Imlay, n. sp.

(Plate 15, figure 9)

**Description:** This species is represented by one internal mold. Shell large, subfusiform; spire short, probably composed of four whorls, but only two preserved, apical angle about 45 degrees; body whorl very large, forming about three-fourths of the total height. Side of whorls gently convex, suture moderately impressed. Posterior part of body whorl ornamented with many small spiral ribs separated by somewhat wider interspaces. Toward the anterior part of the body whorl four of these ribs develop into prominent, diverging carinae of which the two in the middle are the largest. The carinae are separated by broad, nearly flat interspaces which are marked by weak spiral ribs that increase in number anteriorly. Between the posterior carina and the suture are two spiral ribs of which the most posterior is much larger than the other and about one-third the size of the posterior carina. The anterior carinae curve anteriorly; the posterior carinae curve posteriorly; the posterior-most carina rests against the side of the spire. Anterior canal broken.

**Dimensions:** Altitude (incomplete) 125 mm.; maximum diameter 110 mm.

**Remarks:** This species may be distinguished from *H. mexicanus* Imlay by its shorter spire, relatively larger body chamber, and by the presence of minor ribs between the large carinae. It greatly resembles *H. desori* (Pictet et Campiche) (1864, p. 575, pl. XC, figs. 3, 4; d’Orbigny, 1842-1843, p. 304, pl. 212) from the Neo-comian of Europe, but its carinae are broader and rounder.
**SYSTEMATIC DESCRIPTIONS**

**Type**: Holotype 20413, Museum of Paleontology, University of Michigan.

**Occurrence**: Barril viejo shale. Barril viejo, Coahuila.

**Class CEPHALOPODA**

**Genus Phylloceras Suess, 1854**

*Phylloceras cf. serum* var. *perlobata* Sayn

(Plate 21, figures 19-21)

**Remarks**: One small pyritized specimen probably belongs to the group of *Phylloceras tethys* (d’ Orbigny) (1840-1841, p. 174, pl. 53, figs. 7-9; Gignoux, 1920, p. 90-94). No trace of ribs, constrictions, or swelling are visible, and the suture lines are poorly preserved. Its general form, somewhat flattened flanks, extremely narrow umbilicus, and marked enlargement of whorl height with growth, suggests a position near *P. serum* (Oppel) var. *perlobata* Sayn (1901, p. 7-9, pl. 1, figs. 6-8).

**Specimen No. 19039, Museum of Paleontology, University of Michigan.**

**Occurrence**: Taraises formation, lower part of upper member. Locality 58, Sierra de Parras, Coahuila.

**Genus Mexicanoceras Imlay, 1938**

*Mexicanoceras laticostatum* Imlay, n. sp.

(Plate 21, figures 17, 18)

**Description**: The species is represented by one pyritized specimen. Shell small; whorls semi- lunular in section, wider than high, embracing the umbilical tubercles; flanks and venter evenly convex. Umbilicus narrow and deep, wall vertical near base, shoulder rounded. Body chamber unknown.

The upper part of the umbilical wall bears 15 faint ribs which terminate on the umbilical wall in low tubercles. From the tubercles pass bundles of three ribs of which one usually bifurcates low on the flank. The ribs are low, broadly rounded, and are separated by slightly wider interspaces. They incline forward on the lower part of the flank but cross the venter transversely. Exposed outer whorl marked by five weak constrictions.

Greatest diameter of holotype 20 mm.; width of umbilicus 4.8 mm.; height of last whorl 9.2 mm.; thickness of last whorl 12 mm.

**Remarks**: This species most closely resembles *M. rarituberculatum* Imlay (1938a, p. 567, pl. 7, figs. 19-21) but may be distinguished by a broader whorl section, by fewer, broader, and lower ribs, and by the presence of constrictions.

**Type**: Holotype 19059, Museum of Paleontology, University of Michigan.

**Occurrence**: Taraises formation, lower part of upper member. Locality 58, Sierra de Parras, Coahuila.

*Mexicanoceras multicostatum* Imlay, n. sp.

(Plate 21, figures 22-26)

**Description**: This species is represented by two pyritized specimens. The anterior end of the holotype has been slightly compressed.

Shell small; whorls semi-lunular in section, wider than high, embracing the umbilical tubercles; flanks and venter evenly rounded. Umbilicus deep and narrow; wall vertical at base, steeply inclined above; shoulder rounded.

The upper part of the umbilical wall is marked by about 20 low, radially trending ribs which terminate on the umbilical shoulder in small tubercles that are elongated
and inclined forward. From the tubercles pass bundles of two or three ribs of which over half fork on the lower half of the flank. The ribs are moderate in height, narrowly rounded, and are separated by much wider interspaces. They incline forward rather strongly on the lower part of the flanks but recurve and cross the venter transversely. A faint thinning of the ribs along the midventral line occurs on the anterior end of the types. The outer whorl of the holotype bears four weak constrictions.

