CHAPTER VI

PALEONTOLOGY

A. RUDISTAE

Radiolites corrugata (Palmer). (pl. III, figs 3—6).
Syn. Tepeyacia corrugata Palmer.


Tepeyacia corrugata Palmer.


Only fragments of specimens could be studied.
Shell straight, or nearly so, more than 8 cm long (largest fragment) diameter up to 4 cm. Surface covered with 20—30 ribs.

Transverse section.
Shell built up by two layers. Outer one consisting of radial and tangential plates. E and S are represented by two foldings of the outer layer into the inner. A ligamental crest is present (fig. 6)
The cardinal apparatus is not distinctly preserved in our specimens.

Vertical section.
A vertical section shows the shell to be subdivided by septa, built on a somewhat irregular plan, as is seen in fig. 4, 5. There are about 20 septa on 8 cm.

This species is found to live in small colonies (fig. 3).

Palmer described the genus, compared it with Distefanella Parona, but rejects a classification with the Radiolitidae „owing to the absence of radial plates”.

Thiaudens denies the occurrence of a ligamental crest, but his material, which I have studied, is too poorly preserved to justify that statement.

Montagne (4, p. 71) restudied Thiaudens’ material and ascertained the presence of radial plates. He stated that Tepeyacia has to be dropped as the species belongs to Radiolites if a ligamental crest is present or to Biradiolites if the ligamental crest is absent. From the foregoing considerations it is obvious that „Tepeyacia” corrugata belongs to the genus Radiolites.

This species is very close to Radiolites trigeri (Coquand) Toucas. The only difference is the closer and more regular setting of the longitudinal ribs on the outer surface.

F 235—a, F 235—c, H 222 — Tuff Series.
Bournonia nov. sect. sp. 4. MACGILLAVRY 1937.
H. J. MACGILLAVRY. "Geology of the province of Camaguey, Cuba with revisional studies in Rudist paleontology".
As this species is exactly the same as the one figured by MACGILLAVRY, and found at the same place: loc. H 230 (= H 689 on MACGILLAVRY's map) it is not figured again.
H 230 — Habana Series.

?Ichthyosarcolites sp. (pl. III, fig. 1).
Only two sections were found, which showed some characteristics of the genus Ichthyosarcolites. Shell consisting of one, very thick layer, which contains numerous subcircular canals. The marginal canals are strongly elongated. Some small fragments showed the canals in longitudinal section, and it appeared that they are not tabulated. In the shell some cavities occur, along a straight line, one rather larger, the others decreasing in diameter. The interpretation of these cavities remains obscure, they may represent the "cônes supplementaires" of DOUVILLE (2, p. 793).
F 235-f — Tuff Series.

Titanosarcolites giganteum WHITFIELD.
H. J. MACGILLAVRY. "Geology of the province of Camaguey, Cuba with revisional studies in Rudist paleontology".
Geogr. en Geol. Mededelingen, Phys.-Geol. reeks; no. 14, 1937, p. 85, 86, pl. 2, figs. 1—5, 7—11; pl. 9, fig. 1 (with complete synonymy).
H 230, 241, 283, 283 — Habana Series.

Barrettiun monilifera WOODWARD.
V 228-a — Habana Series.

?Sabina sp. THIADENS 1936. (pl. III, fig. 2).
As appears from the figure this sp. is very close to the one pictured by THIADENS. The only apparent difference is that our species is much smaller, in elongate section 6 x 3 cm.
H 222 — Tuff Series.
B. LARGER FORAMINIFERA

_Eocene._
The following samples contained larger foraminifera from the Eocene:

- **T 1109** from the neighbourhood of Aurora, Middle or Upper Eocene
- **T 1110**
- **T 1141** from the Eocene of Nuevitas, Upper Eocene
- **T 1143**
- **T 1144**
- **T 1145**
- **T 1146**
- **T 1147**

Except those underlined, the samples only contained foraminifera in rock sections, which generally didn’t allow specific determination and are not described.

Systematic descriptions:

1. **Dictyoconus Blanckenhorn.**
   - _Dictyoconus sp._
     - **T 1109.** Middle or Upper Eocene.

Some specimens were found, which were too badly preserved to allow specific determination. The small size (2 mm at the base) and the perfectly conical shape suggest _Dictyoconus americanus_ (Cu). It is, however, not certain whether they do not belong to the genus _Coskinolina_, as details of the peripheral layer could not be observed.

2. **Camerina Bruguière.**
   - _Camerina macgillavryi_ M. Rutten.
     - **T 1109.** Middle or Upper Eocene (pl. III, fig. 8—10).

Abundant macrospHERIC forms were found. MicrospHERic forms were absent. This is rather striking as Rutten’s material contained abundant microspHERic forms and only a couple of macrospHERic forms in rock sections.
Test smooth, lenticular. Measurements of diameter and thickness are compiled in table I. Twenty-one specimens were sectioned. The diameters of the embryo are given in table II. The average of the diameters of the first two whorls amounted to about 2.75 mm. Generally 3½ whorls were preserved. The average of the diameters of the embryonal chamber (about 0.7 mm) is somewhat smaller than the figure given by Rutten (0.9 mm). This difference, however, is not considered of sufficient importance to establish a new species, the more so as Rutten's material only comprised four specimens.
Camerina sp.
T 1147, Upper Eocene.
Only one specimen was found. Test smooth, lenticular, diameter 2.4 mm, thickness 0.9 mm, 3½ whorls; the last one carried 22 septa, the preceding one 16. Embryonal apparatus not visible. Septa radial up to three quarters of the height, then abruptly curving strongly backwards.

