Upper Cretaceous and lower Paleogene benthic foraminifera from northeastern Mexico

Laia Alegret[1] and Ellen Thomas[2]

[1]*Departamento de Ciencias de la Tierra, Universidad de Zaragoza, 50009 Zaragoza, Spain*
laia@posta.unizar.es

[2]*Department of Earth and Environmental Sciences, Wesleyan University, Middletown, Connecticut 06459-0139, USA and Center for the Study of Global Change, Department of Geology and Geophysics, Yale University, New Haven, CT 06520-8109, USA*
ethomas@mail.wesleyan.edu

ABSTRACT: The deep-sea, Upper Cretaceous through Paleocene benthic Foraminifera from the Méndez and Velasco Formation (Tampico Embayment, northeastern Mexico) were first described in classical papers of the 1920s. These faunas were among the first deep-water faunas of this age to be described, and many of the species have been recognized in Deep Sea Drilling Project and Ocean Drilling Program sites worldwide. We present the first taxonomic update of these classic faunas since the 1920s, with special attention to species first described from this area, and species that have been widely used in paleobathymetric reconstructions.

Benthic foraminiferal assemblages were analyzed from the Cretaceous Méndez and Paleocene Velasco Formations in seven sections in the northeastern and central-eastern parts of Mexico. The Foraminifera are generally well preserved, although commonly recrystallized and filled with sparry calcite. They indicate paleodepths ranging from upper to middle bathyal for the three northernmost sections, and lower bathyal for the other sections. The clastic unit between the Méndez and Velasco Formations contains a mixture of neritic and bathyal species, and probably originated as a result of mass-wasting associated with the bolide impact on the Yucatan peninsula.

From the about 140 benthic foraminiferal taxa identified, we describe 88 species belonging to 41 genera. These correspond to the most representative taxa in northeastern Mexico across the Cretaceous-Paleogene transition, because of their common occurrence, paleobathymetric significance, or first description from this region.

INTRODUCTION

Deep-sea benthic foraminifera have been used in faunal as well as paleoceanographic and isotopic studies of material collected by the Deep Sea Drilling Project and Ocean Drilling Program in hundreds of sites worldwide. These studies have documented extensively that many species have long stratigraphic ranges and cosmopolitan occurrences (e.g., Berggren 1972; Schnitker 1979; Douglas and Woodruff 1981; Dailey 1983; Boltovskoy 1981,1987; Boltovskoy and Boltovskoy 1988; 1989; Tjalsma and Lohmann 1983; Thomas 1990a; Boltovskoy and Ocampo 1993; Boltovskoy et al. 1995; Kaiho 1998). Upper Cretaceous to lower Paleogene deep-sea benthic foraminifera had been described from few localities before deep-sea drilling, and authors frequently refer to species described from these few localities. These referrals have commonly been made without access to the type material (e.g., Braga et al. 1975; Schnitker 1979), and there tends to be little agreement as to the taxonomy of deep-sea benthic foraminifera, as addressed by van Morkhoven et al. (1986) and Bolli et al. (1994). One of the classic localities for deep-water benthic foraminifera is located in northeastern Mexico. The descriptions of benthic Foraminifera from the Méndez and Velasco Formations were some of the earliest catalogs of Late Cretaceous - Paleogene deep water species, and no detailed taxonomic studies on benthic Foraminifera have been carried out in this area since White's (1928a, 1928b, 1929) studies.

The Upper Cretaceous (Méndez Formation) through Lower Paleocene (Velasco Formation) Foraminifera from the Tampico Embayment in northeastern Mexico (Tamaulipas State) were studied by Cushman (e.g., 1926 a, 1926b) and White (1928 a, b; 1929), who recognized that these faunas represent deeper water environments than are represented in most land sections. Berggren (1972), Berggren and Aubert (1975) and Schnitker (1979) described Paleocene benthic foraminifera from around the North Atlantic and Tethys Oceans, and distinguished between the shallower "Midway-type fauna" on which Berggren and Aubert (1975) concentrated, and the deeper "Velasco-type fauna" (Schnitker, 1979). Midway-type faunas were interpreted as neritic assemblages (shelf), whereas the Velasco fauna contained bathyal to abyssal assemblages (e.g., van Morkhoven et al. 1986). Mixed Midway and Velasco-type faunas are found in upper bathyal settings (e.g., Speijer 1995; Widmark and Speijer 1997a, b).

Since the 1980s, when Alvarez et al. (1980) suggested that a meteorite impact was the cause of the mass extinction at the end of the Cretaceous (K/P boundary), many researchers have become interested in detailed studies of Cretaceous and Paleocene sediments. Penfield and Camargo (1981) recognized a possible location for the impact crater on the northern part of the Yucatan Peninsula (Mexico), but their discovery was not taken into account for ten years. Hildebrand et al. (1991) argued that the Chicxulub structure could indeed be the site of the K/P impact. Later studies documented the synchroneity of the Chicxulub crater and the K/P extinction (e.g., Swisher et al. 1992; Krogh et al. 1993; Schulz and d'Hondt 1996; Morgan et al. 1997; Bralower et al. 1998).

Since the early 1980s, many investigators have thus focused their research on the biostratigraphy, sedimentology, geochemistry and mineralogy of sediments in outcrops of Upper Cretaceous-Paleogene sections close to the impact site, throughout Mexico. Little information on benthic foraminifera is included (e.g., Smit et al. 1992, 1994; Stinnesbeck et al. 1993). Some papers contain scant references to the benthic foraminiferal faunas (e.g., Keller et al. 1994; Keller and Stinnesbeck 1996), but describe them as being neritic to uppermost bathyal, in contrast to the earlier studies quoted above.

We present the first taxonomic study of the Velasco-type benthic foraminiferal assemblages from the Gulf of Mexico since the 1920s. We will document a classic fauna of bathyal benthic foraminifera, in order to elucidate several long-standing taxonomic problems and document primary types as well as morphological variability in common deep-sea taxa. We studied the type material from Cushman (e.g., 1926a, 1926b) in the Smithsonian Institution, and the material described by White (1928a, 1928b, 1929), in the American Museum of Natural History in New York. We compared these specimens with those in our samples.

Geological setting

Sections containing the K/P boundary are well exposed throughout the region bordering the Gulf of Mexico along its western shores. Benthic foraminifera were analyzed from seven sections (La Ceiba, La Lajilla, El Mimbral, El Mulato, El Peñón, Los Ramones and El Tecolote), in the states Veracruz, Tamaulipas and Nuevo León (text-fig. 1). In this region, a controversial clastic deposit, which is intercalated between two hemipelagic marly formations, marks the K/P boundary. The two marly formations are the Maastrichtian Méndez Formation and the Paleogene Velasco Formation (text-fig. 2). During the late Maastrichtian and early Paleogene, Mexican sedimentary basins were controlled by tectonic events associated with the development of the Sierra Madre Oriental (e.g., Pindell and Barrett 1990). These tectonic events caused the deposition of fluvial and deltaic systems in the North, and of deep-water sediments in flysch facies toward the South. In contrast, the North-central region (Tampico-Misantla Basin) was isolated from coarse terrigenous sediments and contains the hemipelagic Méndez and Velasco Formations (Longoria and Gamper 1993). The Méndez Shale (De Golyer 1915) represents the sedimentation of bathyal facies in the Tampico-Misantla Basin from northern Veracruz State to the southern part of Tamaulipas State (Longoria et al. 1993; Longoria and Gamper 1993). The Velasco Formation (Cushman and Trager 1924) is restricted to the deep-water region of the Magiscatzin Basin, an elongated depression trending NW-SE, in the State of Tamaulipas and adjacent parts of Nuevo León, Veracruz and San Luis de Potosí.

The Cretaceous Méndez and the Paleocene Velasco Formations consist of hemipelagic marine marls rich in planktic foraminifera and poor in macrofauna. They are separated by the K/P clastic unit, which displays a fining-upward general sequence, consisting of sandstone with microspherules. Towards the base of the clastic units, mineral grains include micas and shocked quartz; the latter have been interpreted as evidence for the bolide impact (Smit et al. 1992, 1996). The clastic unit contains bioclasts of shallow-water origin, as well as sandstone beds with cross and parallel lamination, and internal erosive surfaces (Arz et al., in press; Soria et al. 2001). According to Smit et al. (1996) and Arenillas et al. (in press), the K/P boundary must be placed at the base of the clastic unit, which is equivalent to the base of the boundary clay of the K/P stratotype, the El Kef section (Tunisia).

Keller et al. (1994), López-Oliva and Keller (1996), and Arz et al. (in press) have carried out detailed planktic foraminiferal biostratigraphic studies of the Méndez and Velasco Formations. These authors have recognized the uppermost Cretaceous *Abathomphalus mayaroensis* and *Plummerita hantkeninoides* planktic foraminiferal Biozones in the Méndez Formation. They document that there is an uncomformity of variable duration, which comprises at least the P0 planktic foraminiferal Biozone, in the lower Danian. Both Méndez and Velasco Formations are present in the studied sections except for the El Peñón, Los Ramones and El Tecolote, which contain only Upper Cretaceous sediments.

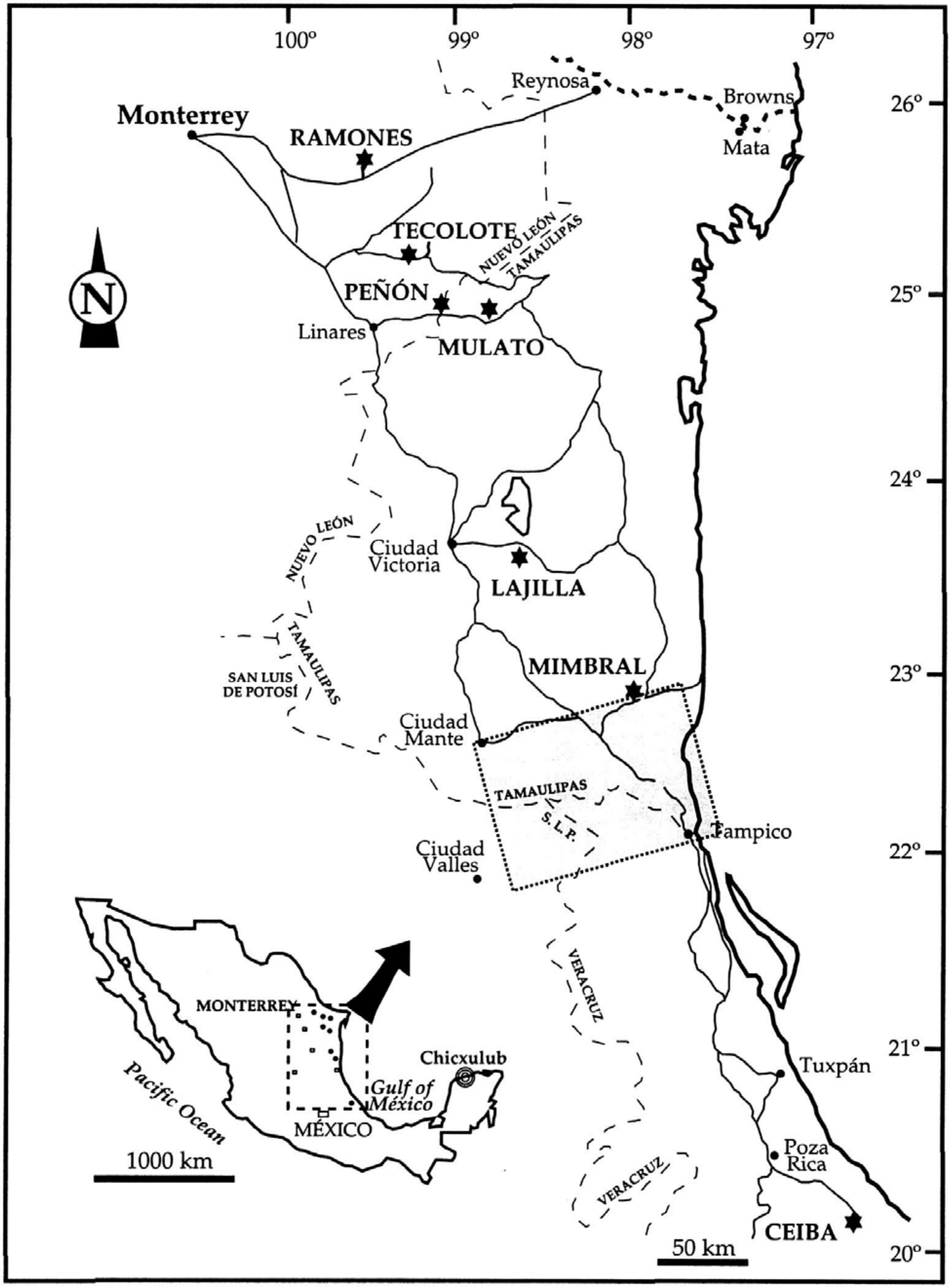
METHODS

A total of 136 marly samples from the Méndez and Velasco Formations were collected at 2cm-intervals close to the K/P clastic unit, and at 10 to 30cm-intervals well below and above the boundary. All samples were disaggregated in tap water to which diluted H_2O_2 was added, and washed through a 63µm sieve. After drying at 50ºC, the >63µm fraction was used for picking benthic foraminifera. The planktic/benthic ratio is high (about 90%) in all samples, except those from the clastic unit. Morphological preservation of benthic foraminifera is good, although the tests are commonly recrystallized, filled with calcite, and in some cases flattened. Population counts were based on representative splits of 300 or more specimens, obtained with a modified Otto microsplitter. All the specimens were mounted on microslides for a permanent record and identification.