Greatest diameter of holotype 17.5 mm.(?); width of umbilicus 3 mm.; height of last whorl 8 mm.(?); thickness of last whorl 9.5 mm.(?).

Remarks: This species differs from M. gloriente Imlay (1938a, p. 567, pl. 8, figs. 33-37) by its much finer and lower ribbing.

Types: Holotype 19063, paratype 18065, Museum of Paleontology, University of Michigan.

Occurrence: Taraises formation, lower part of upper member. Locality 58, Sierra de Parras, Coahuila.

Genus Maderia Imlay, 1938

Maderia marcosensis Imlay, n. sp.

(Plate 21, figures 11-14, 27, 28)

Description: The species is represented by four pyritized specimens. Shell small; whorls semilunar in section, much wider than high, embracing to the umbilical tubercles; flanks rounding evenly from umbilical wall into broadly rounded venter. Umbilicus deep and fairly wide, funnel-shaped; wall high, vertical at base, steeply inclined above; shoulder rounded. Body chamber unknown.

Upper part of umbilical wall marked by about 25 low, radially trending ribs which terminate on the umbilical shoulder in low elongate tubercles. From the tubercles pass bundles of two, or less commonly three, ribs which incline forward on the flanks and then cross the venter transversely. In some bundles one rib branches low on the flank. The ribs are low, rounded, and are separated by slightly wider interspaces. No constrictions observed. A faint thinning of the ribs occurs along the midventral line. Suture line unknown.

Dimensions in mm. are as follows:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Diameter</th>
<th>Whorl height</th>
<th>Whorl thickness</th>
<th>Umbilical width</th>
</tr>
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<tr>
<td>Holotype</td>
<td>21158</td>
<td>24</td>
<td>11</td>
<td>15.5</td>
</tr>
<tr>
<td>Paratype</td>
<td>21157</td>
<td>18</td>
<td>8</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Remarks: This species is intermediate in appearance between Maderia nontuberculata Imlay (1938a, p. 560, pl. 8, figs. 1-4) and Maderia semilunaris Imlay (1938a, p. 561, pl. 3, figs. 6, 7, 13-15) but is readily distinguished from both by the common branching of the ribs in bundles of two instead of three. Furthermore it is distinguished from M. semilunaris Imlay by weaker and more numerous umbilical tubercles, a slightly narrower umbilicus, and a less abruptly rounded umbilical shoulder.

Type: Holotype 21158, paratype 21157, Museum of Paleontology, University of Michigan.

Occurrence: Taraises formation, lower part of upper member. Locality 18, Sierra de Parras, Coahuila.
**Maderia coahuilensis** Imlay, n. sp.

(Plate 21, figures 15, 16)

**Description:** This species is represented by one pyritized specimen. Shell small; whorls semilunar in section, wider than high, embracing about three-fourths of preceding whorls; flanks rounding evenly into rounded venter. Umbilicus moderately deep and wide, funnel-shaped; wall vertical at base, steeply inclined above; shoulder rather abruptly rounded.

The upper two-thirds of the umbilical wall is marked by about 22 low, rounded ribs which become swollen on the umbilical shoulder and pass into pairs of ribs which incline forward low on the flanks and then cross the venter transversely. The flank ribs are fairly high, narrowly rounded, and are separated by much wider interspaces. The anterior end of the holotype shows a faint thinning of the ribs along the midventral line. No constrictions observed.

Greatest diameter of holotype 15 mm.; width of umbilicus 4.5 mm.; height of last whorl 5.7 mm. (?) ; thickness of last whorl 8 mm.

**Remarks:** This species resembles *M. aquilerae* (Böse) (1923, p. 97, pl. 4, figs. 4-7) but has a wider umbilicus, fewer umbilical ribs, and stronger, more flexuous flank ribs.

**Type:** Holotype 12163, Museum of Paleontology, University of Michigan.

**Occurrence:** Taraias formation, lower part of upper member. Locality 18, Sierra de Parras, Coahuila.

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**Maderia casitensis** Imlay, n. sp.

(Plate 21, figures 29-31)

**Description:** This species is represented by one pyritized specimen. Shell small; whorls semilunar in section, much wider than high, embracing the umbilical tubercle; venter broadly rounded. Umbilicus deep and wide, funnel-shaped; wall high, vertical at base, steeply inclined above; shoulder rather abruptly rounded. Body chamber unknown.

The upper part of the umbilical wall bears about 30 moderately low ribs which terminate on the shoulder in fairly acute tubercles. From the tubercles pass bundles of two or three ribs which incline forward slightly on the flanks but cross the venter transversely. In many bundles one of the ribs bifurcates on the flanks. The ribs are rounded, moderately low, and separated by slightly wider interspaces. Outer whorl bears one weak constriction. A slight thinning of the ribs along the midventral line occurs on the anterior part of the outer whorl.