Genus Amphistegina d'Orbigny.
?Amphistegina cubensis Dor. K. Palmer.
M. G. Rutten. Journ. of Pal., vol. 9, no. 6, 1935.
T 1109, Middle or Upper Eocene.
Our forms are on the average smaller than those described by the previous authors. Diameter 1 mm—1.7 mm; a single specimen, however, attains a diameter of 3.2 mm. The asymmetry is very variable, some forms being very much so, others being only slightly asymmetric. As preservation is rather bad, no sections could be prepared, so as to the question of the generic identification, which is doubted by M. G. Rutten, who provisionally assigns this species to Camerina, we cannot give a decisive answer.

Amphistegina lepeziogrói Dor. K. Palmer.
T 1109, Middle or Upper Eocene.
Our species agrees very well with the description given by Dor. K. Palmer.

Genus Tschoppina Keyzer.
Tschoppina cubensis Cushman and Bermudez.
T 1109, Middle or Upper Eocene.
T 1141, 1143, 1145, 1146, 1147, Upper Eocene.

Genus Gypsinia Carter.
Gypsinia globulus Reuss.
T 1109, Middle or Upper Eocene.
Some unmistakable specimens of G. globulus were found.

Genus Lepidocyclus Gömbel.
Lepidocyclus (Lepidocyclus) sp.
T 1141, Upper Eocene.
Only one specimen was found, which was very badly preserved. Diameter 3.3 mm; Thickness 1.1 mm. Selliform. On the outer surface papillae were not observed. While sectioning some indications of pillars were obtained. The horizontal section shows the embryonal apparatus to be of the „isolepidine“
type. Diameter 0.530 mm × 0.450 mm. Equatorial chambers ogival. The average diameter close to the embryo is 0.090 mm radially and 0.105 mm tangentially. This species shows some resemblance to L. (L.) meinzeri VAUGHAN, but it is somewhat smaller.

*Lepidocyclus* (*Lepidocyclus*) maracaibensis Hodson.
M. G. Rutten, Journ. of Pal., vol. 9, n°. 6, 1935.
T 1141, Upper Eocene.

Only four specimens were found. Test small, umbonate. Surface details were not distinct due to bad preservation. Pillars could not be observed. Aequatorial chambers irregularly ogival. Embryonal apparatus isolepidine, measuring 0.150 mm × 0.105 mm in one specimen (walls included), 0.210 mm × 0.170 mm in another. The small diameter of the first embryo may be due to the fact that the section was not quite through the median plane. A vertical section shows about 6 layers of lateral chambers.

Diameters of test: 1.2, 1.3, 1.4, 1.7 mm, corresponding thicknesses: 0.7, 0.6, 0.7, 0.9 mm.

**Genus Discocyclus Gümbel.**

Quite a lot of specimens belonging to this genus were found. The preservation of the outer shell, however, was rather bad. They were extracted from a loose limestone, thus the outer characteristics were often obscured by remnants of limestone and brims were often broken off. This rendered it impossible in some cases to follow the normal course of specific determination, viz to select them in groups according to characteristics of the outer shell before sectioning, and I had to depend exclusively on thin sections. It is obvious that in those cases it was equally impossible to correlate horizontal and vertical sections.

*Discocyclus* marginata CUSHMAN.
T 1109, Middle or Upper Eocene.

Two specimens were found, which could be readily recognised by their broad flange.

*Discocyclus* flintensis CUSHMAN.
T 1109, Middle or Upper Eocene.

Very flat specimens with a diameter of 2.0 mm—6.0 mm and a thickness of 0.6 mm—0.9 mm, more or less umbonate. One of our specimens shows
concentric arrangement of pustules, others were smooth, but revealed a concentric arrangement after being slightly polished.

Horizontal section shows the embryonic apparatus, consisting of a smaller subspherical chamber for the greater part enclosed by a larger chamber. They measure resp. 0.112, 0.144, 0.190 mm and 0.224, 0.224, 0.256, 0.350 mm. The equatorial chambers are arranged in annuli, which show some irregularities in some specimens, due to small variations of the radial diameter of the annuli. The average diameter of the chambers in the embryonal region is about 0.050 mm, near the periphery 0.090 mm radially. The tangential diameter is about 0.040 mm throughout. The walls which separate the chambers of the same annulus are rather sinuous and sometimes they are seen to bifurcate. These features are very typical, conferring a marked aspect to the species, which makes it easy to recognise it from other flat species.

This species is very close to Discocyclina clarki (Cushman), the only difference appearing to be the larger dimensions of the latter, while Discocyclina flintensis is proportionally more inflated. Schenck states that Discocyclina flintensis lacks cyclic ornamentation, which statement must be due to some error.

*Discocyclina kugleri* Gravell.
M. G. Rutten, Journ. of Pal., vol. 9, no. 6, 1935.
T 1109, Middle or Upper Eocene.

This species was exclusively determined on horizontal sections, which are characterised by the four-rayed Asterocyclina stage, which changes rather abruptly into a Discocyclina stage.

*Discocyclina vermonit* M. Rutten.
M. G. Rutten, Journ. of Pal., vol. 9, no. 6, 1935.
T 1109, Middle or Upper Eocene.

The irregularities of the annuli, tending to obliterate the Asterocyclina pattern, the large number of rays (5—7), and the character of the embryonal apparatus, mark the species. Determined only on horizontal sections.

*Discocyclina raadsheoveni* sp. n.
T 1109, Middle or Upper Eocene (pl. II, f. 1, 2; pl. III, f. 7).

Four to five rayed specimens with a raised central area. The rays are thickened towards the end. The periphery between the rays is keeled. Small papillae occur mainly on the umbo and on the median part of the rays. Towards the periphery they diminish in number as well as in diameter. Maximum diameter of papillae about 0.050 mm.

The diameter of the shell amounts to 6 mm. Thickness of central part 1.5 mm—2 mm.