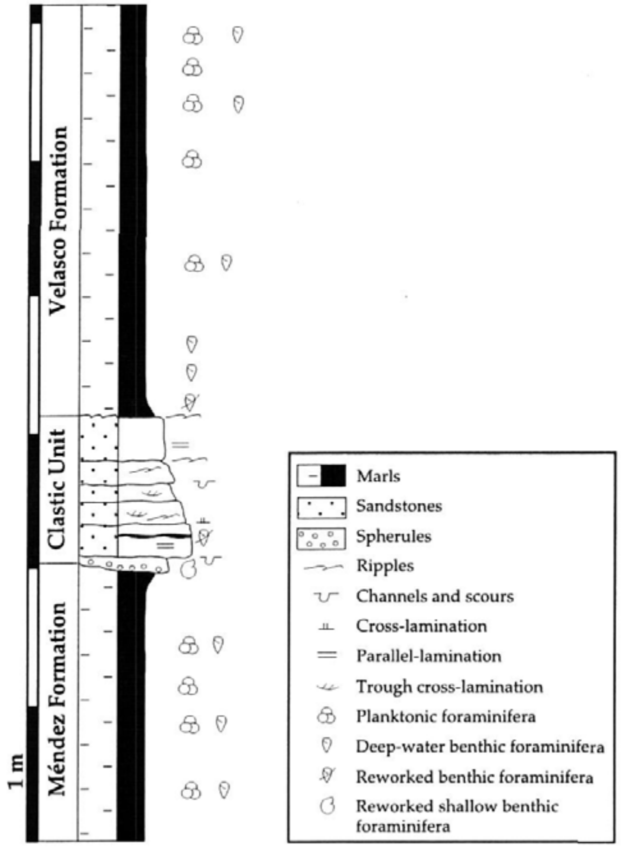
Some specimens were selected and covered with Au or Ag in order to take Scanning Electron Micrographs. All illustrated specimens (with the exception of the type material from White's and Reuss' collections) are deposited at the Department of Earth Sciences, University of Zaragoza, Spain. The occurrence of benthic foraminiferal species in each section is listed in Table 1, and their abundance is noted in the description of each species, according to the following criteria: very abundant (>15%), abundant (5-15%), common (2-5%), rare (1-2%), very rare (<1%). These percentages refer to the abundance of each species in at least one sample.

Paleobathymetry

Both the Méndez and the Velasco Formation have been classically interpreted as deep-water deposits (Cushman 1925, 1926a,b; White 1928a,b, 1929; Berggren and Aubert 1975; van Morkhoven et al. 1986; Longoria and Gamper 1993; Smit et al. 1992, 1994). These formations typically are very poor in macrofauna, which is abundant in neritic deposits, and foraminiferal faunas are strongly dominated by planktic foraminifera. Nevertheless, several authors suggest a neritic depth of deposition (Keller et al. 1994, 1997; Keller and Stinnesbeck 1996; Stinnesbeck et al. 1993, 1996). The paleodepths indicated by the benthic foraminiferal faunas are clearly of importance for the interpretation of the environment of deposition of the K/P clastic unit (Alegret et al. 2001). We base our paleobathymetric estimates on the occurrence and abundance of depth-dependent species, and on comparisons to benthic foraminiferal assemblages at DSDP and ODP sites. At these deep-sea sites paleodepths can be derived independently by backtracking (e. g., Tjalsma and Lohmann 1983; van Morkhoven et al. 1986; Nomura 1991, 1995; Widmark and Malmgren



TEXT-FIGURE 1
Location of the Cretaceous- Paleogene sections in northeastern Mexico. The shaded rectangle corresponds to the area studied by White (1928a,b; 1929).



TEXT-FIGURE 2
Schematic lithologic column of the Cretaceous- Paleogene sediments in the Gulf of Mexico.

1992 a, b). Text-figure 3 shows the main patterns of occurrence of benthic foraminifera at different depths, as well as the distribution of Midway and Velasco-type faunas (Berggren and Aubert 1975, Tjalsma and Lohmann 1983, van Morkhoven et al. 1986, Kaminski et al. 1988; Speijer 1994, Widmark 2000).

The planktic/benthic ratio is higher than 80 to 90% in all samples (except those from the clastic unit), indicating open ocean, at least upper bathyal environments of deposition. In the present Gulf of Mexico, which may be seen as an environment similar to the region of deposition of the Velasco and Mendez Formations because of the deposition of large amounts of fine-grained terrigenous material in hemipelagic deposits, similar planktonic foraminiferal percentages are reached below about 1000m (van der Zwaan et al. 1990).

Sections El Mulato, La Lajilla, El Mimbral and La Ceiba contain high percentages of species such as *Cibicidoides hyphalus, Gyroidinoides globosus* (and abundant other *Gyroidinoides* species) and *Nuttallinella florealis,* which are most common in middle and lower bathyal environments (text-fig. 3). All sections contain very abundant specimens of *Clavulinoides amorpha* and *C. trilatera* (commonly between 20 and 60% of the total assemblage). The latter two are calcium-carbonate agglutinated species which are common in abyssal to lower bathyal environments, where much terrigenous material is available (Kaminski et al. 1988). These species have morphotypes similar to that of *Martinotiella occidentalis* in the modern Gulf of Mexico, which is common below about 1000m (Pflum and Frerichs 1976).

The percentage of Velasco-type species (text-fig. 3) is very high in these sections (Table 1). All sections were deposited well above the calcite compensation depth, as indicated by the presence of abundant calcareous and calcareous-agglutinated species, and lack of evidence of carbonate dissolution. The presence of *Angulogavelinella* aff. *A avnimelechi* and *Coryphostoma incrassata,* which are rare to absent in abyssal deposits (van Morkhoven et al. 1986; fold out), suggests deposition in lower bathyal rather than in abyssal environments (text-fig. 3).

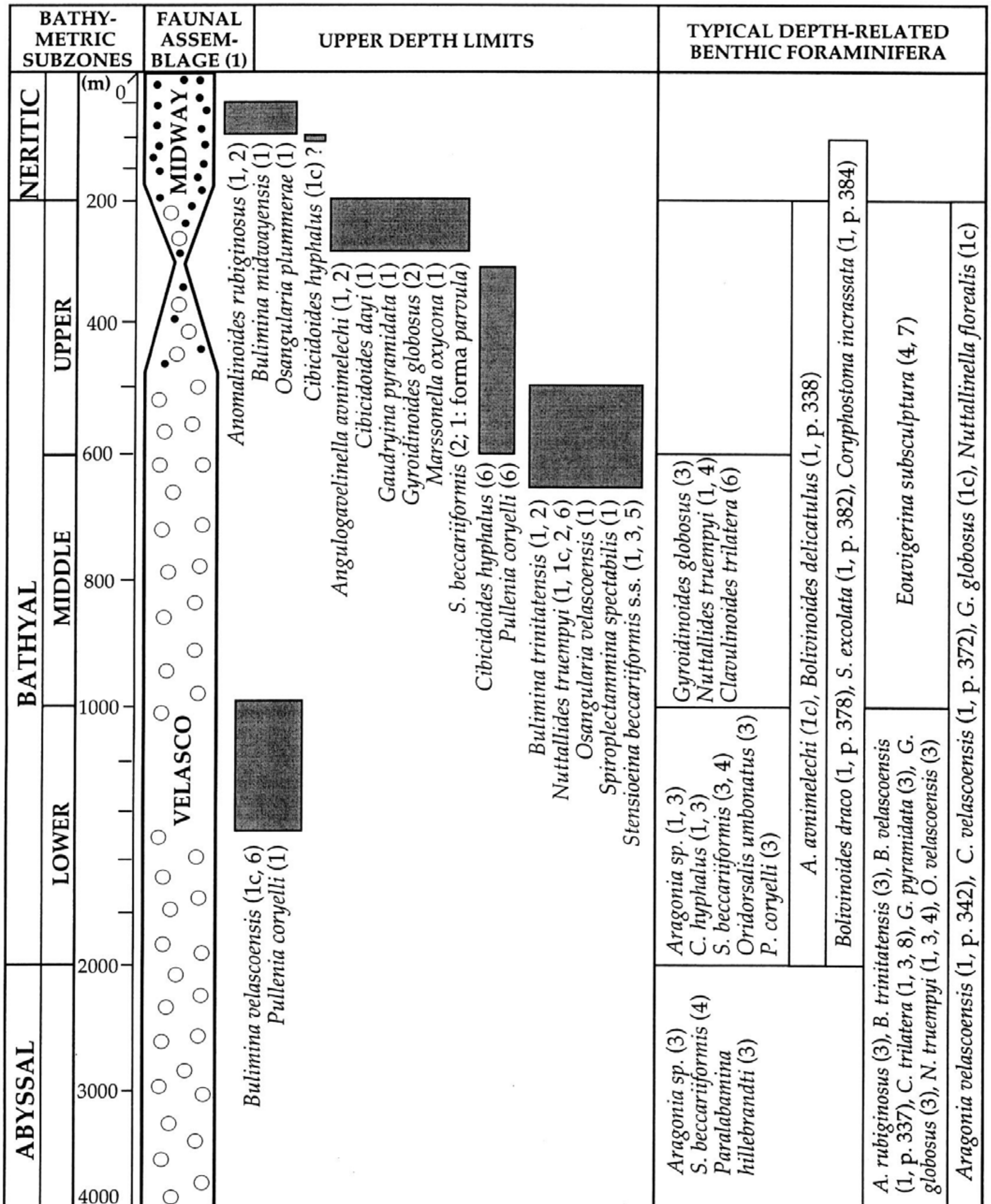
Sections El Tecolote and El Peñón contain slightly higher percentages of species that typically are reported from middle to upper bathyal depths, such as *Eouvigerina subsculptura, Bolivinoides draco,* and *Cibicidoides pseudoacutus* (text-fig. 3). They also contain species of which the upper depth limit is located between about 600 and 300m, such as *Bulimina trinitatensis, Nuttallides truempyi, Stensioeina beccariiformis,* and *Spiroplectammina spectabilis* (Tjalsma and Lohmann 1983, van Morkhoven et al. 1986; Speijer 1994, text-fig. 3). We consider that under the conditions of deposition of the Mexican sections, with the large influx of fine-grained terrigenous matter, the typical depth limits of these species will be towards the lower end of the range (about 500m). This is the case in similar environments in the modern oceans with a large influx of terrigenous material (as e.g., off the Mississippi Delta in the modern Gulf of Mexico). In such regions there is a large influx of organic material from land and high productivity in coastal waters, delivering food to the deep oceans, and causing faunas to occur deeper than in more food-poor environments (e. g., Pflum and Frerichs 1976), the so-called 'Delta-effect'. We thus interpret these two sections as deposited at middle bathyal to lowermost upper depths, between 500-600 and 1000m (Soria et al. 2001; Alegret et al. 2001).

We consider section Los Ramones to be deposited in the shallowest region, because it contains common representatives of the Midway-type fauna, such as *Anomalinoides acutus, A. midwayensis* or *Osangularia plummerae* (Berggren and Aubert 1975) mixed in with Velasco - type species such as *C. amorpha* and *C. trilatera.* We consider this section to have been deposited in the upper bathyal zone, probably between 300 and 500m depth.

Truly neritic fauna (*Lenticulina navarroensis, L. spisso-costata*) has been found only in the K/P clastic unit at the El Mulato section, mixed with bathyal species, indicating that this unit contains components coming from the platform, later re-deposited at bathyal depths (Alegret et al. 2001).

Paleoecology and environmental turnover across the K-T transition

Benthic foraminiferal faunas in northeastern Mexico are highly diverse, as is typical for bathyal faunas. The high percentages of agglutinated specimens (up to 62%) reflect a fairly high, fine-grained clastic input toward the deep basin, similar to that in faunas from Trinidad (Kaminski et al. 1988). The comparison of fossil and recent communities of benthic foraminifera, in addition to morphotype analysis (e.g., Corliss and Chen 1988; Jones and Charnock 1985), allows us to infer probable microhabitat preferences and environmental parameters such as the nutrient supply to the sea-floor and sea water oxygenation



TEXT-FIGURE 3
Upper depth limits and paleobathymetric distribution of Upper Cretaceous and lower Paleogene benthic foraminifera. (1): van Morkhoven et al. (1986), p. 8, fig. 5; (2): Speijer (1994), p. 84, fig. 6; (3) Tjalsma and Lohmann (1983); (4): Widmark (2000), p. 376-377; (5): Berggren and Aubert (1975); (6): R. Speijer, pers. comm., 2001; (7): Widmark and Speijer 1997a; (8): Kaminski et al. 1988; (1c): van Morkhoven et al. (1986), fold out; modified after van Morkhoven et al. 1986.

(e.g., Bernhard 1986; Jorissen et al. 1995). One should be careful with these comparisons, however, because the ecology of present foraminifera is complex and not fully understood (e.g., Murray 2001), and we do not know to what extent the Cretaceous/Paleogene faunas were non-analogs (e.g., Thomas et al. 2000).

The Upper Cretaceous benthic foraminiferal assemblages from the Mexican sections indicate mesotrophic conditions and well-oxygenated bottom waters (Arz et al., in press). Toward the uppermost Cretaceous, infaunal morphogroups (those living in the deepest layers of the sediment, ~4-15cm), such as *Clavulinoides trilatera, Eouvigerina subsculptura* or *Gyroidinoides beisseli,* increased in relative abundance, probably reflecting an increase in the food supply. At the K/P boundary, infaunal species drastically decreased, and epifaunal species such as *Anomalinoides acutus, Cibicidoides hyphalus* or *Stensioeina beccariiformis* increased in relative abundance. This change corresponds to the most important faunal turnover during the Upper Cretaceous and lower Paleogene in eastern Mexico, although very few species became extinct.

This faunal change has been related to a lack of nutrient supply to the deep basin as a result of the collapse in primary productivity at the end of the Cretaceous (Zachos and Arthur 1986; Thomas 1990a; Peryt et al. 1997; Alegret et al. 2001, in press). The faunal change is much more distinct, and extinction is more pronounced, in upper bathyal to neritic sites than at middle bathyal and deeper sites (e.g., Thomas 1990b, Coccioni et al. 1993; Speijer and van der Zwaan 1996). The meteorite impact has been proposed to have caused planktic mass mortality (possibly by causing darkness for several months), thus severely affecting the total food supply, as well as its character, to the benthos (d'Hondt et al. 1998; Arz et al., in press; Alegret et al. in press).

It has generally been argued that detritus-feeding biota survived the K/P extinction to a larger degree than organisms directly using phytoplankton (e.g., Sheehan and Hansen 1986, Jeffrey, 2001). We argue that the lack of extinction of deep-sea benthic foraminifera at the K/P boundary means that many of the taxa in our sections were consumers of detritus rather than users of fresh phytoplankton. Alegret et al. (2001) speculate that in the northeastern Mexican sections, lateral transfer of organic matter from shelf and coastal regions may have contributed substantially to the food used by benthic foraminifera. The mass wasting at the end of the Cretaceous deposited the clastic unit (consisting of organic-poor, sandy sediments) in the lower-bathyal region. The influx of these nutrient-impoverished sediments, in combination with the collapse of surface-water productivity, may have starved benthic foraminifera, but not by so much that significant extinction occurred.