Greatest diameter of holotype 27.3 mm.; width of umbilicus 8.7 mm.; height of last whorl 11.5 mm.; thickness of last whorl 20.5 mm.

**Remarks:** This species is similar to *M. multituberculata* Imlay (1938a, p. 559, pl. 3, figs. 1-3) but has a more depressed whorl section, a wider umbilicus, more umbilical tubercles, and finer ribbing.

**Type:** Holotype 18060, Museum of Paleontology, University of Michigan.

**Occurrence:** Taraias formation, lower part of upper member. Locality 58, Sierra de Parras, Coahuila.

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Genus *Saynoceras* Munier-Chalmas, 1893

**Saynoceras mexicanum** Imlay, n. sp.

(Plate 21, figures 1-4)

**Description:** The species is represented by one crushed, pyritized specimen which does not show the body chamber.
Shell small, subglobose; whorl subcircular in section, slightly wider than high, embracing about one-half; flanks and venter evenly rounded. Umbilicus fairly narrow and deep; wall high, vertical at base, rounding evenly into flanks.

The sculpture of the outer whorl consists of ribs and of lateral and ventral tubercles which are extremely weak at the posterior end and extremely strong at the anterior end. About 17 narrow, fairly prominent ribs begin low on the umbilical wall and trend radially to lateral tubercles. From these tubercles pass broad low ribs which connect with ventral tubercles. The two rows of ventral tubercles are slightly offset in relation to each other and are connected across the midventral area by faint ribs which show a tendency toward a zigzag arrangement only at the posterior end of the whorl. The ventral tubercles have about the same strength as the lateral tubercles in early stages of growth but become nearly twice as strong in the later stages. The midventral area is broad at the posterior end of the outer whorl and becomes rather narrow at the anterior end. Suture line unknown. Approximate dimensions: Greatest diameter 18.5 mm.; width of umbilicus 3.5 mm. (†); height of last whorl 9 mm.; thickness of last whorl 10 mm.

Remarks: This species differs from other described species of Saynoceras by its less globose form and coarser ornamentation. Its occurrence in beds of upper Barremian or lower Aptian age is interesting as the genus has hitherto been recorded by single species from the Tithonian (Roman, 1938, p. 391), the upper Valanginian (Fallot and Termier, 1923, p. 39-43), the lower Hauterivian (Imlay, 1938a, p. 552, 571), and the upper Albian (Pervinquiére, 1907, p. 114).

Type: Holotype 17715, Museum of Paleontology, University of Michigan.

Occurrence: La Peña formation, basal beds (Imlay, 1937b, p. 610 and 624) at locality 32, about 1½ miles south of Rancho El Angel, Sierra de Parras, Coahuila.

Genus Oosterella Kilian, 1911

Oosterella † sp.

(Plate 21, figures 9, 10)

Description: One strongly compressed, calcareous fragment suggests the presence of the genus Oosterella in Mexico. Its venter bears a narrow, sharp keel which is bounded by faint lateral grooves. Its flanks are marked by broad, low, rounded, widely spaced, slightly flexuous ribs which terminate at the keel. The ribs are of two sizes. Some extend across the entire flank, and others begin near the middle of the flank. Some of the short ribs are faintly connected with the long ribs. All the ribs are faint and narrow at their dorsal extremities and are broadest and strongest at their ventral extremities.

Remarks: The ornamentation suggests a comparison with O. cultrata (d'Orbigny) (1840-1841, p. 145, pl. 46, figs. 1-2) from the lower Hauterivian of France.

Specimen No.: 17701, Museum of Paleontology, University of Michigan.

Occurrence: Taraises formation, upper part of upper member. Associated with Olocostephanus at Locality 42, Sierra de Parras, Coahuila.

Genus Dichotomites von Koenen, 1909

Dichotomites multicostatus Imlay, n. sp.

(Plate 18, figure 6)

Description: One fragment shows parts of two outer whorls of a large form. Whorl section higher than wide; outer whorl apparently embracing the inner only about
one-third; flanks high and somewhat flattened; venter rather broadly rounded; umbilical wall abruptly rounded.

The ribs on the umbilical wall are low, broad, and inclined backward. They terminate on the umbilical shoulder in small blunt tubercles or swellings which are slightly elongated radially. From each tubercle pass two ribs of which the most posterior bifurcates slightly above the zone of tubercles. A few simple ribs begin in weak swellings on the umbilical shoulder. Most of the ribs bifurcate again on the upper part of the flanks. The ribs are high, rounded, incline forward on the lower two-thirds of the flanks and then curve forward more strongly above the zone of secondary bifurcation. The interspaces are rounded and slightly wider than the ribs.