A horizontal section shows the embryonal apparatus, consisting of a subspherical chamber measuring 0.100 mm, half embraced by a second chamber with a greatest diameter of 0.170 mm. The diameter of the embryonal
apparatus measured across the two chambers amounts to 0.185 mm. The raylike pattern is maintained in the equatorial layer. The equatorial chambers are very small between the rays, measuring about 0.015 mm tangentially as well as radially. Along the rays they are much larger, measuring near the periphery 0.060 mm radially and 0.030 mm tangentially. A vertical section shows the embryonal layer to thicken from 0.015 mm in the centre to 0.225 mm at the periphery. Lateral chambers are numerous.

This species differs from all other *Asterocyclina* by its general form and the thickening of the equatorial layer.

*Discocyclina* sp.
T 1109, Middle or Upper Eocene.
These are very flat specimens with a smooth surface, which are characterised by very narrow annuli, of which the radial walls were generally not preserved. Diameter up to 7 mm or more, thickness less than 1 mm. Radial diameter of equatorial chambers varied from 0.025 mm at the centre to 0.045 mm at the periphery. Only fragments were found, which did not show the embryonal apparatus. These specimens show some likeness to *Discocyclina cloptoni* VAUGHAN.

*Discocyclina* sp.
T 1109, Middle or Upper Eocene.
Only fragments of this species were found. The diameter of complete specimens must be extending to 7 mm or more. They were characterised by cyclic arrangement of pustules. One fragment was sectioned. It showed the equatorial chambers, which measured 0.130 mm radially and 0.030 mm tangentially. Here also the radial walls of the chambers were seen to bifurcate.
They might be either *Discocyclina floridana* (CUSHMAN) or *Discocyclina clarki* (CUSHMAN).

*Discocyclina* sp. sp.
T 1109, Middle or Upper Eocene (pl. II, f. 4—12).
Here the *Discocyclina* with an "endiscoidine" embryonal apparatus in the sense of VAN DER WYDEN (17) will be dealt with. Measurements obtained from horizontal sections are given in table III in which the specimens are arranged according to the dimensions of the deuteroconch. It is seen that it is impossible to select from these data groups, representing the various species, which, according to outer characteristics the sectioned specimens must contain. These outer characteristics are not connected in any way with the dimensions of the embryo, which may be illustrated by the following examples: no. 5 shows a lenticular shape whereas no. 6 is distinctly umbonate, showing remnants of a peripheral flange, no. 14 is a very flat specimen which before sectioning I had mistaken for *Discocyclina flintensis* (CUSHMAN).

From these considerations we may draw the conclusion that no specific value can be assigned to the dimensions of the embryonal apparatus.
Wright Barker (1) reports the following species to have a „cudiscodine” embryo:

D. archiaci Schlimberger, D. marthae Schlimberger, D. californica Schenck and D. anconensis Barker. To these species the following can be added: D. nummulitica Gömbel, D. scalaris Schlimberger, D. marginata Cushman, D. crassa Cushman and D. blumenthali Rutten non Gorter & v. d. Vlerk. Measurements of these specimens are compiled in table IV. The measurements of the first four species are derived from Wright Barker (1), those of D. nummulitica and D. scalaris from v. d. Weyden (17), those of D. marginata and D. crassa from material collected in East Cuba near the type locality by Keyzer (10), those of D. blumenthali from M. G. Rutten (12). In my opinion this last species is not the same as D. blumenthali Gorter & v. d. Vlerk. The differences, derived from Gorter & v. d. Vlerk’s and Rutten’s descriptions are represented in table V. For this species I propose a new name Discoyclina rutteni.

It appears that the dimensions of the embryo of those species are all of the same order as those of our specimens of table III. This fact confirms our conclusion that dimensions of embryonic chambers are not of specific value.

As to the species which are included in our material I exclusively had to depend on outer characteristics, observed on already sectioned specimens. Of course similar material could be found, but one has to be very careful as D. vermani and D. kugleri, when not perfectly preserved can hardly be distinguished from the larger type of the „cudiscodine” Discocyclinae. Now this larger type, which is lenticular with a thickness of about half the diameter, may be identified with D. crassa, the more as the better preserved specimens showed large pillars, when sectioning. The smaller specimens with a diameter of about 2 mm may be Discocyclina anconensis.

The umbonate specimens are probably D. marginata with broken flanges.

A recent paper from P. Brönnmann (2) revealed us the existence of a new division of the Discocyclinae. As the principles upon which this division is based did not appear from his paper, I did not use those new names.

Oligo-mioene.

Genus Archaeas Montfort.
Archaeas angulatus Fichtel & Moll.

Genus Amphisorus Ehrenberg.
Amphisorus matleyi Vaughan.
### TABLE III: Measurements of „oolidoidine“ Discocyclina