A stepped pattern of recovery has been documented for planktic (d'Hondtet al. 1998) and benthic foraminiferal assemblages at other localities (Coccioni et al. 1993; Alegret et al., in press) through the lower Paleogene. At the Mexican sections, at least 600 kyr later (in the lower *Globanomalina compressa* planktic foraminiferal Biozone), benthic foraminiferal communities had not completely recovered from the K/P event, and infaunal percentages did not return to the high values of the uppermost Cretaceous.

TAXONOMY

For determinations at the generic level, we largely followed the taxonomy established by Loeblich and Tappan (1988). About 140 benthic taxa were identified at the specific or generic level. In this study, we describe the most common taxa, and the species with the most definite and well-documented paleobathymetric significance. We paid attention to species first described from this region (Cushman 1926a, 1926b; White 1928a, 1928b, 1929). These species constitute a major portion of the benthic foraminiferal fauna in sections throughout the various sites, and can therefore be considered to be representative of the benthic foraminiferal faunas in the northeastern Mexican deep-sea environment of the terminal Cretaceous and lower Paleogene. We did not pay detailed attention to recognition at the specific level of taxa of the genera *Oolina*, *Lagena* and *Fissurina* (unilocular taxa), uniserial lagenid taxa, many fragments of *Bathysiphon* spp., and most lenticulinid species. We thus describe 88 benthic foraminiferal species belonging to 41 genera.

We examined primary and secondary types in the Cushman Collection, deposited in the United States National Museum of Natural History (Smithsonian Institution) in Washington, DC. We visited the American Museum of Natural History and examined the White Collection, with all specimens and types that White described in 1928 and 1929. We were allowed to borrow this collection, and received permission to make Scanning Electron Micrographs of various types. We paid special attention to species of *Gyroidinoides*. For this genus, we also studied type material from Reuss (1844) thanks to the help of Dr. Fred Rögl at the Vienna Museum of Natural History. White's material comes from the Tampico Embayment area, which is close to some of our localities (text-fig. 1). The numbers on the slide coincide with the number of the types given by White (1928a, 1928b, 1929), but in most cases the slide with the types contained several specimens, and no holotype was designated. In some cases, we are confident that we indeed saw the figured specimen, and thus could recognize the holotype; in other cases, we designated a lectotype. Specimens from our sections are similar to those described by White, not only in their morphology but also in their size and preservation.

Alabamina creta (Finlay) 1940
Plate 1, figure 1

Pulvinulinella creta FINLAY 1940, p. 463, pl. 66, figs. 187-192.
Alabamina solnaesensis BROTZEN 1948, p. 102, p. 16, fig. 4.
Alabamina creta (Finlay). – DAILEY 1983, p. 764. – TJALSMA and LOHMANN 1983, p. 4, pl. 7, fig. 13. – NOMURA 1991, p. 21, pl. 1, figs. 2a-c. – WIDMARK and MALMGREN 1992a, p. 110, pl. 4, fig. 1.

Description: Test trochospiral unequally biconvex, subcircular in outline, periphery rounded. Dorsal side evolute, convex, sutures oblique nearly straight, broad and depressed between chambers. Ventral side slightly convex, evolute, last chambers inflated; ventral sutures flush, indistinct, except for the last ones, depressed. Aperture interiomarginal, an elongated slit on the ventral side. Wall calcareous, smooth.

Remarks: Several paratypes of *A. creta* were examined at the Smithsonian Institution (USNM No. 689019). These specimens are thick, with rounded periphery and clearly depressed sutures on the dorsal side. *A. creta* (Finlay) is distinguished from other *Alabamina* species by its broad depressions along the sutures between chambers on the dorsal side, and its rounded periphery.

TABLE 1
Presence/absence of benthic foraminiferal species in the studied sections.

Species	Ceiba	Lajilla	Mimbral	Mulato	Peñón	Ramones	Tecolote
Alabamina creta (Finlay)		X	X		X		
Alabamina midwayensis Brotzen	X	X			X	X	X
Alabamina wilcoxensis Toulmin	X	X	X	X	X		X
Allomorphina velascoensis Cushman				X	X	X	
Ammodiscus cretaceus (Reuss)	X	X	X	X	X	X	X
Ammodiscus latus Grzybowski	X	X	X	X	X	X	X
Ammodiscus macilentus (Myatlyuk)	X	X	X	X	X	X	X
Angulogavelinella att *avnimelechi* (Reiss)	X	X	X	X			
Anomalinoides acutus (Plummer)	X	X	X	X	X	X	X
Anomalinoides affinis (Hantken)	X	X	X	X	X		X
Anomalinoides ammonoides (Reuss)	X	X	X	X	X	X	X
Anomalinoides midwayensis (Plummer)		X				X	X
Anomalinoides rubiginosus (Cushman)	X	X		X	X	X	
Aragonia velascoensis (Cushman)	X	X		X			
Arenobulimina truncata (Reuss)	X	X					X
Bathysiphon sp. A	X	X	X	X	X		X
Bathysiphon sp. B	X	X	X	X	X		X
Bathysiphon sp. C	X	X	X	X	X	X	X
Bolivinoides delicatulus Cushman	X	X	X	X	X		
Bulimina trinitatensis Cushman & Jarvis	X	X	X	X		X	X
Bulimina velascoensis (Cushman)				X	X	X	X
Buliminella grata Parker & Bermudez							X
Cibicidoides dayi (White)	X	X	X	X		X	
Cibicidoides howelli (Toulmin)	X	X	X	X	X	X	X
Cibicidoides hyphalus (Fisher)	X	X	X	X	X		X
Cibicidoides naranjoensis (White)	X	X	X	X			
Cibicidoides proprius Brotzen	X	X	X	X	X	X	X
Cibicidoides pseudoacutus (Nakkady)						X	X
Cibicidoides sp. A					X		X
Cibicidoides velascoensis (Cushman)	X	X	X	X			
Clavulinoides amorpha (Cushman) emend. Alegret & Thomas	X	X	X	X	X	X	X
Clavulinoides amorpha juvenile form		X	X	X	X		X
Clavulinoides trilatera (Cushman)	X	X	X	X	X	X	X
Clavulinoides trilatera juvenile form	X	X	X	X	X	X	X
Coryphostoma incrassata (Reuss)	X	X	X	X	X	X	X
Coryphostoma incrassata gigantea (Wicher)	X	X	X	X		X	X
Dorothia bulleta (Carsey)	X	X	X	X	X		
Dorothia bulleta juvenile form	X	X		X			
Dorothia bulleta coarsely agglutinated		X	X	X		X	X
Dorothia pupa (Reuss)	X	X	X	X	X		X
Dorothia pupa juvenile form	X	X	X	X	X		X
Eouvigerina subsculptura McNeil & Caldwell	X	X	X	X	X	X	X
Euuvigerina elongata (Cole)		X	X	X			
Gaudryina laevigata Franke		X			X		X
Gaudryina pyramidata Cushman	X	X	X	X	X		X
Gaudryina sp. flattened		X		X	X		
Globorotalites sp. A	X	X	X	X	X	X	
Globorotalites multiseptus (Brotzen)					X	X	X
Glomospirella grzybowski (Jurkiewicz)	X	X	X	X	X		X
Gyroidinoides beisseli (Reuss) emend. Alegret & Thomas	X	X	X	X	X	X	X
Gyroidinoides depressus (Alth)	X	X	X	X	X	X	X
Gyroidinoides globosus (Hagenow)	X	X	X	X	X	X	X
Gyroidinoides girardanus (Reuss)	X	X	X	X	X	X	X
Gyroidinoides goudkoffi (Trujillo)	X	X	X	X	X	X	X
Gyroidinoides subangulatus (Plummer)		X	X	X	X	X	X
Haplophragmoides? sp. large variant	X	X	X	X	X		X
Haplophragmoides? sp. small variant	X	X	X	X	X	X	
Karreria fallax Rzehak				X	X	X	
Lenticulina macrodisca (Reuss)	X	X	X	X	X	X	X
Lenticulina navarroensis (Plummer)				X			
Lenticulina spisso-costata (Cushman)				X			
Lenticulina velascoensis White	X	X					X
Marssonella indentata (Cushman & Jarvis)	X	X		X	X	X	X
Marssonella oxycona (Reuss)	X	X	X	X	X		X
Marssonella oxycona juvenile form	X	X	X	X		X	
Nuttallides truempyi (Nuttall)	X	X	X	X	X		X
Nuttallinella coronula (Belford)	X	X	X	X	X	X	X
Nuttallinella florealis (White)	X	X	X	X			
Oridorsalis umbonatus (Reuss)	X	X	X	X	X		X
Osangularia cordieriana (d'Orbigny)	X	X	X	X			
Osangularia plummerae Brotzen		X	X	X	X	X	X
Osangularia velascoensis (Cushman)	X	X	X	X			X
Paralabamina hillebrandti (Fisher)	X	X	X	X	X		
Paralabamina lunata (Brotzen)	X	X			X		
Praebulimina kickapooensis (Cole)		X			X		X
Praebulimina reussi (Morrow)		X	X	X	X		X
Praeglobobulimina quadrata (Plummer)		X	X	X		X	X
Pullenia coryelli White	X						
Pullenia cretacea Cushman	X	X	X	X	X		X
Pullenia jarvisi Cushman	X	X	X	X	X		X
Quadrimorphina allomorphinoides (Reuss)	X	X	X	X	X		X
Reophax globosus Sliter	X	X	X	X			
Repmanina charoides (Jones & Parker)	X	X	X	X	X		
Saccammina placenta (Grzybowski)	X	X	X	X	X		X
Sitella cushmani (Sandidge)		X	X			X	X
Spiroplectammina chicoana Lalicker	X	X	X				X
Spiroplectammina israelsky Hillebrandt	X	X	X	X	X	X	
Spiroplectammina laevis (Roemer)	X	X		X	X	X	X
Spiroplectammina navarroana Cushman	X	X				X	
Spiroplectammina spectabilis (Grzybowski)	X	X	X	X	X	X	X
Stensioeina beccariiformis (White)	X	X	X	X	X	X	X
Stensioeina excolata (Cushman)		X	X	X	X		X
Subreophax velascoensis (Cushman)	X	X	X	X			

Occurrence: Very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral and El Peñón.

Alabamina midwayensis Brotzen 1948
Plate 1, figure 2

Alabamina midwayensis BROTZEN 1948 p. 99, pl. 16, figs. 1,2. – NAKKADY 1959, p. 460, pl. 2, figs. 2a-c. – SPEIJER 1994, p. 114, pl. 3, fig. 2; p. 160, pl. 6, fig. 3.
Alabamina sp. A WIDMARK 1997, p. 60, pl. 27, figs. A-C.

Description: Test trochospiral, almost equally biconvex, periphery subacute, outline oval. Dorsal side evolute, about 6 chambers visible in the last whorl; earlier whorls commonly obscured by a thickening of shell material. Dorsal sutures distinct, oblique. Ventral side more or less convex, involute; sutures depressed and radial. Last chamber much larger than earlier ones, with a flap-like extension over the small umbilicus. Aperture ventral, hardly visible, interiomarginal. Wall calcareous, smooth.

Remarks: A. midwayensis Brotzen differs from *A. wilcoxensis* Toulmin (see below) by its more biconvex test.

Occurrence: Rare to very rare in the Méndez and Velasco Formations in sections La Ceiba, La Lajilla, El Peñón, Los Ramones and El Tecolote.

Alabamina wilcoxensis Toulmin 1941
Plate 1, figure 3

Pulvinulinella exigua var. *obtusa* CUSHMAN and PONTON 1932, p. 71, pl. 9, figs. 9a-c.
Alabamina wilcoxensis TOULMIN 1941, p. 603, pl. 81, figs. 10-14; textfig. 4A-C. – SPEIJER 1994, p. 56, pl. 9, fig. 7.
Alabamina midwayensis Brotzen. – BERGGREN and AUBERT 1975, (non Brotzen) p. 147, pl. 2, figs. 14a-c; pl. 12, fig. 2.

Description: Test trochospiral, subcircular in outline, planoconvex to unequally biconvex; periphery acute. Dorsal side evolute, flat to slightly convex; sutures flush, oblique and straight. Ventral side convex, involute, sutures radial. Aperture a long slit on the ventral side, at the base of the apertural face. Wall calcareous, smooth.

Remarks: This species has been confused commonly with *A. midwayensis* Brotzen. According to the original species descriptions *A. wilcoxensis* Toulmin is nearly planoconvex, whereas *A. midwayensis* is more biconvex. A paratype of *A. wilcoxensis* was examined at the Smithsonian Institution (Cushman Collection No 38519); its periphery is subacute and its dorsal side is flat.

Occurrence: Very rare in the Méndez and Velasco Formations in all studied sections except section Los Ramones.

Allomorphina velascoensis Cushman 1926
Plate 1, Figure 4

Allomorphina velascoensis CUSHMAN 1926a, p. 604, pl. 20, figs. 20a-c. – CUSHMAN 1946, p. 146, pl. 60, fig. 8.

Description: Test trochospiral, small, triangular in dorsal view and broadly oval in side view. Chambers inflated, rapidly increasing in size, 3 chambers in each whorl; sutures slightly depressed. Aperture consisting of an elongate slit at the base of the last chamber on ventral side near the central point. Wall calcareous, smooth.

Remarks: The holotype is in Cushman's Collection at the Smithsonian Institution (No. 5218) and is very similar to our material. This species differs from *A. trochoides* (Reuss) by its less elongate test, somewhat more compressed side view, less inflated chambers. We leave open the possibility that these names may be synonyms. *Allomorphina velascoensis* differs from *A. paleocenica* by the shape of its chambers and the overall, broadly oval shape of the test.

Occurrence: Rare in the Méndez Formation in sections El Mulato and El Peñón; very rare in section Los Ramones.