Remarks: This species belongs in the genus *Dichotomites* on the basis of its small umbilical tubercles, the forward curve of its ribs on the upper part of the flanks and on the venter, and the character of its rib bifurcation. It is apparently less involute than is common in the genus, but this appearance is due in part to deformation. It greatly resembles *D. tersscissus* (v. Koenen) (1902, p. 106, pl. LIII, figs. 1, 2) but has a broader whorl section and closer-spaced ribbing.

Type: Holotype 20439, Museum of Paleontology, University of Michigan.


Genus *Acanthodiscus* Uhlig 1905 emend. Spath 1921

*Acanthodiscus aff. radiatus* Bruguière

(Plate 19, figure 2)

Description: Form stout, discoidal; outer whorl subhexagonal in section, slightly wider than high, embracing about two-fifths; lower part of flanks nearly flat, upper part rounding evenly into venter. Umbilicus fairly wide, wall nearly vertical, shoulder abruptly rounded. The primary ribs are strong, widely spaced, and bear prominent umbilical and lateral tubercles. From the latter pass bundles of two, or three, weak secondary ribs which incline forward and terminate ventrally in much weaker tubercles. Between most bundles is a single rib which begins at about the height of the lateral tubercle. The ventral area between the ventral tubercles is fairly narrow and is marked by weak rib continuations.

Remarks: The specimen is similar in form and sculpture to *A. radiatus* Bruguière (Baumberger, 1906, p. 13-20, pls. 16-18 in part) but may be distinguished by weaker ventral tubercles and a narrower midventral area.

Specimen No.: 15978, Museum of Paleontology, University of Michigan.


*Acanthodiscus magnificus* Imlay

(Plate 14, figure 1; Plate 18, figure 1)

1938. *Acanthodiscus magnificus* Imlay, Geol. Soc. Am., Bull., vol. 49, p. 572, pl. 9, figs. 1, 2, 7, 8; pl. 13, fig. 4; text figure 3.

Remarks: This species is represented from Barril viejo by one internal mold which shows the major convolutions of the suture line. The latter, drawn at a whorl height of 45 mm., shows the characteristic pattern of *Acanthodiscus*. The lateral lobes consist of two unsymmetrical branches of which each is divided in turn. The first lateral lobe is moderate in width and much longer than the siphonal lobe. The second lateral lobe is much shorter than the first and trends obliquely to it. The external saddle is fairly broad and is divided by a secondary lobe into two
nearly equal parts. The first lateral saddle is narrower than the first lateral lobe, rather deeply incised, and subdivided by a long secondary lobe.

**Hypotype**: 20395, Museum of Paleontology, University of Michigan.

**Occurrence**: Barril viejo shale. Barril viejo, Coahuila.

Genus *Leopoldia* K. Mayer 1887

*Leopoldia truncata* Imlay, n. sp.

(Plate 18, figures 2-4)

**Description**: This species is represented by one internal mold with some shell matter adhering near the umbilicus. Form discoidal, involute; outer whorl subtrapezoidal in section, nearly twice as high as wide, embracing almost completely; flanks fairly flat, lower two-thirds gently swollen; venter fairly narrow, truncated, slightly concave. Umbilicus shallow and extremely narrow, wall vertical, shoulder subangular.

Shell marked by faint, broad, falciform ribs which become fainter anteriorly. Ribs incline forward strongly on the upper third of the flanks and at the anterior end continue faintly across the venter.

The suture line (Pl. 18, fig. 3), drawn at a whorl height of 36 mm., is surprisingly undeveloped compared with other species of *Leopoldia* at similar diameters, and this condition does not appear to be due to corrosion. The broad unsymmetrical first lateral lobe, with the inner branch more strongly developed than the outer, is characteristic of the genus (Baumberger, 1906, p. 27).

Greatest diameter of holotype 67 mm.; width of umbilicus 4 mm.; height of last whorl 41 mm.; thickness of last whorl 22 mm.

**Remarks**: This species is characterized by its extremely narrow umbilicus, truncated and slightly concave venter, and faint, broad ribbing.

**Type**: Holotype 15977, Museum of Paleontology, University of Michigan.

**Occurrence**: Barril viejo shale. Barril viejo, Coahuila.

*Leopoldia crassicostata* Imlay

(Plate 16, figures 1-3)


**Remarks**: This species is represented at Barril viejo by two specimens which show more advanced stages of growth than the Sierra de Parras specimens. They show that the whorls embrace about two-fifths and that the primary and secondary ribs became more loosely connected and less falciform during growth. The species is easily distinguished from other described Mexican species by its lower whorl section, lesser degree of involution, flatter venter, and coarser ribbing which remains fairly distinct until a late stage of growth. Among European species *L. dubistensis* var. *bargemensis* Kilian (1915, p. 244, pl. XI, figs. 1, 2; pl. XII, fig. 5) probably bears the closest resemblance to *L. crassicostata* but may be distinguished by a thinner whorl section, a flatter venter, and apparently finer ornamentation. Roman (1933, p. 14, pl. 3, fig. 2) considers *L. bargemensis* a variety of *L. castellanensis* (d'Orbigny) and figures a form which is similar to *L. crassicostata* Imlay.