<table>
<thead>
<tr>
<th>P</th>
<th>D</th>
<th>N</th>
<th>M</th>
<th>T</th>
<th>Pattern of equatorial chambers</th>
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<td>1</td>
<td>110</td>
<td>230</td>
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<td>2</td>
<td>260</td>
<td>9</td>
<td>3.0</td>
<td>2.0</td>
<td>( \frac{1}{2} ) M</td>
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<tr>
<td>3</td>
<td>200</td>
<td>290</td>
<td>7-8</td>
<td>4.25</td>
<td>( \frac{1}{2} ) M</td>
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<tr>
<td>4</td>
<td>220</td>
<td>325</td>
<td>7-8</td>
<td>4.00</td>
<td>( \frac{1}{2} ) M</td>
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<tr>
<td>5</td>
<td>215</td>
<td>340</td>
<td>7-9</td>
<td>4.0</td>
<td>( \frac{1}{2} ) M</td>
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<tr>
<td>6</td>
<td>---</td>
<td>340</td>
<td>7</td>
<td>5.0</td>
<td>( \frac{1}{2} ) M</td>
</tr>
<tr>
<td>7</td>
<td>200</td>
<td>350</td>
<td>7</td>
<td>2.75</td>
<td>( \frac{1}{2} ) M</td>
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<tr>
<td>8</td>
<td>210</td>
<td>350</td>
<td>7</td>
<td>2.5</td>
<td>( \frac{1}{2} ) M</td>
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<td>9</td>
<td>260</td>
<td>415</td>
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<td>10</td>
<td>215</td>
<td>425</td>
<td>7</td>
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<td>11</td>
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<td>1.0</td>
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<td>450</td>
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<td>2.5</td>
<td>1.5</td>
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<td>14</td>
<td>290</td>
<td>475</td>
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<td>15</td>
<td>225</td>
<td>490</td>
<td>6</td>
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<tr>
<td>16</td>
<td>---</td>
<td>520</td>
<td>5-6</td>
<td>4.25</td>
<td>( \frac{1}{2} ) M</td>
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<tr>
<td>17</td>
<td>340</td>
<td>540</td>
<td>5</td>
<td>2.0</td>
<td></td>
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</tbody>
</table>

### TABLE IV: Measurements of known species of „oolidoidine“ Discocyclina

| D. nummulistica     | 125 × 150 | 375 × 425 | 4—6 | 1.8—2 |
| D. scalaris         | 180 × 240 | 350—400 × 400—560 | 4—8 | 1—1.5 |
| D. archiaci         | 250       | 400       | up to 20 | 2.0  |
| D. marthae          | 220       | 390       | 2.3—7 | 1.0  |
| D. californica      | 210       | 350       | 3.5—8.5 | 2.5—5.0 |
| D. amoenusis        | 140—170   | 280—315   | 2.0—2.1 | 1.0  |
| D. marginata        | 190 × 300 | 400 × 560 | 8.8 | 2.4  |
| D. crassa           | 260       | 520       | 3—5.5 | 1.8—2.8 |
| D. ruteni           | 2360      | 520—590   | 2.4—4.1 | nearly 1/5 M |

**Meaning of symbols used in tables III and IV:**
- P = diameter protoconch (μ)
- D = diameter deuterocoonch (μ)
- M = diameter test (mm)
- T = thickness test (mm)
- N = number of annuli till 400 μ from embryon

### TABLE V

<table>
<thead>
<tr>
<th></th>
<th>D. ruteni</th>
<th>D. blumenthalii</th>
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<tbody>
<tr>
<td>Diameter</td>
<td>2.4—4.1</td>
<td>6.0—6.3</td>
</tr>
<tr>
<td>Thickness</td>
<td>nearly 1/5 of diam.</td>
<td>2.1—2.4</td>
</tr>
<tr>
<td>Form of embryo</td>
<td>eudiscoidal</td>
<td>&quot;round embryonic chamber partly embraced by a second one&quot;</td>
</tr>
<tr>
<td>Diameter of embryo</td>
<td>520 × 520—590 × 590</td>
<td>225 × 290</td>
</tr>
</tbody>
</table>
Genus *Gypsina* Carter.

*Gypsina globula* Reuss.

H 242, W 206.

*Gypsina vesicularis* Parker and Jones.

R 125a.

Genus *Mgysina* Sacco 1893.

*Mgysina hawkinsi* Hodson (pl. II, f. 3).


A. A. Thiadens, Journ. of Pal., vol. 11, no. 2, 1937.


H 242, K 102.

Test wedge-shaped, diameter not exceeding 2.5 mm, thickness 0.6—0.7 mm. Large papillae, up to 160 μ occur mainly on the area between center and embryon. Towards the periphery they become much smaller. Some very flat specimens probably represent microsporiferous forms.

Embryonal apparatus.

Close to the periphery (60 μ). Consists of a globular chamber (160 μ) partially embraced by a second one (150 × 225 μ). Some specimens show the second chamber to be more circular and of about equal size as the first. These sections, however, are very bad. The five following chambers are spirally arranged, intermediate in size between initial chambers and equatorial chambers. Equatorial chambers arranged along two intersecting curves; diamond shaped, 125 × 110 μ. Towards the periphery chambers become ogival shaped. Chamber walls about 16 μ. Cribiform perforations were observed in the roof and floor of the equatorial chambers and in the walls of the second embryonal chamber.

This species is very close to *M. bracensis* Vaughan (Vaughan 15). As Thiadens already pointed out the only difference appears to be the size of the papillae, which are much smaller (37—50 μ) in Vaughan’s species. Vaughan also, somewhat vaguely mentions the embryonal apparatus to be of a different kind. This difference apparently is based upon the shape and size of the second embryonal chamber, which is more circular and about as large as the initial chamber. Thiadens’ material contained this type of embryo but according to the size of the papillae those species belong to *M. hawkinsi* Hodson. The material of B. Van Raadshooven (in litt.) contains transitional forms with papillae of 80—120 μ. Thus probably both species are the same. Recently Cole described some forms of *M. hawkinsi* Hodson, which differ from the type material in having papillae of 60—80 μ and the distance of the embryo to the periphery being larger: 140—300 μ.

Some measurements of *M. hawkinsi* are tabulated together with those of *M. bracensis*.
LITERATURE LARGER FORAMINIFERAE


C. SMALLER PORAMINIFERA

Descriptions of new or aberrant species.
Owing to the bad preservation of most of the samples, only those species are described and figured, which were very characteristic or better preserved. Lists of species will be found at the end of the chapter.