Ammodiscus cretaceus (Reuss) 1845
Plate 1, figure 5

Operculina cretacea REUSS 1845, p. 35, pl. 13, figs. 64, 65.
Cornuspira cretacea (Reuss). – WHITE 1928a, p. 185, pl. 27, fig. 9.
Ammodiscus cretaceus (Reuss). – CUSHMAN 1946, p. 17, pl. 1, fig. 35. – KAMINSKI et al. 1988. p. 184, pl. 3, fig. 7. – KLASZ and KLASZ 1990 p. 404, pl. 2, figs. 2-3. – BUBÍK 1993, p. 79, pl. 10, fig. 5. – KAMINSKI et al. 1996, p. 10, pl. 1, figs. 1-2.

Description: Test planispiral and compressed, concave on both sides, circular to elliptical in outline. Test consists of a tubular chamber very gradually and uniformly increasing in size with succeeding coils; evolute coiling. Aperture semicircular, at the end of the tubular chamber. Wall agglutinated, very smooth and polished.

Remarks: The plesiotype figured by Cushman was examined (Cushman Collection No. 5224), and our material is very similar to these specimens. *A. cretaceus* differs from *A. latus* Grzybowski by its more evolute coiling, and more numerous coils; the diameter of the tubular chamber is shorter than that of *A. latus*. According to Kaminski et al. (1988), *A. cretaceus* is characterized by fine, radial striations on the surface of the test. These striations were found in the figured specimen examined in White's collection at the American Museum of Natural History, but not in our material. We consider that both round and elliptical forms (commonly described as *A. peruvianus* Berry) can be placed in this species, conform useage in Bolli et al. (1994), but more study is needed to decide this.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections.

Ammodiscus latus Grzybowski 1898
Plate 1, figure 6

Ammodiscus latus GRZYBOWSKI 1898, p. 282, pl. 10, figs. 27, 28. – BOLLI et al. 1994, p. 68, pl. 18, fig. 25.

Description: Test planispiral, somewhat involute, consisting of few coils; circular outline. The diameter of the tubular chamber is constant or slightly increases with succeeding coils. Aperture simple, at the end of the tubular chamber. Wall agglutinated.

Remarks: A. latus Grzybowsky resembles *A. cretaceus* (Reuss), but it has fewer, wider whorls and a more involute coiling.

Occurrence: Rare to very rare in the Méndez and Velasco Formations in all studied sections.

Ammodiscus macilentus (Myatlyuk) 1970
Plate 1, figure 7

Grzybowskiella macilenta MYATLYUK 1970, p. 72, pl. 13, figs. 2, 3.
Ammodiscus macilentus (Myatlyuk). – BOLLI et al. 1994, p. 68, pl. 18, figs. 26, 27.

Description: Test planispiral, large and robust, concave on both sides; circular to elliptical outline, periphery rounded. Tubular chamber very gradually increasing in size with succeeding coils. Aperture simple, at the end of the tubular chamber. Wall agglutinated.

Remarks: A. macilentus differs from *A. cretaceus* (Reuss) by its larger, more robust test; it is also larger and more evolute than *A. latus* Grzybowski.

Occurrence: Very rare in the Méndez and Velasco Formation in all studied sections.

Angulogavelinella avnimelechi (Reiss) 1952
Plate 1, Figure 8

Pseudovalvulineria avnimelechi REISS 1952, p. 269, figs. 2a-c.
Rotalia convexa LEROY 1953, p. 48, pl. 9, figs. 13-15
Angulogavelinella avnimelechi (Reiss). VAN MORKHOVEN et al. 1986, p. 344, pl. 112, figs. 1-3. – BOLLI et al. 1994, p. 161, pl. 45, figs. 34-36. – SPEIJER 1994, p. 166, pl. 3, fig. 7. – WEIDICH 1995, p. 324-315, pl. 4, figs. 4-6, 10-12, Pl. 5, figs. 13-20. – WIDMARK 1997, p. 76, pl. 37, figs. A-C.

Description: Test trochospiral, nearly plano-convex, periphery subacute, with a distinct, rounded keel. Dorsal side flat to slightly convex in the center, sutures flush, oblique and curved; spiral suture slightly raised. Ventral side lowly convex, about 10 chambers visible in the last whorl; sutures limbate, with irregular depressions along the sutures, which radiate from the umbilicus. Primary aperture interiomarginal, separated by a bridge from the slitlike, interiomarginal secondary aperture extending toward the umbilicus. Wall calcareous, nearly smooth on the dorsal side and coarsely perforate on the ventral side.

Remarks: Typical features of *A. avnimelechi* (Reiss) are the keeled periphery, the limbate ventral sutures with irregular depressions radiating from the umbilicus, and its split aperture. It is commonly found in association with *Stensioeina beccariiformis* (White), from which it can be distinguished by its keeled periphery and its apertural features (Weidich, 1995). In our specimens the double apertures can not be observed due to preservation, and we can thus not be fully certain of our identification of this species. Our specimens, however, look very similar to these figured by Weidich (1995), and we thus question his statement that this species is an old-world taxon.We agree with Weidich (1995) that *Rotalia convexa* Leroy is probably a junior synonym.

Occurrence: Rare in the upper Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral and El Mulato.

Anomalinoides acutus (Plummer) 1926
Plate 1, figure 9

Anomalina ammonoides (Reuss) var. *acuta* PLUMMER 1926, p. 149, pl. 10, figs. 2a-c.– BROTZEN 1948, p. 87, pl. 15, figs. 2a-c.
Anomalinoides acuta (Plummer). – OLSSON 1960, p. 51, pl. 11, figs. 4, 5. – BERGGREN and AUBERT 1975, p. 149, pl. 5, figs. 4a-d; pl. 8, figs. 3a, b; pl. 9, fig. 1; pl. 12, fig. 5; pl. 13, fig. 8; pl. 17, fig. 5; pl. 18, fig. 2; pl. 19, fig. 2.
Falsoplanulina acuta (Plummer). – BOLLI et al. 1994, p. 149, pl. 40, figs. 18-20.

Description: Test trochospiral, biconvex but much compressed, peripheral margin subacute. Dorsal side evolute, somewhat more flattened than the umbilical side. Umbilical side involute, 12 to 14 narrow chambers visible in the last whorl. Sutures distinct, curved to limbate, especially those among the last-formed chambers; sutures on the ventral side terminate toward the inner edge in a series of thin ridges, surrounding an irregular filling of clear shell material. Sutures merge at the center of the dorsal side into a more or less developed elevated boss. Aperture an arched opening extending from the peripheral margin toward the umbilicus. Wall calcareous, finely perforated.

Remarks: Anomalinoides acutus is distinguished from other species of *Anomalinoides* by its more compressed test, numerous chambers, the boss on the dorsal side and the irregular filling of clear shell material on the ventral side.

Occurrence: Abundant in the Méndez and Velasco Formations in all studied sections; common in section El Peñón.

Anomalinoides affinis (Hantken) 1875
Plate 2, figure 1
Pulvinulina affinis HANTKEN 1875, p. 78, pl. 10, figs. 6a-b.
Anomalina affinis (Hantken). – CUSHMAN and RENZ 1948, p. 40, pl. 8, figs. 9, 10.

Description: Test trochospiral plano-convex, periphery rounded to broadly rounded. Dorsal side flat to slightly concave; ventral side convex. About 8 chambers visible in the last whorl, the last ones inflated; sutures distinct, depressed. Aperture hardly visible in the studied specimens, an interiomarginal slit at the base of the last chamber.

Remarks: This species is very close to *Anomalinoides ammonoides* (Reuss), but is less flattened, with a broader periphery and more inflated last chambers; *A. ammonoides* has more chambers (10-12) in its last whorl.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections, with the exception of Los Ramones where it is absent.

Anomalinoides ammonoides (Reuss) 1844
Plate 2, figures 2-3

Rotalina ammonoides REUSS 1844, p. 214.
Anomalina ammonoides (Reuss). – CUSHMAN and JARVIS 1932, p. 149, pl. 16, figs. 1a-c.
Cibicides ammonoides (Reuss). – TRUJILLO 1960, p. 335, pl. 48, figs. 8a-c.
Anomalinoides affinis (Hantken). – BOLLI et al. 1994, p. 373, pl. 59, figs. 13-15c (non Hantken). – SPEIJER 1994, p. 58, pl. 6, fig. 1 (non Hankten)

Description: Test trochospiral biconvex, slightly flattened, periphery rounded. Umbilical side involute, dorsal side evolute, somewhat concave in the middle, outer whorl convex. 10 to 12 chambers visible in the last formed whorl; sutures flush, curved. Aperture interiomarginal, a slit extending from near the umbilicus toward the dorsal side, along the dorsal suture. Wall calcareous, finely perforated.

Remarks: This species is distinguished from *A. acutus* (Plummer) by its more rounded periphery and less flattened test. See also description of *A. affinis* (Hantken), which is less compressed and has fewer chambers.

Occurrence: Méndez and Velasco Formations. Abundant in sections La Ceiba, La Lajilla and El Tecolote; common in section Los Ramones and rare in sections El Mimbral, El Mulato and El Peñón.

Anomalinoides midwayensis (Plummer) 1926
Plate 2, fgures 4-5

Truncatulina midwayensis PLUMMER 1926, p. 141, pl. 9, fig. 7; pl.15, fig. 3.
Anomalinoides midwayensis (Plummer). – BROTZEN 1948, p. 88, pl. 14, figs. 3a-c. – OLSSON 1960, p. 51, pl. 11, figs. 6-8. – BERGGREN and AUBERT 1975, p. 149, pl. 6, fig. 1a-f; pl. 9, fig. 3; pl. 10, fig. 8; pl. 11, fig. 3; pl. 12, fig. 3; pl. 16, fig. 2.

Description: Test trochospiral involute, biconvex, moderately compressed; peripheral margin rounded to slightly subacute. Final whorl (with about 12 chambers) strongly embracing. Sutures very distinct, curved, raised and thickening toward the umbilicus on both sides. Aperture an interiomarginal slit extending toward the umbilicus. Test calcareous.

Remarks: The strongly embracing final whorl and the distinct, raised sutures throughout the test are the most distinct features of *A. midwayensis*.

Occurrence: Abundant in section Los Ramones, and in marly clasts found in the clastic unit in section La Lajilla. Rare in the Méndez Formation in section El El Tecolote.

Anomalinoides rubiginosus (Cushman) 1926
Plate 2, figure 6

Anomalina rubiginosa CUSHMAN 1926a, p. 607, pl. 21, figs. 6a-c. – CUSHMAN 1946, p. 156, pl. 64, figs. 4-6.
Cibicides danica BROTZEN 1940, p. 31, pl. 7, figs. 2a-c.
Anomalina rubiginosa Cushman.
Gavelinella danica (Brotzen). – DAILEY 1983, p. 766, pl. 9, figs. 6-8. – TJALSMA and LOHMANN 1983, p. 13, pl. 5, fig. 7. – GAWOR-BIEDOWA 1992, p. 166, pl. 35, figs. 11-13.
Anomalinoides rubiginosus (Cushman). – VAN MORKHOVEN et al. 1986, p. 366, pl. 119. – BOLLI et al. 1994, p. 158, pl. 44, figs. 6, 13, 18-19. – SPEIJER 1994, p. 60, pl. 8, fig. 3; p. 164, pl. 1, fig. 5.
Anomalinoides danicus (Brotzen). – NOMURA 1991, p. 21, pl. 2, figs. 4a-c.

Description: Test trochospiral, closely coiled; periphery broadly rounded. Dorsal side slightly convex, ventral side somewhat concave. Chambers and sutures indistinct, the last ones more distinct; 9 to 10 chambers in the last whorl. Aperture interiomarginal, extending toward the ventral side. Wall calcareous, very coarsely perforate on both sides.

Remarks: The holotype of *A. rubiginosus* was examined at the Smithsonian Institution (Cushman Collection No. 5226). It is coarsely perforate on both sides, with periphery broadly rounded, and irregular ridges on the ventral side. The specimen determined and figured by White in 1928 in his collection at the American Museum of Natural History was labeled *Planulina rubiginosa* (Cushman), and clearly shows the coarse pores on both sides, as well as the broadly rounded periphery. *Anomalinoides rubiginosus* resembles *Cibicidoides howelli* (Toulmin) but it has coarser pores, present on both sides, as well as a more broadly rounded periphery. We agree with van Morkhoven et al. (1986) that *A. danica* is a junior synonym *of A. rubiginosa*.

Occurrence: Very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mulato and El Peñón; rare in section Los Ramones. Abundant in the Méndez Formation in section El Tecolote.

Aragonia velascoensis (Cushman) 1925
Plate 2, figure 7

Textularia velascoensis CUSHMAN 1925, p. 18, pl. 3, figs. 1a-c.
Bolivinoides trinitatensis CUSHMAN and JARVIS 1928, p. 99, pl. 14, figs. 10a, b. – CUSHMAN and JARVIS 1932, p. 43, pl. 13, fig. 3. – CUSHMAN 1946, p. 114, pl. 48, fig. 17.
Gümbelina velascoensis (Cushman). – WHITE 1929, p. 39, pl. 4, fig. 14.
Bolivinoides velascoensis (Cushman). – CUSHMAN 1946, p. 114, pl. 48, fig. 16.
Bolivinoides ouezzanensis REY 1955, p. 210, pl. 12, fig. 2.
Aragonia ouezzanensis (Rey). – TJALSMA and LOHMANN 1983, p. 4, pl. 5, fig. 4.
Aragonia velascoensis (Cushman). – TJALSMA and LOHMANN 1983, p. 5, pl. 4, fig. 6.– VAN MORKHOVEN et al. 1986, p. 340, pl. 111A, figs. 1-3; pl. 111B, figs. 1-3. – BOLLI et al. 1994, p. 130, pl. 35, figs. 7, 15.

*Description:*Test broadly flaring, oval in front view, biserial; pointed initial end, test broadest in the middle portion. Test thickening rapidly toward the apertural end; periphery broadly truncate. Chambers distinct except in the earlier portion. Ornamentation consists of distinct, raised and limbate sutures; between these sutures there are raised projections extending toward the lateral truncate surfaces. Aperture rounded, at the inner margin of the last chamber. Wall calcareous, rugose due to the raised ornamentation.

Remarks: Specimens from our material closely resemble the holotype of *Textularia velascoensis* Cushman (Cushman Collection No. 4303). We agree with van Morkhoven et al. (1986) that *A. ouezzanesis* Rey is a junior synonym of *A. velascoensis*.