**Type**: Hypotypes 20733, 20422, Museum of Paleontology, University of Michigan.

**Occurrence**: Taraises formation at Locality 58 in the Sierra de Parras; Barril viejo shale at Barril viejo, Coahuila.
Leopoldia spp.

(Plate 16, figure 4; Plate 17, figures 2, 3; Plate 19, figure 1)

Remarks: The genus Leopoldia is represented in the near-shore facies at Barril viejo, Coahuila, by several specimens which probably represent the same species as occur (Imlay, 1938a, p. 581-583) in the Taraises formation. Two specimens are like L. victoriensis Imlay, and two like L. bakeri Imlay. One specimen (Pl. 16, fig. 4) is as large as some figured by Baumberger (1905, p. 26-47, pl. 4-9). A specimen (Pl. 17, figs. 2, 3) from the Potrero de Oballos near Hermanos, Coahuila, compares with L. bakeri Imlay in the closeness of ribbing at the posterior end of the exposed whorl.

Figured Specimens: 15980, 20438, 20444, Museum of Paleontology, University of Michigan.

Occurrence: Barril viejo shale, Barril viejo, Coahuila.

Genus Thurmannites Kilian, 1913

Thurmannites cf. novihispanicus Imlay

(Plate 17, figure 1)

Remarks: One specimen bears a very close resemblance to T. novihispanicus Imlay (1937a, p. 563, pl. 78, figs. 8, 9; pl. 79, fig. 6) from beds of Valanginian age at Miquihuana, Tamaulipas. It possibly has a flatter venter and fewer single ribs. It is associated with Exogyra reedi Imlay, Vermetus cornejoii Castillo y Aguilera var. varians Imlay, Berriasella? sp., Blanfordiceras? sp., Pinna sp., Spondylus sp., and corals and represents the same horizon as Kellum's (1936, p. 1068) collection A-4 and A-34 in the mountains west of the Laguna district.

Specimen No.: 19415, Museum of Paleontology, University of Michigan.

Occurrence: Carbonera formation, about 325 feet below top. Northwest end of Cuesta del Carbonera, about 2 miles south of Las Cuevas, Durango.

Genus Distoloceras Hyatt, 1900

Distoloceras sp. juv.

(Plate 21, figures 7, 8)

Description: One small specimen is particularly interesting because it illustrates the development of the ornamentation characteristic of the genus. It is possibly the immature form of D. nodosum Imlay. On the exposed outer whorl the ribs begin at the line of involution, are widely but variably spaced, and trend nearly radially across the flanks. At the posterior end the ribs are nearly equal in size and terminate ventrally in broad tubercles. Anteriorly they are differentiated markedly into prominent trituberculate ribs which terminate ventrally in large spines, and weak non-tuberculate ribs, which do not become stronger ventrally. Tuberculation appears first on the venter and last on the umbilical shoulder. The midventral area is narrow and slightly impressed.

Specimen No.: 19036, Museum of Paleontology, University of Michigan.

Occurrence: Taraises formation, lower part of upper member. Locality 58, Sierra de Parras, Coahuila.
Genus *Hemihoplites* Spath, 1924

*Hemihoplites*? *mexicanus* Imlay, n. sp.

(Plate 21, figures 5, 6)

**Description**: The species is represented by a fairly mature form preserved as a calcareous cast and by a small pyritized whorl which has been slightly compressed. The larger specimen, here designated the holotype, was described previously (Imlay, 1938a, p. 586, pl. 2, fig. 10).

Shell discoidal, involute, whorl section subovate, higher than wide, thickest in lower third, probably slightly embracing preceding whorl; flanks gently convex, becoming flatter with age; venter rather narrowly rounded. Umbilicus fairly small; wall low, vertical at base, rounding evenly into flanks.

The shell is marked with flexuous, nontuberculate, widely spaced ribs which are weakest on the umbilical wall and strongest on the venter. The ribs trend nearly radially on the umbilical wall, incline forward strongly to the middle of the flanks, and then recurve to the venter which they cross transversely. Most ribs are single, but on the holotype a few appear to bifurcate low on the flank. In cross section the ribs are shaped like an inverted V, i.e., with broad bases and narrowly rounded summits. The interspaces are broadly rounded, becoming broader on outer whorls than on inner. Suture line unknown. Dimensions of paratype: Whorl height, 13.5 mm.; whorl thickness, 11.5 mm. (?).