Upper Eocene.
All smaller Foraminifera from the Upper Eocene came from sample T 1147 from the vicinity of Nuevitas. It must be noted that W. H. Hadley (Bull. Am. Pal., vol. 20, 70 A, 1934, pp. 3—40 (107—144), pls. 1—5 (12—16)) described among others a small fauna, consisting of 16 species from a place "1½—2 km N of Nuevitas railway station on Nuevitas Bay" which had 6 species in common with this fauna.

*Verneulinina carinata* sp. n. (pl. IV, fig. 1, 2).
Test triangular throughout, triserial. Sides flat or slightly concave, bordered by a prominent, roughly spinose keel. Sutures indistinct, flush with the surface. Aperture at the inner margin of the last-formed chamber. Surface coarsely arenaceous.

This species resembles some forms of *V. münsteri* Riss. as pictured by J. A. Cushman (Mon. Verneulinidae, Cushman Lab. For. Res. Spec. Publ., no. 7, 1937, pl. 1, figs. 9—12) but the sutures are much less marked. Length 0.90 mm—1.30 mm. Breadth 0.68 mm. Common. A small and an elongate form are pictured.

*Verneulinina nubitasensis* sp. n. (pl. IV, fig. 3).
Test small, triangular throughout, sides flat, triserial. Sutures very indistinct, flush with the chambers. Chambers very narrow. Aperture at the inner margin of the last-formed chamber. This species differs from the known *Verneulinina* by its thick-set shape.
Length 0.68 mm. Breadth 0.60 mm. Common.

*Gaudryina cf. asperita* Cushman and Barbat (pl. IV, figs. 5).
*Gaudryina asperita* Cushman and Barbat.
Test elongate, early portion triserial, outstanding with flattened sides, angles acute. Biserial portion consisting of three or four pairs of chambers, slightly inflated. Sutures of triserial part indistinct, slightly depressed in biserial portion. This species differs from *G. asperita* by having the triserial portion not keeled and the biserial chambers less inflated.
Length 1.60 mm. Breadth 0.80 mm. Common.
Dorothia cf. lobatula Cushman and Barbat (pl. IV, fig. 6).
Dorothia lobatula Cushman and Barbat.


Our specimen resembles *D. lobatula* in being equally compressed. The triserial stage, however, is relatively larger.

Length 0.84 mm. Breadth 0.40 mm. Thickness 0.20 mm. Rare.

*Tritaxilina pentagonalis* Montagne (pl. IV, fig. 4).

D. G. Montagne, Ac. thesis, Utrecht 1941, p. 50, pl. 4, figs. 17, 18, 19.

Two specimens, one of which closely resembles Montagne’s holotype, were collected. The specimen figured is rather different from Montagne’s figure, but probable the same. It lacks the last two-serial chambers and the final uniserial one. The transverse section is distinctly pentagonal.

Length 1.3, 1.2 mm. Diameter 0.66, 0.75 mm.

*Robulus* *williamsoni* (Reuss) (pl. IV, fig. 12).
*Cristellaria williamsonii* Reuss.


*Robulus williamsoni* (Reuss).

Test keeled, six chambers, sutures very slightly depressed. Last chamber very much inflated. Apertural face slightly concave. Our form is very close to the one figured by Cushman and Jarvis. Diameter 1.1 mm. Rare.

*Marginulina* *sp.* (pl. IV, fig. 7).

Test small, consisting of six chambers. Walls parallel throughout. Sutures strongly limbate, broad, slightly oblique in the beginning. First chamber subsphaerical, the rest of the chambers increasing gradually in height.

Length 0.72 mm. Diameter 0.16 mm.

*Plectofrondicularia* *sp.* (pl. IV, fig. 11).

Test elongate beginning with a subglobular chamber, followed by two series of biserial chambers and some ten uniserial ones. Sides tricostate. Tiny ridges are seen on the initial part. About halfway on the median part one ridge appears which persists till the apertural region. With the appearance of this ridge the chambers become more inflated. According to the constriction of the later chambers this species resembles *Amphimorphina*, but the arrangement of the earlier chambers points to *Plectofrondicularia*. *P. mexicana* has no inflated chambers and *P. trinitatensis* has continuous median ridges.

*Virgulina keizgari* *sp.n.* (pl. IV, fig. 10).

*Virgulina* *sp.*

Test nearly three times as long as broad, in the early portion triserial, later becoming biserial. Biserial stage slightly twisted. Chambers rapidly increasing in height, later ones lengthened downwards, forming a distinct spine. Sutures distinct, depressed, steeply inclined. Aperture an elongate slit at the base of the last chamber. This species is undoubtedly the same as the one figured by KEIJZER. It closely resembles *V. spinosa* (H. ALLEN and EARLAND) as figured by CUSHMAN (Mon. Virg. Cushman. Lab. For. Res. Spec. Publ. no. 9, 1937, p. 30, pl. 5, figs. 2, 3). According to CUSHMAN, however, this species is triserial throughout and consequently a *Bulimina*.

Length 0.64 mm. Breadth 0.24 mm. Rare.

*Loxostomum* sp. (pl. IV, fig. 8).

Test elongate, about four times as long as broad, triserial part very indistinct, followed by biserial part and rather long uniserial part. Sutures distinct, depressed. Aperture at the end of the last-formed chamber. This form is closest to *L. mayor* CUSHMAN (Mon. Virg., Cushman. Lab. For. Res. Spec. Publ. no. 9, 1937, p. 195, pl. 22, figs. 16, 17), but our form lacks longitudinal costae and has a longer uniserial portion.

Length 0.68 mm. Breadth 0.15 mm. Very rare.

*Elliptospondosaria* sp. (pl. IV, fig. 9).