Occurrence: Rare to very rare in the Velasco Formation in sections La Ceiba, La Lajilla and El Mulato.

Arenobulimina truncata (Reuss) 1845
Plate 2, figure 8

Bulimina truncata REUSS 1845, p. 37, pl. 8, fig. 73.
Verneuilina rotunda WHITE 1928b, p. 310, pl. 42, figs. 5a, b.
Arenobulimina truncata (Reuss). – KAMINSKI et al. 1988, p. 194, pl. 8, fig. 10. – BOLLI et al. 1994, p. 91, pl. 24, figs. 19, 20.

Description: Test triserial, rounded at the apex. Rounded general shape, chambers rather indistinct; sutures flush, indistinct. Characteristic broad apertural face; aperture a low arc in the middle of the apertural face. Wall coarsely agglutinated.

Remarks: In White's collection in the American Museum of Natural History, a slide labeled *Verneuilina rotunda* n. sp. may contain the holotype of his species. Its general shape, rounded initial end and the embracing apertural end are consistent with the description of *Arenobulimina truncata* (Reuss), and with the specimens in our material.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla and El Tecolote.

Bathysiphon sp. A
Description: Test consists of a thick, large, cylindrical tube. The wall is much thicker than that of the other *Bathysiphon* species, and more resistant to compression in the sediment (undeformed pieces of this species are more commonly found than compressed, flattened ones). Wall finely agglutinated.

Remarks: Only broken fragments of *Bathysiphon* have been found. To estimate the relative abundance of this species, we divided the number of pieces by 5, considering that on average about 5 pieces are representative of one specimen.

Occurrence: Very rare in the Méndez and Velasco Formation in all studied sections; absent in section Los Ramones.

Bathysiphon sp. B
Plate 2, figure 9

Description: Test consisting of large pieces of a tube flattened in the center, and more inflated toward the margins. The wall is agglutinated, very smoothly finished.

Remarks: In order to work out the relative abundance of this species, we consider one individual of *Bathysiphon* sp. B equal to five pieces. No complete specimens have been found.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections; absent in section Los Ramones.

Bathysiphon sp. C
Plate 2, fgure 10

Description: Test consisting of small pieces of a tube, more compressed toward the centre. The wall is agglutinated, not as smoothly finished as that of Bathysiphon sp. B.

Remarks: Only small, broken pieces have been found. In order to work out the relative abundances, we consider that one individual of *Bathysiphon* sp. C equals five pieces.

Occurrence: Very rare in the Méndez and Velasco Formation in all studied sections.

Bolivinoides delicatulus Cushman 1927
Plate 2, figure 11

Bolivinoides decorata (not Jones). – CUSHMAN 1926a, p. 586, pl. 15, fig. 11.
Bolivinoides decorata (Jones) var. *delicatula* CUSHMAN 1927a, p. 90, pl. 12, fig. 8. – CUSHMAN 1927b, p. 158, pl. 28, fig. 7.– CUSHMAN and JARVIS 1928, p. 99, pl. 14, fig. 9. – CUSHMAN and JARVIS 1932, p. 42, pl. 13, fig. 2. – CUSHMAN 1946, p. 113, pl. 48, figs. 10-14.
Bolivina decorata Jones. – WHITE 1929, p. 43, pl. 5, fig. 1.
Bolivinoides delicatulus Cushman. – TJALSMA and LOHMANN 1983, p. 5, pl. 4, fig. 7. – VAN MORKHOVEN et al. 1986, p. 337, pl. 110, figs. 1, 2. – NOMURA 1991, p. 21, pl. 1, fig. 6.

Description: Test tapering, slender, biserial; periphery slightly rounded. Ornamentation consists of oblique lobes confined to each individual chamber. Apertural end thickened and smooth; aperture at the inner margin of the last chamber. Wall calcareous, thin, fairly smooth toward the initial part of the test.

Remarks: The holotype of *B. delicatulus* was studied at the Smithsonian Institution (Cushman Collection No. 5139), and closely resembles our material. The specimen that White figured and named *Bolivina decorata* Jones was found in his collection at the American Museum of Natural History, and is in our opinion also *B. delicatulus*.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral, El Mulato and El Peñón.

Bulimina trinitatensis Cushman and Jarvis 1928
Plate 2, figures 12-15

Bulimina cf. *inflata* Seguenza. – CUSHMAN 1926a, p. 591, pl. 17, fig. 7 (not Seguenza).
Bulimina inflata Seguenza. – WHITE 1929, p. 48, pl. 5, figs. 7a-c (not Seguenza).
Bulimina incisa CUSHMAN 1926a, p. 592, pl. 17, figs. 9a,b. – CUSHMAN 1946, p. 124, pl. 52, fig. 7.
Bulimina cf. *incisa* Cushman. – WHITE 1929, p. 47, pl. 5, figs. 6a-c.
Bulimina trinitatensis CUSHMAN and JARVIS 1928, p. 102, pl. 14, fig. 12. – CUSHMAN and JARVIS 1932, p. 44, pl. 13, figs. 4a, b. – CUSHMAN 1946, p. 124, pl. 52, fig. 9. – TJALSMA and LOHMANN 1983, p. 7, 8, pl. 3, figs. 3, 4; pl. 14, fig. 1. – VAN MORKHOVEN et al. 1986. p. 299, pl. 98A, figs. 1a-2c; pl. 98B, figs. 1-4. – NOMURA 1991, p. 21, pl. 1, fig. 10. – WIDMARK and MALMGREN 1992a, p. 111, pl. 1, fig. 7. – BOLLI et al. 1994, p. 136, pl. 36, figs. 28, 29. – SPEIJER 1994, p. 154, pl. 2, fig. 3. – WIDMARK 1997, p. 40, pl. 15, figs. C-D.
Bulimina taylorensis CUSHMAN and PARKER 1935, p. 96, pl. 15, figs. 3a, b. – CUSHMAN 1946, p. 123, pl. 52, figs. 1, 2. – BOLLI et al. 1994, p. 136, pl. 36, fig. 27.

Description: "Test somewhat longer than broad, rounded in transverse section, chambers distinct with the lower border extended into a overhanging plate which is marked on the upper side by an irregular network of reticulate areas, the outer angles ending in short spines; aperture elongate, comma-shaped, the apertural face smooth." This description of the species (Cushman and Jarvis 1928) is fully in agreement with observations on our material.

Remarks: We examined the holotype of *B. trinitatensis* Cushman and Jarvis (Cushman Collection No. 9602) and several paratypes (Cushman Collection Nos. 9697, 15414, 15415, 15422) at the Smithsonian Institution. The distinct ridges at the base of the chambers and the overlapping of the chambers over the sutures are the main distinctive features of *B. trinitatensis*. Some of the paratypes have a smooth surface because the ridges are eroded. The short spines are broken in our material, and the ridges are eroded in some of the specimens; they are more or less distinct depending on the preservation. One extreme case of ridge erosion is the specimen figured by Cushman in 1926 and named *Bulimina incisa* n. sp. We studied the holotype of *B. incisa* (Cushman Collection No. 5157), and consider that its indentations at the base of the chambers are the result of the abrasion of the ridges, so that it looks smooth and shows only shallow indentations. We consider it thus probable that *B. incisa* is an eroded and badly preserved specimen of *B. trinitatensis*.

In the White collection at the American Museum of Natural History there is a slide labelled *Bulimina* cf. *incisa* Cushman; it did not contain the specimen figured by White in 1929, but other specimens determined by White as *Bulimina* cf. *incisa* . These specimens are smooth, and do not show the grooves shown in figure 6 (pl. 5). Also in White's collection was a slide labeled *Bulimina inflata* Seguenza, containing several specimens, including the figured one. All have the characteristic grooves at the base of the chambers, and thus should be placed in *B. trinitatensis*. The Cushman Collection at the Smithsonian Institution contains several secondary types and a plesiotype (No. 5159) of *B. inflata* Seguenza. We do not consider that this specimen corresponds to the species as defined by Seguenza.

Occurrence: This species is very rare to abundant in the Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral and El Mulato; one specimen in the Méndez Formation in section El Tecolote.

Bulimina velascoensis (Cushman) 1925
Plate 3, figure 1

Gaudryina velascoensis CUSHMAN 1925, p. 20, pl. 3, fig. 7.
Bulimina velascoensis (Cushman). – WHITE 1929, p. 50, pl. 5, fig. 13. – CUSHMAN 1946, p. 124, pl. 52, fig. 8. – TJALSMA and LOHMANN 1983, p. 8, pl. 3, fig. 2. – VAN MORKHOVEN et al. 1986, p. 335, pl. 109, figs. 1, 2. – WIDMARK and MALMGREN 1992a, p. 111, pl. 1, fig. 6. – WIDMARK 1997, p. 41, pl. 15, figs. E-F.

Description: Test elongate, broader toward the apertural end. Early portion of the test triangular in cross section, later part more angular, somewhat quadrangular, with angles broadly rounded. Chambers not inflated, indistinct in the earlier portion; sutures indistinct except for those between the last chambers, slightly depressed. Aperture elongate and with an oval inner side. Wall calcareous with perforations arranged longitudinally, forming long striations in the earlier portion. Later part of the test smooth.

Remarks: We examined the holotype (Cushman Collection No. 4349) and a paratype (No 320069) at the Smithsonian Institution. These specimens are not well preserved, and striae are barely visible. A slide labeled *Bulimina velascoensis* (Cushman) was found in White's collection at the American Museum of Natural History. The specimen figured by White in 1929 probably was among the specimens in the slide, but we could not decide which one it was. All specimens agree with the description of the species. This species is distinguished from other *Bulimina* species because the early part of its test is finely striate and triangular in cross section, and its later part smooth and quadrangular.

Occurrence: Rare to very rare in the Méndez and Velasco Formations in sections El Mulato, El Peñón, Los Ramones and El Tecolote.

Buliminella grata Parker and Bermudez 1937
Plate 3, fgure 2

Buliminella grata PARKER and BERMUDEZ 1937, p. 515, pl. 59, figs. 6a-c. – CUSHMAN and RENZ 1948, p. 24, pl. 5, fig. 12. – TJALSMA and LOHMANN 1983, p. 26, pl. 12, fig. 7. – BOLLI et al. 1994, p. 137, pl. 37, fig. 3.

Description: Test small and tapering, slightly longer than broad. Four chambers in the last whorl; sutures distinct, flush to irregularly incised, giving a rugose aspect. Apertural face broad; aperture small, oval, at the inner margin of the apertural face. Wall calcareous.

Remarks: The holotype of *Buliminella grata* in the Cushman Collection at the Smithsonian Institution (No. 23340) closely resembles our material. This species can be distinguished from other *Buliminella* species by its broader apertural face, and characteristic sutures.

Occurrence: Rare in section El Tecolote.

Cibicidoides dayi (White) 1928
Plate 3, figures 3-4

Planulina dayi WHITE 1928b, p. 300, pl. 41, figs. 3a-c.
Cibicidoides dayi (White). – DAILEY 1983, p. 766, pl. 9, figs. 1-3. – TJALSMA and LOHMANN 1983, p. 9, pl. 6, figs. 6-7. – VAN MORKHOVEN et al. 1986, p. 353, pl. 114.
Gavelinella dayi (White). – BOLLI et al. 1994, p. 162, pl. 46, figs. 11-13.

Description: Test trochospiral, compressed, biconvex, and biumbonate; periphery subacute. Numerous chambers (12 to 16) in the last whorl. Dorsal sutures distinct, curved and limbate; characteristic spiral suture, strongly depressed, around a prominent umbo. Ventral sutures flush, umbo rather indistinct. Aperture a simple arc at the base of the last chamber. Wall calcareous, coarsely perforate on the dorsal side; smooth, imperforate on the ventral side.

Remarks: The compressed test, with numerous chambers and limbate sutures and regular chamber shape throughout the test are the main characteristics of *C. dayi*. We examined the syntypes in White's collection (No. 19908) at the American Museum of Natural History, as well as the types of the two unnamed varieties defined by this author (Nos. 19909 and 19010). Both varieties have depressed sutures between the last chambers of the last whorl, and they differ in the more or less involute convex side. According to these characteristics, we included both varieties into *Cibicidoides hyphalus* (Fisher) (see below), which resembles *C. dayi*.

Occurrence: Cibicidoides dayi appears in the Velasco Formation only; it is abundant in section La Ceiba, and very rare in sections La Lajilla, El Mimbral and El Mulato.

Cibicidoides howelli (Toulmin) 1941
Plate 3, figure 5

Cibicides howelli TOULMIN 1941, p. 609, pl. 82, figs. 16-18. – CUSHMAN 1951, p. 67, pl. 19, figs. 15-17.

Description: Test trochospiral planoconvex, periphery angulate in the earlier portion of the last whorl, bluntly angled or rounded in the later portion. Dorsal side flat to concave, umbilical side lowly convex. Six chambers visible in the last whorl, increasing gradually in size except for the last chamber, which is much larger and overlaps with earlier chambers. Sutures curved and depressed on both sides. Aperture a slit at the base of the last chamber, arching across the periphery and extending onto the dorsal side. Wall calcareous, coarsely perforated on the dorsal side.

Remarks: Cibicidoides howelli (Toulmin) is easily distinguished from other *Cibicidoides* by its large and overlapping last chamber, and its subacute periphery throughout the test except for the last portion, where it is broadly rounded. Berggren and Aubert (1975) illustrated *C. howelli* Toulmin (pl. 5, figs. 2a-c; not Toulmin) but those specimens lack the well-developed last chamber and have an acute periphery throughout the test. Therefore, we would include them into *C. propius* Brotzen (see below). A slide containing 5 paratypes of *C. howelli* was examined at the Smithsonian Institution (Cushman Collection No 38529); we would include two of these specimens into *C. propius*, because they lack the rounded last portion of the test and have an acute periphery. The other three specimens would fit in the description of *C. howelli*. *Cibicidoides howelli* (Toulmin) differs from *Gavelinella danica* (Brotzen) by its subacute early portion and non-perforated ventral side, as well as by the longer than broad shape of the chambers.

Occurrence: Rare to abundant in the Méndez and Velasco Formation in all studied sections; very rare in section Los Ramones.