**Remarks**: This species probably belongs to an undescribed genus. Its ribbing suggests relationships with *Pascoeites* Spath (1933, p. 827, 828, pl. CXXVI, figs. 5a, b, 7a-c, 12a-c, pl. CXXVII, figs. 1a, b) and to *Aegocrioceras* Spath (1924, p. 76), but it is more involute, and its whorls enlarge more rapidly than either of these genera. It is more likely an immature form of the Hemihoplitidae, such as *Pseudothurmannia* Spath (1921, p. 66) or *Hemihoplites* Spath (1924, p. 84).

**Type**: Holotype 16866, paratype 19057, Museum of Paleontology, University of Michigan.

**Occurrence**: Taraises formation, lower and upper parts of upper member. Localities 20 and 58, Sierra de Parras, Coahuila.

**Works to Which Reference Is Made**


*—* (1850) *Prodrome de paléontologie stratigraphique universelle*.


*—* (1937a) *Lower Neocomian fossils from the Miqiuhauna region*, Jour. Palaeont., vol. 11, no. 7, p. 552-574, pls. 70-83, 8 figures.


——— (1910) Paléontologie Universalis, fiche 194.


Pictet, F. J., and Campiche, G. (1864-1872) Description des fossiles du terrain crétacé des environs de Sainte Croix, in Matériaux pour la paléontologie suisse, 4ième série, 1864-1868; 5ième série, 1868-1871; 6ième série, 1872; illust.


——— (1924) Ammonites of the Speeton clay, Geol. Mag., vol. 61, p. 73-89.

——— (1927-1933) Revision of the Jurassic cephalopod fauna of Kachh (Cutch), Paleont. Indica, n. s., vol. 9, 6 parts, 945 pages, 130 plates.


EXPLANATION OF PLATES
Plate 1

Neocomian Fossils from Northern Mexico

Figure

(1-16) "Terebratula" coahuilensis Imlay, n. sp.; (1-4) Dorsal, ventral, lateral, and anterior views of holotype U.M. 20926, Barril viejo shale, Barril viejo, Coahuila; (5-8) Paratype U.M. 20929, Barril viejo shale, Barril viejo, Coahuila; (9-12) Paratype U.M. 20927, Barril viejo shale, Sierra de Azul, Coahuila; (13-16) Paratype U.M. 20928, Barril viejo shale, Potrero de Oballos, Coahuila (p. 140).

(17-20) "Terebratula" kanei Imlay, n. sp.; Lateral, anterior, ventral and dorsal views of holotype U.M. 20925, Barril viejo shale, Potrero de Oballos, Coahuila (p. 142).

(21, 22) Astrocoenia hispaniensis Imlay, n. sp.; (21) view of corallites of upper surface and (22) section of corallum of holotype U.M. 19345, Carbonera formation, northwest end of Cuesta del Carbonera, about 2 miles south of Las Cuevas, Durango (p. 136).

Figures natural size unless otherwise indicated.
Plate 2

Neocomian Fossils from Northern Mexico

Figure

(1-18) *Antiptychina? formosa* Imlay, n. sp.; (1-4) Paratype U.M. 20935; (5-8) Paratype U.M. 20933; (9-12) Holotype U.M. 20930; (13, 14) Paratype U.M. 20934; (15, 16) Paratype U.M. 20931; (17, 18) Paratype U.M. 20932. All specimens from Barril viejo shale; Sierra de Azul, Coahuila (p. 138).


(41-42) *Plicatula torreonensis* Imlay, n. sp.; (41, 42) Holotype U.M. 15815, Carbonera formation, locality A-34, eastern Durango (p. 144).

All figures natural size.
Plate 3

Neocomian Fossils from Northern Mexico

Figure

(1-9, 14-17) *Plicatula pulchra* Ilay, n. sp.; (1-3) Paratype U.M. 20608; (4-6) Paratype U.M. 20607; (7-9) Holotype U.M. 20606; (14) Paratype U.M. 20612; (15) Paratype U.M. 20610; (16) Paratype U.M. 15803; (17) Paratype U.M. 20611. All specimens from Carbon era formation, locality A-34, eastern Durango (p. 144).

(10-13, 22) *Plicatula umbonata* Ilay, n. sp.; (10, 11) Left valve and lateral view of paratype U.M. 20784; (12, 13) Left valve and lateral view of holotype U.M. 20787; (22) Paratype U.M. 20785. All specimens from Barril vieJO shale, Barril vieJO, eastern Coahuila (p. 145).


All figures natural size.
PLATE 4

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1, 2) *Cucullaea gabrielis* var. *fraterna* Imlay, n. var.; Dorsal and lateral views of holotype U.M. 20728, Barril viejo shale, Barril viejo, eastern Coahuila (p. 143).


(7, 8) *Nieithea biangulata* Imlay, n. sp.; Paratype U.M. 20731, Barril viejo shale, Barril viejo, eastern Coahuila (p. 146).

All figures natural size.
PLATE 5

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1, 2) Prohinnites ordoñesi Imlay, n. sp.; Lateral view and right valve of paratype U.M. 20390, Barril viejo shale, Barril viejo, eastern Coahuila (p. 147).