Test elongate, consisting of 8—9 chambers, increasing gradually in size. First chamber subsphaerial, in some cases provided with a short spine. Sutures more or less depressed. Aperture at the end of the last chamber, provided with a lip. Between lip and last chamber a collar is formed. This sp. differs from *E. matuskana* PALMER and BERMUDEZ (Mem. Soc. Cub. Hist. Nat. X, 1936, p. 298, pl. 18, fig. 12) in being much larger and in having a collar.

Length 1.10 mm, diameter 0.20 mm. Common.

*Eponides ponderosa* HADLEY (pl. IV, fig. 13).

W. H. HADLEY, Bull. Am. Pal. vol. 70 A, 1934, p. 22, pl. 3, figs. 9—11. These specimens quite agree with HADLEY’s description and figures. As his figures are rather indistinct the species is refigured here. Common.

*Asterigerina cf. primaria* PLUMMER (pl. IV, fig. 15).

H. J. PLUMMER, Univ. Texas, Bull. no. 2644, 1926, p. 157, pl. 12, fig. 8. Test small, biconvex, trochoid. Ventral side with supplementary chambers, 5—6 in the last whorl. Dorsal side completely evolute. Dorsal sutures depressed. Chambers inflated. Aperture ventral. Periphery subacute. This species differs from the one figured by PLUMMER in lacking a keel and in having a proportionally much larger final chamber. Diameter 0.30 mm. Common.

*Globotruncana* arca (CUSHMAN) (pl. V, fig. 1).

*Pulvinulina arca* CUSHMAN.

Very close to CUSHMAN's species, from which it differs in having a less conspicuous double keel, and in having less radial, more curved ventral sutures. As to the nature of the keel this species has some affinities to *Globotruncana sp.*, as figured by MRS. D. K. PALMER (Mem. Soc. Cab. Hist. Nat., XV, 1941, p. 290, pl. 29, fig. 2) from the upper Oligocene Cojimar formation of Cuba, but that species also has radial sutures. It is possible that the specimens are reworked, but the state of preservation is the same as with the other species. Rare.

*?Anomalina sp.* (pl. IV, fig. 14).

Test plano-convex, dorsal side nearly flat, sometimes slightly concave. Seven to nine chambers in the last whorl. Periphery broadly rounded. Sutures slightly limbate, in the earlier part nearly flush with the surface, later becoming slightly depressed. As the aperture is not visible generic determination is uncertain. The general shape, however, points to *Anomalina*.

Diameter 0.45 mm. Common.

*Cibicides sp.* (pl. V, fig. 2).

Test biconvex, dorsal side more so. 8 chambers in the last whorl, each chamber approximately comprising a sector of 45°. Ventral sutures radial or very slightly curved, depressed. Dorsal sutures oblique, only one whorl is visible, the centre being covered by a mass of secondary shell material, which causes the convexity. Aperture a slit in the base of the last chamber, extending ventrally.

This sp. shows some resemblance to *C. lobatulus*, but can be distinguished from it by its dorsal knob.

*Oligo-miocene.

*Quinquesculina byramensis* nom. nov. (pl. V, fig. 3).

W 206.

syn. *Quinquesculina bicostata* CUSHMAN 1922 (non d'ORBIGNY).

J. A. CUSHMAN, U.S. Geol. Surv., P.P. 129 E, p. 102, pl. XXVI, figs. 2—4.

This species, which is very close to the one figured by CUSHMAN from the Byram Marl, is much more elongate than d'ORBIGNY's species, from which it differs moreover by having the chambers slightly twisted, thus getting a rather irregular appearance.

Length 1.20 mm. Breadth 0.65 mm. Common.

*Massilina ?marylandica* CUSHMAN and CAHILL (pl. V, fig. 4).

W 206.

Our specimens differ from the original in having the earliest chambers rounded, while they are elongated in Cushman’s species. 
Length 0.90 mm. Breadth 0.65 mm. Common.

_Elphidium aff. poeyanum_ D'Orbigny (pl. V, fig. 7).
W 205.
Our specimens differ from the species pictured by Cushman (Mon. Non., U.S. Geol. Surv. Prof. Pap. 191, 1939, p. 54, pl. 14, figs. 25, 26) in having only seven chambers, whereas Cushman figures nine chambers. D’Orbigny’s original figure (in „de la Sagra” Hist. Phys. Poliz. Nat. Cuba, Foram., 1839, p. 55, pl. 6, figs. 25, 26) has even eleven chambers. Diameter 0.45 mm. Breadth 0.20 mm. Common.

_Elphidium rutteni_ sp. n. (pl. V, fig. 6).
H 242, K 96a, 100, R 125a, T 1096, W 182, 186a, 191b, 191e, 203, 205, 206.
Test planispiral, broadly rounded, about 12 chambers in the last whorl. This species is characterised by the continuation of the retractor processes. Last chambers sometimes slightly lobulate. The frontal face of the species shows some variation; from broadly rounded it may become subacute.
It must be noted that if wetted, the species gets quite another habit, because then the sutures of the chambers become visible and the retractor processes fall into the background.
This species may be the same as _E. chipolense_ Cushman from the Miocene of Florida (Mon. Non. U.S. Geol. Surv. Prof. Pap. 191, 1939, p. 46, pl. 12, fig. 12), and the original in (U.S. Geol. Surv., Prof. Pap. 128 B, 1920, p. 72, pl. XI, fig. 23). Cushman’s figures are quite different from each other but they may correspond to resp. a wetted and a dry specimen. His species figured in the Monography, however, has 16 chambers at least, whereas the number of chambers he mentions in his description is 10—12. So as not to add to the confusion, I gave this species another name.
Diameter 0.75 mm. Thickness up to 0.40 mm. Abundant.