Cibicidoides hyphalus (Fisher) 1969
Plate 3, figures 6-7

Planulina dayi White variety. – WHITE 1928b, pl. 41, figs. 4a-c. – WHITE 1928b, pl. 41, figs. 5a-c.
Anomalinoides hyphalus FISHER 1969, p. 198, fig. 3a-c.
Gavelinella hyphalus (Fisher). – TJALSMA and LOHMANN 1983, p. 13, pl. 4, figs. 8, 9; pl. 7, fig. 11.
Cibicidoides hyphalus (Fisher). – VAN MORKHOVEN et al. 1986, p. 359, pl. 116. – WIDMARK and MALMGREN 1992a, p. 111, pl. 5, figs. 1, 2. – SPEIJER 1994, p. 156, pl. 1, fig. 3.
Cibicidoides cf. *hyphalus* (Fisher). – SPEIJER 1994, p. 54, pl. 5, figs. 2, 3.

Description: Test reversed trochospiral, involute, unequally biconvex to planoconvex, rounded outline and periphery subacute to rounded. "The spiral side is convex, somewhat involute, and usually smooth. The umbilical side is flat, sometimes umbonate, almost completely involute, and coarsely perforate" according to van Morkhoven et al. (1986). "Chambers distinct, up to 12 in final whorl. Spiral side convex, smooth, nonpunctate, with transparent umbo through which previous whorls may be seen. Umbilical side flat or slightly convex, almost completely involute, deep umbilicus obscured by triangular flap-like extensions of later chambers, and by a sometimes imperfectly developed umbilical plug. Sutures curved, transparent, flush on spiral side; curved, limbate, especially near the center of the umbilical side. Umbilical side coarsely but sparsely punctate, especially in depressed areas between sutures. Aperture a low arch at base of apertural face, and extending between chambers where sutures have been excavated" (Fisher 1969).

Remarks: Specimens included in this species are highly variable in the degree of convexity and coiling of both sides, which is in agreement with the morphological variability described by other authors (e.g., van Morkhoven et al. 1986). Two extreme morphotypes are distinguished in the studied material:

Morphotype A: plano-convex, flat side involute to somewhat evolute, always coarsely perforate. When visible, the aperture extends along the spiral suture. Convex side involute, smoother than the flat side.

Morphotype B: biconvex, the test tends to be planispiral, with both sides involute, but one of them is usually slightly more involute than the other. Wall coarsely perforate on the umbilical side.

Intermediate forms between these to extremes have been found, and allow us to include all of them into the species *C. hyphalus* (Fisher). We thus disagree wih Speijer's (1994) observation that there are no intermediate forms; possibly, such intermediate forms are limited to deeper basins.

Cibicidoides hyphalus (Fisher) closely resembles *C. dayi* (White). We examined the slide (No. 19908) containing the syntypes of *C. dayi* (White) at the American Museum of Natural History. The types of White's species *C. dayi* have more chambers, regular in shape, as well as distinct limbate sutures throughout the test on dorsal side, whereas in *C. hyphalus* the sutures are depressed between the last chambers. We also examined the specimens labeled *Planulina dayi*, var (No. 19909) that White figured (pl. 41, figs. 4a-c) in 1928. We found these consistent with the description of *C. hyphalus* (morphotype A), and thus include it into this taxon. The second variety figured by White in pl. 41, figs. 5a-c was found in slide No. 19910; the more convex side in this variety is somewhat more involute than in the preceding one, and we include it in *C. hyphalus* morphotype B. *Cibicidoides hyphalus* (Fisher) differs from *C. proprius* Brotzen by its less acute periphery, the flap-like extensions of later chambers around the umbilicus, and the limbate sutures on the umbilical side.

Occurrence: Rare to very abundant in the Méndez and Velasco Formation in all studied sections; absent in section Los Ramones.

Cibicidoides naranjoensis (White) 1928
Plate 4, figure 1

Cibicides naranjoensis WHITE 1928b, p. 298, pl. 41, fig. 1.

Description: Test large, biconvex trochospiral; periphery subangular. Umbilical side convex, about 8 chambers visible on the last whorl; sutures curved, flush. Dorsal side evolute, flat to slightly convex; sutures distinct, oblique, and chambers square to somewhat rectangular on dorsal side. Aperture hardly visible, an interiomarginal slit extending from near the umbilicus to the periphery. Wall calcareous, smooth.

Remarks: The syntypes examined in White's collection at the American Museum of Natural History are biconvex and variable in the degree of convexity of the dorsal side. The dorsal side is coarsely perforate, and the ventral side is smooth. The slide with the holotype and paratypes not only contains *C. naranjoensis*, but also several *C. proprius*, which are more plano-convex, with a more acute periphery.

Occurrence: Very rare in the Velasco Formation in sections La Ceiba, La Lajilla and El Mimbral sections, and in the Méndez Formation in section El Mulato.

Cibicidoides proprius Brotzen 1948
Plate 4, figures 2-4

Cibicidoides proprius BROTZEN 1948, p. 78, pl. 12, figs. 3, 4. – BOLLI et al. 1994, p. 148, pl. 39, figs. 28-30.
Cibicidoides howelli (Toulmin). – BERGGREN and AUBERT 1975, p. 153, pl. 5, figs. 2a-c (not Toulmin)

Description: Test trochospiral, slightly biconvex to nearly planoconvex, periphery acute, outline somewhat lobate. Dorsal side moderately convex to nearly flat with a distinct central plug, flat to slightly elevated. About 8 chambers in the last whorl, the last one may be inflated; ventral sutures curved, sinuate and depressed between the last chambers. Umbilical side convex, umbilicus covered by a small boss of translucent shell material. Aperture arched, at the base of the last chamber and extending shortly towards the umbilical side. Wall calcareous, smooth.

Remarks: Specimens referred to this taxon show variability in the convexity of the dorsal side. Adult forms look flatter than the younger ones, because the convexity of the ventral side does not increase much during growth. According to the characteristics cited above, we include into this taxon the forms determined as *C. howelli* (Toulmin) by Berggren and Aubert (1975), as well as some specimens that White included into his new species *Cibicides naranjoensis*. *Cibicidoides proprius* can be distinguished from the latter one by its more plano-convex test, more acute periphery and the depressed sutures between the last chambers. *Cibicidoides howelli* (Toulmin) differs from *C. dayi* (White) by its non-limbate sutures on the dorsal side; it differs from *C. hyphalus* (Fisher) by its acute periphery, sinuate, not-limbate sutures, and the umbilicus usually covered by a small boss of translucent shell material. *Cibicidoides alleni* differs from *C. proprius* by its ridges of calcite along the spiral side; it also lacks the acute periphery of the later species.

Occurrence: Very rare to abundant in the Méndez and Velasco Formations in all studied sections.

Cibicidoides pseudoacutus (Nakkady) 1950
Plate 4, figure 5

Anomalina pseudoacuta NAKKADY 1950, p. 691, pl. 90, figs. 29-32.
Anomalinoides acuta (Plummer). – KELLER 1988, p. 161, pl. 2, figs. 9, 10, 12, 13.
Cibicidoides pseudoacutus (Nakkady). – SPEIJER 1994, p. 54, pl. 7, figs. 6a-c.

Description: Test trochospiral biconvex, biumbonate; periphery subacute. Spiral (dorsal) side semi-involute, sutures flush, central area pronounced because of secondary calcite deposition. Dorsal sutures limbate in the earlier stages, depressed between the last chambers; sutures thickened towards the dorsal plug, which is delimited by a depressed spiral suture. Ventral side involute, 9 to 10 chambers visible in the last whorl; ventral sutures flush, central area elevated, umbonate. Aperture interiomarginal, extending toward the dorsal side along the spiral suture. Wall calcareous, coarsely perforate on the dorsal side and smooth on the ventral side.

Remarks: Cibicidoides pseudoacutus (Nakkady) resembles *C. dayi* (White), but is less compressed, with fewer chambers per whorl, increasing gradually in size as added; the sutures become depressed between the last chambers, and their shell texture is different. It mainly differs from *Anomalinoides praeacutus* (Vasilenko) by its peripheral view, the location of the aperture and the central plug of translucent material on ventral side.

Occurrence: Abundant in sections Los Ramones and El Tecolote (Méndez Formation).

***Cibicidoides* sp. A**
Plate 4, fgure 6

Description: Test trochospiral much compressed, planoconvex; periphery subacute. Spiral side flat, evolute, sutures flat to limbate in the earlier part of the test, depressed between the last chambers. Small boss on dorsal side, rounded, and formed by the projections of the inner chamber sutures. Ventral side convex, involute, 12 chambers visible in the last formed whorl; sutures smoothly curved and slightly depressed. Boss on ventral side absent to small, smooth. Aperture interiomarginal, extending to the dorsal side. Wall calcareous, smooth on ventral side and perforate on dorsal side.

Remarks: This species is similar to *C. dayi* (White) in the number of chambers and overall shape, but the sutures are not limbate on the umbilical side. It also resembles *C. hyphalus* (Fisher), but it is more compressed, its periphery more acute, and it has more chambers per whorl. *Cibicidoides* sp. A has a semi-involute dorsal side, and its sutures on the umbilical side are very similar to those of *C. hyphalus*; for these reasons we consider that *Cibicidoides* sp. A may be related to the *hyphalus* group.

Occurrence: Rare in the Méndez shale in sections El Peñón and El Tecolote.

Cibicidoides velascoensis (Cushman) 1925
Plate 4, figure 7

Anomalina velascoensis CUSHMAN 1925, p. 21, pl. 3, figs. 3a-c. – CUSHMAN 1926a, p. 607, pl. 21, figs. 7a-c. – CUSHMAN 1927b, p. 170, pl. 28, fig. 14.
Planulina velascoensis (Cushman). – WHITE 1928b, p. 303, pl. 41, figs. 7a-c.
Gavelinella velascoensis (Cushman). – TJALSMA and LOHMANN 1983, p. 14, pl. 5, fig. 8.
Cibicidoides velascoensis (Cushman). – VAN MORKHOVEN et al. 1986, p. 371, pl. 121, figs. 1, 2.

Description: Test trochospiral, planoconvex; periphery rounded. Dorsal side nearly flat, coarsely punctate, thickened in the center with a depressed area coinciding with the line of coiling; sutures somewhat limbate and raised. Ventral side convex and broadly rounded, evolute, finely perforate. Chambers fairly distinct, sutures curved, nearly flush on the ventral side. Wall calcareous, smooth.

Remarks: The holotype (Cushman Collection No. 4345, Smithsonian Institution) is well preserved and clearly shows the line of coiling on the dorsal side, which is not visible in most of our specimens due to preservation. *Cibicidoides velascoensis* can be distinguished from *C. hyphalus* (Fisher) by its more strongly convex evolute side, fewer chambers in the last whorl and a more rounded periphery. The specimen in White's collection at the American Museum of Natural History (figured in 1928) shows the distinctive characteristics of *C. velascoensis* (Cushman); the dorsal side in this specimen is transparent, and all the dorsal whorls and chambers can be clearly seen, as figured.

Occurrence: Rare to very rare in the Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral and El Mulato. *Cibicidoides velascoensis* also appears as a rare species in the Méndez Formation in section La Ceiba.

Clavulinoides amorpha (Cushman) **emend.** Alegret and Thomas
Plate 5, figures 1-3

Clavulina amorpha Cushman 1926a, p. 589, pl. 17, fig. 5. – WHITE 1928b, p. 315, pl. 42, fig. 12.
Clavulina trilatera var. *aspera* Cushman. – WHITE 1928b, p. 315, pl. 42, fig. 14.
Clavulina aspera CUSHMAN and JARVIS 1932, p. 19, pl. 5, fig. 4.
Clavulina aspera Cushman var. *whitei* CUSHMAN and JARVIS 1932, p. 19, pl. 5, figs. 6, 8 (non 7).
Clavulinoides aspera (Cushman). – CUSHMAN 1946, p. 38, pl. 9, figs. 24-30. – KAMINSKI et al. 1988, p. 194, pl. 8, figs. 11, 12. – WIDMARK and MALMGREN 1992a, p. 113, pl. 10, fig. 10.
Tritaxia aspera (Cushman). – TJALSMA and LOHMANN 1983, p. 20, pl. 1, fig. 1.

Description: Test large, stout and elongate, triangular in cross section. Chambers triserial in early stage, uniserial in later portion. Periphery acute to subacute in the early portion of the test, rounded in later, uniserial portion. Uniserial chambers are globular and separated by depressed sutures. Aperture consists of a rounded opening at the end of a slight projection. Walls coarsely agglutinated.

Remarks: Chambers in the last portion of the test, typically globular and rounded in section, are the main characteristics to distinguish *C. amorpha* (Cushman) from other *Clavulinoides* species. Uniserial, globular and coarsely agglutinated broken pieces have been included into *C. amorpha* and are considered as a broken piece containing the last chambers of this species. At the Smithsonian Institution we examined several types of *Clavulinoides*.The species that we named *C. amorpha* has commonly been called *C. aspera* (see synonymy), but the holotype of *Clavulina trilatera* var. *aspera* Cushman (Cushman Collection No. 5154) has angular chambers throughout the test, from the initial part to the later uniserial one, instead of having the globular, inflated last chambers typical in our material. The holotype of *Clavulina amorpha* (Cushman Collection No. 5153) presents those rounded, inflated last chambers, although its preservation is not very good. We therefore decided that *C. amorpha* is the earliest described species with the characteristics typical of our material. A slide labeled *Clavulina amorpha* Cushman in White's collection at the American Museum of Natural History contains several specimens, including the one figured in 1928, which also closely resemble our material and show the globular, rounded chambers in the last part of the test. The holotype of *Clavulina aspera* Cushman var. *whitei*

(Cushman Collection No. 15306) looks exactly the same as our material, with the inflated last chambers, and is much better preserved than the holotype of *C. amorpha*. A paratype of *C. whitei* (Cushman Collection No. 15307), however, figured by Cushman and Jarvis in 1932 (pl. 5, fig. 7a, b) agrees with the description of *C. trilatera* (Cushman) and has keeled chambers throughout. The specimens that White figured as *Clavulina trilatera* var. *aspera* Cushman (pl. 42, fig. 14) are consistent with our concept of this species.

Occurrence: Rare in the Méndez and Velasco Formation in all studied sections; very rare in section Los Ramones.