Figures about four-fifths natural size.
PLATE 6
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1) *Prohinnites ordoñesi* Imlay, n. sp.; Left valve of holotype U.M. 20442.
Barril viejo shale, Potrero de Oballos, eastern Coahuila (p. 147).


(7,8) *Panope cf. gurgitis* (Brongniart); Lateral view of specimen U.M. 20416,
Barril viejo shale, Barril viejo, eastern Coahuila (p. 154).

Figures natural size unless otherwise indicated.
PLATE 7

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1) *Prohinnites ordoñesi* Imlay, n. sp.; Right valve of holotype U.M. 20442, Barril viejo shale, Potrero de Oballos, eastern Coahuila (p. 147).

(2, 3) *Sphaera americanus* Imlay, n. sp.; Left valve and dorsal view of holotype U.M. 20421, Barril viejo shale, Barril viejo, eastern Coahuila (p. 153).

Figures natural size unless otherwise indicated.
Figure

(1–6) *Gryphaea* spp.; (1, 2) Views of right and left valves of specimen U.M. 15826; (3) Left valve of specimen U.M. 15944; (4) Left valve of specimen U.M. 15810; (5, 6) Left valve of specimen U.M. 15805. All specimens from Carbonera formation, locality A-34, eastern Durango (p. 147).

(7) *Lima* (*Plagiostoma*) *kanei* Imlay, n. sp.; Left valve of Paratype U.M. 13848, Barril viejo shale, Barril viejo, eastern Coahuila (p. 150).

(8, 9) *Sphaera americana* Imlay, n. sp.; Lateral and dorsal views of para-type U.M. 20445, Barril viejo shale, Potrero de Oballos, eastern Coahuila (p. 153).

(10, 11) *Astarte durangensis* Imlay, n. sp.; Dorsal and lateral views of holotype U.M. 15819, Carbonera formation, locality A-34, eastern Durango (p. 151).

All figures natural size.
PLATE 9

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1-3) *Lima* (*Plagiostoma*) *kanei* Imlay, n. sp.; (1) Left valve of holotype U.M. 20409, Barril viejo, Coahuila; (2) Right valve of paratype U.M. 13861, Potrero de Oballos, Coahuila; (3) Right valve of paratype U.M. 20427, Barril viejo, Coahuila. All specimens from Barril viejo shale (p. 150).

(4-6) *Exogyra reedi* Imlay; (4, 5) Hypotype U.M. 20567; (6) Hypotype U.M. 20568. Both specimens from Menchaca limestone, Potrero de Menchaca, eastern Coahuila (p. 148).

All figures natural size.
PLATE 10

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1, 2) *Gervillia alatior* Imlay, n. sp.; Left valve and anterior view of holotype U.M. 20625, Barril viejo shale, Barril viejo, Coahuila (p. 150).

Figures natural size.
PLATE 11

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure


All figures natural size.
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO
PLATE 12

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1, 2) *Exogyra reedi* Imlay; (1) Posterior view of left valve of hypotype U.M. 15814 (see Pl. 13, figs. 4 and 5, for other views), Menchaca limestone, Potrero de Menchaca, Coahuila; (2) Left valve of hypotype U.M. 20333, Barril viejo shale, Barril viejo, Coahuila (p. 148).


All figures natural size.
PLATE 13

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1-5) *Exogyra reedi* Imlay; (1) Hypotype U.M. 20453, Menchaca limestone, Potrero de Menchaca, Coahuila; (2, 3) Right and left valves of hypotype U.M. 20564, Carbonera formation, locality A-34, eastern Durango; (4, 5) Interior of left valve of hypotype U.M. 15814, Menchaca limestone, Potrero de Menchaca, Coahuila (p. 148).

All figures natural size.
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO
PLATE 14

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1) Acanthodiscus magnificus Imlay; Suture line of hypotype U.M. 20395 shown on Plate 18, figure 1, Barril viejo shale, Barril viejo, Coahuila (p. 163).

(2-6) Vermetus cornejoi var. varians Imlay, n. var.; (2, 3) Paratype U.M. 20619; (4-6) Holotype U.M. 20617. Specimens from Carbonera formation, locality A-34, eastern Durango (p. 157).

(7, 8) Natica cf. hugardiana d’Orbigny; Specimen U.M. 20775, Barril viejo shale, Barril viejo, Coahuila (p. 157).

(9) Harpagodes mexicanus Imlay, n. sp.; Holotype U.M. 15976, Barril viejo shale, Barril viejo, Coahuila (p. 158).

All figures natural size.
Plate 15

Neocomian Fossils from Northern Mexico

Figure

(1-4) _Turbo? gigas_ Imlay, n. sp.; (1-3) views of holotype U.M. 20418; (4) Paratype U.M. 20902. Both specimens from the Barril viejo shale, Barril viejo, Coahuila (p. 156).