_Nanionella kingmai_ sp. n. (pl. V, fig. 5).
W 206.
Test depressed, in the adult slightly longer than broad; dorsal side concave, evolute, with a tendency to uncoil; ventral side slightly convex, involute. Chambers numerous, about 15 in the last-formed whorl. Sutures strongly limbate, slightly curved, flush with the periphery. Last-formed chambers somewhat lobulate. Periphery rounded.
Length 0.50 mm. Thickness 0.135 mm. Common.

_Globotruncanina arca_ (Cushman) (pl. V, fig. 8).
W 205.

_Pulvinulina arca_ Cushman.

As the occurrence of six specimens of this species in the Guines is remarkable, it is figured. They might be reworked, but the state of preservation is the same as of the other species of this sample. Recently Mrs. D. K. Palmer (Mem. Soc. Hist. Nat., vol. XV, no. 3, 1941, p. 290, pl. 29, fig. 12). described and figured two species of Globotruncana from the Cojimar formation (upper Oligocene), which she believes to be not reworked. None of them shows much resemblance to this species.

Diameter 0.40 mm. Thickness 0.21 mm.

**SMALLER FORAMINIFERA FROM THE UPPER EOCENE**

*Textularia cubensis* Lalicker & Bermúdez.  
  **marielensis** Lalicker & Bermúdez.  
  **porrecta** Brady.  

*Volvulina foetida* (Cushman).  
  **pachybeila** (Hadley).  
  **pennatula** (Batsch).  

*Vernonilina carinata* sp.n.  
  **nuvitasonensis** sp.n.  

*Tritaxia tricarinata* (Reuss).  

*Gaudryina cf. asperula* Cushman & Barbat.  
  **fiuntii** Cushman.  
  **kuimeterca** Hadley.  

*Pseudoclavulina cocoensis* Cushman.  
  **pietonensis** Cushman.  

*Clavulinoides cubensis* Cushman & Bermúdez.  
  **excurrens** Cushman & Bermúdez.  
  **havanensis** Cushman & Bermúdez.  
  **szuboi** (Hantken).  

*Marssonella oxycona* (Reuss).  

*Dorothia coeli* (Nuttall).  
  **eocenica** Cushman.  
  **cf. lobatula** Cushman & Barbat.  
  **nuttalli** Cushman.  

*Karreriella arenasensis* Cushman & Bermúdez.  

*Tritaxilina pentagonalis* Montagne.  

*Quinqueloculina auroriana* d'Orbigny.  
  **laxigata** d'Orbigny.  
  **seminum** (Linne).  

*Spiroloculina depressa* d'Orbigny, var. retundata Williamson.  

*Triloculina trigonula* (Lamarck).  

*Robulus adelinensis* Keijzer.  
  **cultratus** (Montfort).  
  **formosus** Cushman, var. Nuttall 1932.
inornatus (d'ORBIGNY).
" navis (BORNEMANN).
" rotulatus (LAMARCK).
" protulatus (LAMARCK).
" williamsoni (REUSS).
Lenticulina deformis (REUSS).
" papillosa (FICHTEL a. MOLL).
Vaginulina legumen (d'ORBIGNY).
Frondicularia tenuissima HANTKEN.
Marginulina glabra (d'ORBIGNY).
" subbullata HANTKEN.
" tumida REUSS.
" sp. II KEIJZER 1945.
" sp.
Saracenaria acutaauricularis (FICHTEL a. MOLL).
" italica (DEFRANCE).
" latifrons (BRADY).
Dentalina communis (d'ORBIGNY).
" consobrina (d'ORBIGNY).
Nodosaria acuminata HANTKEN.
" ?erbessina SCHWAGER.
" ewaldis REUSS.
" granti PLUMMER.
" hispida (d'ORBIGNY).
" longicata (d'ORBIGNY).
" pyrula (d'ORBIGNY).
" cf. vertebralis (BATSCH).
" sp. KEIJZER 1945.
" sp. B PALMER a. BERMÚDEZ 1936.
Chrysalogytonium elongatum CUSHMAN a. JARVIS.
" cf. teniscoestatum CUSHMAN a. BERMÚDEZ.
Pseudoglandulina laevigata (d'ORBIGNY).
" laevigata (d'ORBIGNY) var. occidentalis CUSHMAN.
Glutulina problema (d'ORBIGNY).
Ramulina globulifera BRADY.
Nonion affinis REUSS.
" grateloupii (d'ORBIGNY).
" micrum COLE.
" nipeensis KEIJZER.
" pompilioides (FICHTEL a. MOLL).
Nonionella banckeni CUSHMAN a. APPLIN var. spissa CUSHMAN.
" jacksonensis CUSHMAN.
GÆmbelina goodwini CUSHMAN a. JARVIS.
" ultimatumida WHITE.
Plectofrondicularia mexicana CUSHMAN.
trinitatensis CUSHMAN a. Jarvis.

vanguhini CUSHMAN.

sp.

Bulimina arkadophiana CUSHMAN a. PARKER, var. midwayensis CUSHMAN a. PARKER.

ovata d'ORBIGNY.

ovula d'ORBIGNY.

Angulogorina carinata CUSHMAN, var. bradyi CUSHMAN.

Uvigerina pigmaea d'ORBIGNY, var. caribbeana KEIJZER.

carapitana HEDBERG.

cubana PALMER a. BERMUDEZ.

gallowayi CUSHMAN.

gardnerae CUSHMAN, var. cubana HEDBERG.

nuttalli CUSHMAN a. EDWARDS.

proboscidea SCHWAGER, var. vadesens CUSHMAN.

semivestita BERMUDEZ.

Virgulina acuta (d'ORBIGNY).

cylindrica CUSHMAN a. BERMUDEZ.

schreiberiana CZYZEK.

vicksburgensis CUSHMAN.

keijzeri sp.n.