Clavulinoides amorpha juvenile form
Plate 5, figures 4-5

Description: Test triserial, triangular in cross section, with greatest width close to the apertural end. Margins rounded to subacute. Chambers indistinct except for the last ones, more or less circular in cross section and separated by depressed sutures. Aperture small and rounded, hardly visible, at the base of the last chamber. Wall coarsely agglutinated but smoothly finished.

Remarks: These specimens resemble *Tritaxia paleocenica* Tjalsma and Lohmann but, according to the characteristics cited above, have been considered not as a different species but as juvenile individuals of *Clavulinoides amorpha* (Cushman), without the uniserial chambers. Specimens included in this taxon always co-occur with adult forms of *C. amorpha* (Cushman).

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral, El Mulato, El Peñón and El Tecolote.

Clavulinoides trilatera (Cushman) 1926
Plate 5, figures 6-8

Clavulina trilatera CUSHMAN 1926a, p. 588, pl. 17, fig. 2. – WHITE 1928b, p. 315, pl. 42, fig. 13. – CUSHMAN and JARVIS 1932, p. 18, pl. 5, fig. 5.
Clavulina trilatera Cushman var. *aspera* CUSHMAN 1926a, p. 589, pl. 17, fig. 3.
Clavulinoides trilaterus (Cushman). – LEROY 1953, p. 26, pl. 1, figs. 9-10.
Tritaxia trilatera (Cushman). – TJALSMA and LOHMANN 1983, p. 21, pl. 1, fig. 2.
Clavulinoides trilatera (Cushman). – KAMINSKI et al. 1988, p. 195, pl. 9, fig. 2.
Tritaxia aspera (Cushman). – WIDMARK 1997, p. 21, pl. 7, fig. C, not Cushman.

Description: Test large, elongate, margins angular, sides parallel throughout its length, slightly contracted at both ends. Chambers numerous, in the early stage of the test triserial, in the later parts uniserial; sutures somewhat indistinct. Triangular in cross section along triserial and uniserial part of the text. Aperture circular, at the end of a short neck at the end of the last chamber. Wall coarsely agglutinated, smoothly finished.

Remarks: We examined the holotype of *C. trilatera* at the Smithsonian Institution (Cushman Collection No. 5155); specimens from our material are very similar to this holotype. *Clavulinoides trilatera* differs from *C. aspera* (Cushman) by its angular margins extending throughout the test, from the initial stage to the last chamber. The specimen figured by White in 1928 and determined as *Clavulina trilatera* Cushman was found in his collection, and it is consistent with the original description of *C. trilatera* (Cushman).

Occurrence: This species occurs in all studied sections; it is abundant to very abundant in the Méndez Formation, and rare to abundant in the Velasco Formation.

Clavulinoides trilatera juvenile form
Plate 5, figures 9-10

Description: Test triserial, margins angular; cross section triangular, increasing in width as chambers are added. Chambers and sutures rather indistinct. Aperture small and rounded, hardly visible, at the base of the last chamber. Wall coarsely agglutinated but smoothly finished.

Remarks: Specimens with these characteristics are very similar to the early stages of *C. trilatera* (before the development of uniserial chambers) and we consider these forms juveniles of *C. trilatera* (Cushman). These juvenile forms are always associated to adult species of *C. trilatera* (Cushman).

Occurrence: The species occurs in all studied sections, and is abundant to very abundant in the Méndez and lowermost Velasco Formation (common in section Los Ramones), and rare to very rare in the remainder of the Velasco Formation.

Coryphostoma incrassata (Reuss) 1851
Plate 4, figures 8-9

Bolivina incrassata REUSS 1851, p. 45, pl. 4, fig. 13. – WHITE 1929, p. 44, pl. 4, fig. 19 – CUSHMAN 1946, p. 127, pl. 53, figs. 8-11. – MCGUGAN 1957, p. 340, pl. 32, figs. 1-4. – MCGUGAN 1964, p. 942, pl. 150, figs. 22, 23. – SLITER 1968, p. 88, pl. 12, fig. 14. – KOCH 1977, p. 54, pl. 14, figs. 5-6.
Coryphostoma cf. *midwayensis* (Cushman). – TJALSMA and LOHMANN 1983, p. 12, pl. 2, fig. 8 (non fig. 7)
Coryphostoma incrassata (Reuss). – VAN MORKHOVEN et al. 1986, p. 382, pl. 126, figs. 1, 2.
Coryphostoma incrassatum (Reuss). – BOLLI et al. 1994, p. 138, pl. 37, figs. 10-12.

Description: Test stout, elongate, moderately compressed; greatest breadth toward the apertural end, periphery rounded. Chambers biserially arranged, numerous and somewhat inflated; sutures distinct, oblique and slightly depressed. Aperture loop-shaped, at the inner margin of the last chamber, with a internal tooth-plate which can not be observed in our material. Wall calcareous, thick, smooth, very finely perforate; occasionally very fine striae at the surface.

Remarks: A slide in White's collection at the Museum of Natural History contained the specimen figured in 1929, which agrees fully with the description of *C. incrassata* and strongly resembles our specimens. A slide labeled *C. incrassata* contains a non-figured specimen, which more resembles *C. incrassata gigantea* (Wicher) (see below).

Occurrence: Rare in the Méndez and Velasco Formation in sections La Ceiba, El Mimbral, El Mulato and Los Ramones; abundant in sections La Lajilla, El Peñón and El Tecolote.

Coryphostoma incrassata* forma *gigantea (Wicher) 1949
Plate 5, figure 11

Bolivina incrassata Reuss, forma *gigantea* WICHER 1949, p. 57, pl. 5, figs. 2-3. – WICHER 1956, p. 120, pl. 12, figs. 2-3.
Bolivina incrassata gigantea Wicher. – KOCH 1977, p. 54, pl. 14, figs. 1-2.
Coryphostoma incrassata gigantea (Wicher). – SPEIJER 1994, p. 52, pl. 1, figs. 4, 5.

Description: Test elongate, compressed, oval in section. Greatest width of the test at the middle portion or toward the apertural end. Chambers biserially arranged, numerous, separated by somewhat depressed sutures. Commonly, chambers thicken slightly toward the middle longitudinal portion of the test, showing a row of protuberances. Aperture at the inner margin of the last chamber. Wall calcareous, thick, smooth.

Remarks: C. incrassata forma *gigantea* differs from *C. incrassata* (Reuss) by its thicker and larger test, less elongate, somewhat oval outline and, when visible, the longitudinal row of protuberances. A slide labelled *C. incrassata* (Reuss) was found in White's collection at the Museum of Natural History; this specimen resembles *C. incrassata* forma *gigantea.*

Occurrence: Rare to absent in the Méndez Formation from all sections, very abundant in section Los Ramones; abundant to very abundant in the lower Velasco Formation in all studied sections.

Dorothia bulleta (Carsey) 1926
Plate 5, figure 12

Gaudryina bulleta CARSEY 1926, p. 28, pl. 4, fig. 4.
Dorothia bulleta (Carsey). – LEROY 1953, p. 27, pl. 2, figs. 7-8. – SLITER 1968, p. 49, pl. 3, figs. 11a, b. – WIDMARK 1997, p. 21, pl. 8, fig. A.

Description: Test large, elongate, almost cylindrical with rounded periphery; in cross section subcircular to oval. Width of cross section more or less constant throughout the test. Early stages trochospiral, later biserial. Chambers distinct, particularly those in the biserial stage, inflated, separated by depressed sutures; the two last chambers are most inflated. Aperture an arc at the base of the last chamber. Wall finely agglutinated, smooth.

Occurrence: Very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral, El Mulato and El Peñón.

Dorothia bulleta juvenile form
Plate 5, figure 13

Description: These specimens are small, elongate, and consist of a short early trochospiral stage, and a longer biserial part with the last two chambers inflated. Aperture a low arc at the base of the last chamber; wall agglutinated smoothly finished.

Remarks: These specimens are considered to be juvenile individuals of *Dorothia bulleta* (Carsey), with which is commonly found co-occurring.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla and El Mulato.

Dorothia bulleta coarsely agglutinated variant
Plate 5, figures 14-15

Description: Representatives of this taxon have almost the same characteristics as *D. bulleta*, but they are smaller, with an oval cross section. All chambers in the biserial part are equally inflated, and the wall is coarsely agglutinated.

Occurrence: Abundant in the Velasco Formation in sections La Lajilla, El Mimbral and El Mulato, very rare in the Méndez Formation in sections Los Ramones and El Tecolote.

Dorothia pupa (Reuss) 1860
Plate 5, figures 16-17

Textularia pupa REUSS 1860, p. 232, pl. 13, figs. 4a,b.
Dorothia pupa (Reuss). – CUSHMAN 1937, p. 78, pl. 8, figs. 22 and 24 (20, 21, 23?). – LEROY 1953, p. 28, pl. 1, figs. 14-15. – MCGUGAN 1964, p. 941, pl. 150, fig. 15, 16. – SLITER 1968, p. 50, pl. 4, figs. 1a, b. – GAWOR-BIEDOWA 1992, p. 56, pl. 7, fig. 11. – WIDMARK and MALMGREN 1992a, p. 111, pl. 10, fig. 1. – WIDMARK 1997, p. 22, pl. 8, fig. B.

Description: Test stout and tapering, with pointed initial part. Subcircular in cross section; width of the cross section increases from the early portion to the later one. Chambers in early stage trochospiral; later biserial; two last chambers inflated and strongly overlapping earlier parts of the test; sutures indistinct, except for the last ones, which are more depressed. Aperture an arc at the base of the last chamber. Wall agglutinated and smooth, fine-textured.

Remarks: This species is shorter and thicker than *D. bulleta* (Carsey), with more inflated chambers, especially the last two; the diameter of the test increases very rapidly from the early stages on.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections; absent in section Los Ramones.

Dorothia pupa juvenile form
Plate 5, figures 18-19

Description: These specimens are small, somewhat longer than broad, and consist of an early trochospiral stage, and a short, broadly rounded, biserial part with the last two chambers inflated. Aperture a low arc at the base of the last chamber. Wall agglutinated, smoothly finished.

We consider these specimens to be juvenile individuals of *Dorothia pupa* (Reuss), with which it is usually found.

Remarks: In White's collection at the Museum of Natural History we examined the specimens named *Gaudryina retusa* Cushman. These specimens were very similar to our material, and close to that figured by White in 1928 (pl. 42, fig. 9), although they do not resemble figure 8 (pl. 42). We consider that these specimens are juvenile forms of *Dorothia pupa* (Reuss).

Occurrence: Very rare in the Mendez and Velasco Formation in all studied sections, but abundant in the Velasco Formation in section La Lajilla.

Eouvigerina subsculptura McNeil and Caldwell 1981
Plate 6, figures 1-2

Eouvigerina aculeata CUSHMAN 1933a, p. 62, pl. 7, fig. 8.
Eouvigerina subsculptura (nomen novum) MCNEIL and CALDWELL 1981, p. 21, pl. 18, figs. 20, 21. – WIDMARK and MALMGREN 1992a, p. 111, pl. 1, fig. 8. – BOLLI et al. 1994, p. 131, pl. 35, figs. 12, 13. – SPEIJER 1994, p. 48, pl. 1, fig. 7. – WIDMARK 1997, p. 36, pl. 14, fig. D. – WIDMARK and SPEIJER 1997b, p. 147, pl. 1, fig. 5.

Description: Test small, elongate, tapering; periphery lobate. Maximum width of the test at the last two chambers. Early portion biserial, compressed; later chambers uniserial. Chambers distinct in the adult part, with a costate rim along the upper half of each chamber, slightly concave in the lower part. Sutures distinct and depressed in the later portion of the test. Aperture terminal, at the end of a short neck. Wall calcareous, rugose surface in the earliest chambers, smooth in the later ones.

Remarks: The studied material presents a rugose wall surface in the earlier part of the test, and smooth chambers in the later portion, as described and figured by McNeil and Caldwell (1981) in their material from the Manitoba Escarpment. We examined the holotype of *E. aculeata* (Cushman Collection n° 19047), and found it consistent with the concept of the species described by McNeil and Caldwell; it consists of a small specimen with a smooth surface and a neck with a rounded lip.

Occurrence: Very abundant in the Méndez Formation in sections La Lajilla, El Mimbral, El Mulato, El Peñón and El Tecolote; rare in sections La Ceiba and Los Ramones. Very rare in the Velasco Formation in sections El Mimbral and El Mulato.

Euuvigerina elongata (Cole) 1927
Plate 5, figures 20-22

Uvigerina elongata COLE 1927, p. 26, pl. 4, figs. 2, 3.
Euuvigerina elongata (Cole). – BOLLI et al. 1994, p. 138, p.137, fig. 4.

Description: Test stout, elongate, periphery rounded. Early stage triserial, followed by a biserial stage, later chambers become uniserial. Sutures distinct, depressed; chambers inflated throughout the test, except for the latest ones. Aperture terminal, at the end of a short neck. Wall calcareous, with small, short spines throughout the test.

Remarks: One paratype of *E. elongata* was examined at the Smithsonian Institution (USNM No. 243225); this specimen is better preserved than our material, and clearly shows the short spines all over the surface. The early triserial stage is very small in some specimens, and thus is difficult to see. In these specimens, *Euuvigerina elongata* can be distinguished from *Eouvigerina subsculptura* McNeil and Caldwell by its smaller size, globular chambers, and ornamentation of the test consisting of tiny spines.

Occurrence: Rare to abundant in the Velasco Formation in sections La Lajilla, El Mimbral and El Mulato.

Gaudryina laevigata Franke 1914
Plate 6, fgure 3

Gaudryina laevigata FRANKE 1914, p. 431, pl. 27, figs. 1-2. – CUSHMAN 1926a, p. 587, pl. 17, figs. 1a-b. – CUSHMAN 1946, p. 33, pl. 8, fig. 4. – NAKKADY 1959, p. 457, pl. 1, figs. 5a-b. – SLITER 1968, p. 48, pl. 3, fig. 8. – BOLLI et al. 1994, p. 89, pl. 23, figs. 35-37.

Description: Test tapering, more or less elongate. Early portion triserial and sharply triangular in cross section; later portion biserial, increasing in diameter rapidly; many chambers in the biserial part. Chambers distinctive, inflated and overlapping; characteristic truncated chamber margins. Sutures distinctive and depressed. Aperture barely visible, at the inner margin of the last-formed chamber. Wall finely agglutinated smoothly finished.