(9) _Harpagodes americanus_ Imlay, n. sp.; Holotype U.M. 20413, Barril viejo shale, Barril viejo, Coahuila (p. 158).

All figures natural size.
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO
PLATE 16

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1-3) Leopoldia crassicostata Imlay; (1, 3) Lateral and ventral views of hypotype U.M. 20793; (2) Hypotype U.M. 20422. Both specimens from Barril viejo shale, Barril viejo, Coahuila (p. 164).

(4) Leopoldia sp., U.M. 15980, Barril viejo shale, Barril viejo, Coahuila (p. 165).

Figures natural size unless otherwise indicated.
PLATE 17

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1) *Thurmannites cf. novihispanicus* Imlay; Specimen U.M. 19415, Carbonera formation, northwest end of Cuesta del Carbonera, eastern Durango (p. 165).

(2, 3) *Leopoldia cf. bakeri* Imlay; Specimen U.M. 20444, Barril viejo shale, Potrero de Oballos, Coahuila (p. 165).

All figures natural size.
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO
PLATE 18

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1) *Acanthodiscus magnificus* Imlay; Hypotype U.M. 20395, Barril viejo shale, Barril viejo, Coahuila (p. 163).

(2-4) *Leopoldia truncata* Imlay, n. sp.; Holotype U.M. 15977, Barril viejo shale, Barril viejo, Coahuila (p. 164).

(5) *Pholadomya* cf. *gigantea* (Sowerby); U.M. 19282, Barril viejo shale, Potrero de Oballos, Coahuila (p. 155).

(6) *Dichotomites multicostatus* Imlay, n. sp.; Holotype U.M. 20439, Barril viejo shale, Barril viejo, Coahuila (p. 162).

All figures natural size.
PLATE 19

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1) *Leopoldia* sp.; U.M. 20438, Barril viejo shale, Barril viejo, Coahuila (p. 165).

(2) *Acanthodiscus aff. radiatus* Bruguère; Specimen U.M. 15978, Barril viejo shale, Barril viejo, Coahuila (p. 163).

(3, 4) *Trochus* n. sp. ind.; Specimen U.M. 20402, Barril viejo shale, Barril viejo, Coahuila (p. 156).

All figures natural size.
Plate 20

Neocomian Fossils from Northern Mexico

Figure.

(1-3) *Spondylus oballosensis* Imlay, n. sp.; Lateral and anterior views of holotype U.S. 21129, Barril viejo shale, Potrero de Oballos, Coahuila (p. 146).

(4, 5) *Trigonia cf. carinata* Agassiz; Specimen U.M. 21130, Barril viejo shale, Potrero de Oballos, Coahuila (p. 149).

(6, 7) *Neithia biangulata* Imlay, n. sp.; Holotype U.M. 19365, Barril viejo shale, Potrero de Menchaca, Coahuila (p. 146).

All figures natural size.
PLATE 21

NEOCOMIAN FOSSILS FROM NORTHERN MEXICO

Figure

(1-4) Saynoceras mexicanum Imlay, n. sp.; Holotype U.M. 17715, La Peña formation, locality 32 (p. 161).

(5, 6) Hemihoplites? mexicanus Imlay, n. sp.; Paratype U.M. 19057, Taraises formation, locality 58 (p. 166).

(7, 8) Distoloceras sp. juv.; Lateral and ventral views of specimen U.M. 19036, Taraises formation, locality 58 (p. 165).

(9, 10) Oosterella? sp.; Lateral views of specimen U.M. 17701, Taraises formation, locality 42 (p. 162).

(11-14, 27, Maderia marcosensis Imlay, n. sp.; (11-14) Paratype U.M. 21157; (27, 28) holotype U.M. 21158. Both specimens from Taraises formation, locality 18 (p. 160).

(15, 16) Maderia coahuilensis Imlay, n. sp.; Holotype U.M. 12163, Taraises formation, locality 18 (p. 161).

(17, 18) Mexicanoceras laticostatum Imlay, n. sp.; Holotype U.M. 19059, Taraises formation, locality 58 (p. 159).

(19-21) Phylloceras cf. serum (Oppel) var. perlobata Sayn. Specimen U.M. 19039, Taraises formation, locality 58 (p. 159).

(22-26) Mexicanoceras multicoostatum Imlay, n. sp. (22) Paratype U.M. 18065; (23-26) holotype U.M. 19063. Both specimens from Taraises formation, locality 58 (p. 159).

(29-31) Maderia casitensis Imlay, n. sp.; Holotype U.M. 18060, Taraises formation, locality 58 (p. 161).

Localities listed above are in the Sierra de Parras, Coahuila.
All figures natural size.
NEOCOMIAN FOSSILS FROM NORTHERN MEXICO