Bolivina alazanensis CUSHMAN.

byramensis CUSHMAN.

damillensis HOWE a. WALLACE.

marginata CUSHMAN.

mexicana CUSHMAN.

midwayensis CUSHMAN.

palmerae CUSHMAN a. BERMUDEZ.

Loxostomum sp.

Bifarina vicksburgensis CUSHMAN.

Bitubulogenerina vicksburgensis HOWE.

Ellipsonodosaria cocoensis CUSHMAN.

mattanza PALMER a. BERMUDEZ.

recta PALMER a. BERMUDEZ.

torei PALMER a. BERMUDEZ.

verneulli (d'ORBIGNY).

verneulli (d'ORBIGNY).

sp.

Discorbis araucana (d'ORBIGNY).

bertheloti (d'ORBIGNY), var. floridensis CUSHMAN.

Gyroidina depressa (ALTH).

elongata CUSHMAN a. BERMUDEZ.

soldanii d'ORBIGNY.

Rotalia bassleri CUSHMAN a. CAHILL.

Cancri sagra (d'ORBIGNY).
Eponides byramensis (CUSHMAN), var. campester PALMER a. BERMÚDEZ.
  " ponderosa HADLEY.
  " ruteni CUSHMAN a. BERMÚDEZ.
Siphonina advena CUSHMAN.
Asterigerina cf. primaria PLUMMER.
Cassidulina subglobosa BRADY.
Chilostomella mexicana NUTTALL.
  oolina SCHWAGER.
  " Pullenius sphaeroides (d'ORBIGNY).
Globigerina bulloides d'ORBIGNY.
  " eocenica TERQUEM.
  " inflata d'ORBIGNY.
Hautkenina alabamensis CUSHMAN.
  " brevispinosa CUSHMAN.
  " inflata HOWE.
  " longispina CUSHMAN.
Globotruncanata varca (CUSHMAN).
Globorotalia camariensis (d'ORBIGNY).
  " centralis CUSHMAN a. BERMÚDEZ.
  " cocoensis CUSHMAN.
Anomalina alaçanensis NUTTALL.
  " ornata COSTA.
?Anomalina sp.
Planulina cocoaensis CUSHMAN.
  " constricta v. HAGENOW.
  " jahacoensis BERMÚDEZ.
Cibicides advena (d'ORBIGNY).
  " lobatus (WALKER a. JACOB), var. ornatus CUSHMAN.
  " mantaensis (GALLOWAY a. MORREY).
  " multata (SEGUEÑZA).
  " perlucidus NUTTALL.
  " pseudonagerianus CUSHMAN.
  " tschoppi VAN BELL.
  " sp.

SMALLER FORAMINIFERA FROM THE OLIGO-MIOCENE

Clavulina difformis BRADY W 205.
  " tricarinata d'ORBIGNY H 242, K 96a, R 125a, T 1096, W 182,
     W 191b, W 206.
Quinqueloculina auberiana d'ORBIGNY R 125a, W 191b, W 205.
  " byramensis nom. nov. W 206.
  " contorta d'ORBIGNY R 125a, W 205, W 206.
  " disparilis d'ORBIGNY W 206.
"laevigata" d'Orbigny R 125a, W 191b, W 206.
"lamarckiana" d'Orbigny, var. sculpturata v. Raadschooven H 242, R 125a, W 206.
"parkeri" Brady H 242, W 191b.
"poyana" d'Orbigny R 125a, W 206.
"seminulum" (Linne) R 125a, W 182, W 191e, W 205, W 206.
"tropicalis" Cushman W 206.

Massilina glutinosa Cushman a. Cahill W 182.
"imarylandica" Cushman a. Cahill W 206.
"secaus" (d'Orbigny) R 125a, W 206.

Spiroloculina antillarum d'Orbigny W 206.
"gratialopi" d'Orbigny W 206.
"poyana" d'Orbigny W 191b, W 206.

Signoilina tenus (Czyzak) W 206.
Haworina bradyi Cushman R 125a, W 191b.

Triiloculina cuneata Karrer H 242, R 125a, W 191b.
"oblonga" (Montfort) R 125a, W 182, W 191e, W 205, W 206.
"tricornuta" d'Orbigny R 125a.
"trigonula" (Lamarck) R 125a, W 191b, W 191e.

Pyrgo denticulata (Brady) W 191b, W 206.
"depressa" (d'Orbigny) R 125a.
"elongata" (d'Orbigny) W 206.
"subspheirica" (d'Orbigny) R 125a, W 205, W 206.

Cornospira involvens Reuss R 125a.
Nonion cubense Van Wessem W 191e.

Elphidium aff. poyananum (d'Orbigny) W 205.
"rotum" Ellis H 242, K 96a, T 1096, W 203, W 205, W 206.
"rugosum" (d'Orbigny) W 206.
"rutteni" sp.n. H 242, K 96a, K 100, R 125a, T 1096, W 182, W 186a, W 191b, W 191e, W 203, W 205, W 206.

Nonionella kingmai sp.n. W 206.

Peneroplis bradyi Cushman R 125a.

Spirolina aristina (Batsch) R 125a.

Discorbis aracana (d'Orbigny) H 242, K 96a, K 100, T 1096, W 203, W 205, W 206.

Retalia beccarii (Linne) F 194a, H 242, K 91, K 96a, K 98a, T 1096, R 125a, W 182, W 191b, W 191e, W 203, W 205, W 206.

Eponides ?punctulatus (d'Orbigny) R 125a, W 206.
Amphistegina lessonii d'Orbigny H 242, T 1096.

Orbulina porosa Terque A 242.

Globotruncanarca arca (Cushman) W 205.

Planorbilina larvata (Parker a. Jones) R 125a.