Remarks: This species varies considerably in the degree of broadening of the biserial part. It is smaller, thinner and more elongated than *G. pyramidata* Cushman, and has more inflated chambers (see below).

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Peñón and El Tecolote.

Gaudryina pyramidata Cushman 1926
Plate 6, figure 4

Gaudryina laevigata Franke var. *pyramidata* CUSHMAN 1926a, p. 587, pl. 16, figs. 8a-b. – WHITE 1928b, p. 313, pl. 42, fig. 7. – CUSHMAN and JARVIS 1932, p. 18, pl. 5, fig. 3.
Gaudryina (Pseudogaudryina) pyramidata Cushman. – CUSHMAN 1946, p. 36, pl. 8, fig. 14.
Gaudryina pyramidata Cushman. – LEROY 1953, p. 31, pl. 1, figs. 17, 18. – NAKKADY 1959, p. 457, pl. 1, figs. 6a-b. – TRUJILLO 1960, p. 308, pl. 44, figs. 9a-c. – SLITER 1968, p. 48, pl. 3, fig. 9. – TJALSMA and LOHMANN 1983, p.12, pl. 2, fig. 4; pl. 8, fig. 1. – KAMINSKI et al. 1988, p. 194, pl. 8, fig. 7. – WIDMARK and MALMGREN 1992a, p. 111, pl. 10, fig. 3. – SPEIJER 1994, p. 44, pl. 4, fig. 1. – WIDMARK 1997, p. 20, pl. 7, figs. F-G.
Gaudryina cf. *pyramidata* Cushman. – TJALSMA and LOHMANN 1983, p.12, pl. 8, fig. 2.

Description: Test pyramidal, more or less elongate; periphery acute. Transverse section triangular in the triserial early stage, subrectangular and biserial in later portion. Chambers low and broad, increasing in size as added and slightly inflated in later portion of the test. Sutures distinct and somewhat depressed. Aperture consists of a low interiomarginal opening. Walls rather coarsely agglutinated.

Remarks: In White's collection at the Museum of Natural History we studied several specimens determined as *G. laevigata* Franke var. *pyramidata* Cushman. They are small and have an acute periphery, and strongly resemble the original species description. We could not identify the specimen figured by White in 1928, because all specimens that we examined were very similar. There seems to be a morphological variability in the last chambers (rounded to more acute).

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral, El Mulato, El Peñón and El Tecolote; abundant in section La Ceiba.

***Gaudryina* sp.** flattened
Plate 6, figure 5

Description: Test pyramidal, all the specimens appear flattened; rectangular in cross section. Early portion very reduced, triserial; later portion biserial, low and very broad. Aperture a low opening at the inner margin of the last chamber. Walls agglutinated, coarsely grained.

This species resembles *Gaudryina pyramidata* Cushman, but differs by a much broader cross section of the biserial part. The biserial stage in *G. pyramidata* is longer, and the chambers increase more gradually in size as added, whereas the few chambers in *Gaudryina* sp. flattened increase very rapidly in width, especially the last two ones.

Occurrence: Very rare in the Velasco Formation in sections La Lajilla, El Mulato and El Peñón.

***Globorotalites* sp. A**
Plate 6, figure 6

Description: Test trochospiral planoconvex, outline suboval, somewhat lobate; periphery acute. Dorsal side evolute, flat, about two whorls visible; sutures straight, slightly elevated. Ventral side involute, strongly convex; chambers distinct, 6 visible in the last whorl. Ventral sutures distinct, depressed, straight to slightly curved, meeting in a point in the center over the small umbilicus. Apertural face indented, aperture slitlike, interiomarginal, about midway between the umbilicus and the periphery but coomonly obscured by sediment deposited into the indentation. Wall calcareous, finely perforate and smoothly finished.

Occurrence: Abundant in the Velasco Formation in sections La Lajilla, El Mimbral and El Mulato. Common in section Los Ramones; very rare in the Méndez Formation in sections La Ceiba, El Mimbral and El Peñón.

Globorotalites multiseptus (Brotzen) 1936
Plate 6, figure 7

Globorotalia multisepta BROTZEN 1936, p. 161, pl. 11, figs. 6-7, text. figs. 59-61.
Globorotalites multiseptus (Brotzen). – BROTZEN 1942, p. 31. – REVETS 1996, p. 111, figs. 1-4, text. figs. 80.

Description: Test trochospiral conical, periphery angular, with a slightly thickened keel. Spiral side flat and evolute, sutures limbate or arcuate. Umbilical side very convex and involute, chambers narrow and oblique, sutures flush and sigmoidal. Aperture consisting of a narrow interiomarginal slit extending from the umbilicus to the periphery. Walls calcareous, finely perforated.

Remarks: We examined several syntypes of *G. multiseptus* at the Smithsonian Institution (Cushman Collection No. 25669, 25670); they are clearly representative of the species, and show the rounded lip at the peripheral margin, as well as an open umbilicus and slightly curved dorsal sutures, tangent to the spiral suture. We do not agree with the specimens determined as syntypes of *G. multisepta* in slide Cushman Collection No. 25671: this slide contains one *Gyroidinoides goudkoffi* (Trujillo) and a small *Cibicidoides* sp.

Occurrence: Rare to very rare in the Méndez Formation in sections El Peñón and El Tecolote; common in section Los Ramones.

Glomospirella grzybowskii Jurkiewicz 1960
Plate 6, figure 8

Glomospirella grzybowski JURKIEWICZ 1960, p.342, pl. 38, figs. 7, 10, 11. – BUBÍK 1993, p. 81, pl. 9, fig. 12. – KUHNT and KAMINSKI 1993, p. 73, pl. 2, fig. 5. – MUFTAH 1993, p. 177, pl. 1, fig. 9. – KAMINSKI et al. 1996, p. 12, pl. 1, fig. 10.

Description: Test consisting of a proloculus, followed by a streptospirally enrolled, non-divided tubular chamber, which later becomes planispirally coiled. Aperture at the end of the tube. Wall finely agglutinated, smooth.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections; absent in section Los Ramones.

Gyroidinoides beisseli (White) **emend.** Alegret and Thomas
Plate 7, figures 1-10

Gyroidina beisseli WHITE 1928b, p. 291-292, pl.39, figs. 7a-c
Gyroidina comma WHITE 1928b, p. 292, pl. 39, figs. 8a-c
Gyroidina mendezensis WHITE 1928b, p.293, pl. 40, fig. 4a-c.
Gyroidina nitida (Reuss). – WHITE 1928b, p.296, pl. 40, figs. 6a-c (not Reuss).
Gyroidina simplex WHITE 1928b, p.296, pl. 40, fig. 7.
Gyroiina sparski WHITE 1928b, p.297, pl. 40, fig. 8.
Gyroidina vortex WHITE 1928b, p. 297, pl. 40, figs. 9a-c
Gyroidina nitida (Reuss). MORROW 1934, p. 197, pl. 30, figs. 1a-c. – CUSHMAN 1946, p. 140, pl. 58, fig. 5.
Eponides bollii CUSHMAN and RENZ 1946,
Eponides simplex (White). – CUSHMAN1946, p. 142, pl. 57, fig. 15.
Eponides cf. *beisseli* Schijfsma. – MCGUGAN, 1964, p. 944, pl. 151, fig. 4.
Eponides cf. *simplex* (White). – MCGUGAN, 1964, p. 945, pl. 151, figs. 7, 8.
Gyroidinoides nitidus (Reuss). – SLITER, 1968, p. 121, pl. 22, figs. 7a-c. – QUILTY, 1992, p. 421, pl. 7, figs. 10, 11. – REVETS 1996, p. 78, pl. 11, figs. 5-8. – WIDMARK 1997, p.73, pl. 36, figs. D-F.
Gyroidinoides beisseli (White). – DAILEY, 1983, p. 767, pl. 6, figs. 5-6, 9. – WIDMARK and MALMGREN, 1992a, p. 111, pl. 7, fig. 2. – WIDMARK 1997, p. 71, pl. 35, figs. A-C.
Gyroidinoides (Rotalina) nitidus (Reuss). – LOEBLICH and TAPPAN, 1988, p. 633, pl. 713, figs. 7-9.
Oridorsalis nitidus (Reuss). – THOMAS 1990a, p. 590, pl. 3, figs. 7-9.
Gyroidinoides bollii (Cushman and Renz). – KAIHO 1998, p. 292, pl. 1, fig. 2.

Description: Test trochospiral, ranging with considerable variability from planoconvex to somewhat biconvex; subcircular in outline, periphery angular but with a rounded, sometimes angular to subangular edge. Dorsal side flat to slightly convex, with the coil more or less projecting; when convex, it shows a very distinct and raised spiral suture. The central part of the test on the dorsal side is commonly covered with a thick layer of calcite, making sutures in that part difficult to see. Chambers longer than broad on the dorsal side, sutures oblique. Umbilical side convex and involute, 6 to 8 chambers visible on the last whorl; sutures curved to slightly sinuate, flush to somewhat depressed. Umbilicus very narrow, open to hidden by the overhanging flaps of the last chambers over the umbilical side. Aperture a long narrow interiomarginal slit, extending from the umbilicus to the periphery; in some specimens surrounded by a depression in the apertural face; others present a distinct lip. Wall calcareous, characteristically thick, smooth and finely perforated.

Remarks: In 1928, White defined several new species of *Gyroidinoides* in his material from the Tampico Embayment. We examined the syntypes of these species, because White did not designate a holotype for any of his species at the American Museum of Natural History. The abundant *Gyroidinoides* in our material from the Gulf of Mexico allowed us to recognize many forms intermediate between the various species defined by White.

The slide marked *G. beisseli* (Slide No. 19897) contained 12 specimens, and we could not be certain which specimen was figured by White (1928b): White's figures 7a and 7b show a dextrally coiled specimen, while his figure 7c shows a sinistrally coiled specimen. We designated a lectotype from the series of syntypes, now labeled No. 19897-a. The specimen is shown in plate 7, figure 1. The slide with the remaining paratypes is now labeled No. 19897-b. The specimens in this slide are variable, but all more or less biconvex, with the involute side slightly more convex than the evolute side, and the periphery subacute.

The slide labeled *G. comma* (No. 19898) contained 4 specimens. We could recognize the figured specimen easily, because only one of the specimens has a diameter of 1.1µm, as White described the holotype. This holotype is now in a slide labeled No.19898-a, and the remaining paratypes are labeled 19898-b. The species is larger than *G. beisseli*, but the overall shape is very similar. The holotype is a rather extreme specimen, with a more acute periphery than all other specimens in the slide, which show varying angularity. The size and shape of the umbilicus is variable in individuals that we studied, and we do not consider this a valid criterion to establish a separate species. The holotype is figured in plate 7, figure 2.

The slide labeled *G. mendezensis* (No. 19900) contained 8 specimens, which differ from *G. beisseli* by having (on average) a slightly higher involute side. This character, however, is quite variable within these *Gyroidinoides* species, and we do not want to use it to separate a distinct species. The periphery is subacute; according to White there is a depression in the apertural face. We could indeed recognize the figured specimen, which has this character (pl. 7, fig. 3), and that we thus recognize as the holotype. The other specimens in the slide, however, do not have this character, or have it much less pronouncedly. In specimens labeled *G. beisseli* and *G. comma* in White's collection we noticed variability in the shape of the apertural face, with a depression being absent, slight or more pronounced in all three groups. The holotype is now labeled No.19900-a, the remaining paratypes are labeled 19900-b.

The slide labeled *G. simplex* (No.19903) contained 7 specimens. We could not recognize the figured specimen in this group because none of the syntypes was similar to the figured specimen. We thus chose a lectotype from the syntypes (pl. 7, fig. 5). This group of specimens is similar in outline and shape of the periphery to *G. beisseli*, but the specimens have, on average, a thicker layer of secondary calcite covering the central part of the evolute side. The lectotype is now labeled No.19903-a, the remaining paratypes No.19903-b.

The slide labeled *G. sparksi* (No.19904) contains 2 specimens, neither of which resemble the figured specimen. Both were much flatter in outline, as well as smaller. We chose one specimen as lectotype (pl. 7, fig. 4). We consider this also to be a synonym of *G. beisseli*. The characters listed to separate it from *G. simplex* are a smaller umbo and a more indented periphery. Both characters are variable throughout all new species of *Gyroidinoides* described by White. The lectotype is labeled No.19904-a, the remaining paratype 19904-b.

The slide labeled *G. vortex* (No.19905) contains 10 specimens, once of which is in our opinion a misidentified *N. truempyi*. None of the specimens resembles the figured one, which has a very rounded periphery. All specimens in this slide have a subacute periphery, with an, on average, higher involute side than the other taxa that we included in *G. beisseli*. This character is, however, highly variable. *G. vortex* is said to have more wavy sutures on the involute side, but we see these sutures vary from straight to wavy in all taxa that we include in *G. beisseli*. We chose a lectotype (pl. 7, fig. 6), which is now labeled No. 19905-a, while the remaining paratypes are labeled No. 19905-b.

Slide No. 15444 in the Smithsonian contains three plesiotypes of *G. nitidus* that are in complete agreement with our description of *G. beisseli*, and very similar to our material. They show a thick, high plano-convex test and subacute periphery, with chambers longer than broad and the coil projecting on dorsal side. On dorsal view the outline is somewhat lobate because of depressed sutures between the last few chambers.

In our concept, *G. beisseli* differs from *G. goudkoffi* (Trujillo) by its subangular periphery, which is not sharp (tending towards a keel) but has a rounded, sometimes angular to subangular edge, but not as sharp as *G. goudkoffi*. We identified many specimens intermediate between the various species defined by White in our material as well as in White's picked specimens. For a long time, the taxonomy of the various *Gyroidinoides* species within this group has been in a considerable state of confusion, with the use of names inconsistent from author to author. We consider that all these types with different names represent wide intraspecific variability of *G. beisseli* (White), and therefore are junior synonyms.

Occurrence: Abundant to very abundant in the Méndez Formation and rare in the Velasco Formation in sections La Ceiba, El Mimbral, El Mulato, El Peñón and El Tecolote. In section La Lajilla, *G. beisseli* is abundant in both the Méndez and the Velasco Formation, and it is common in section Los Ramones.

Gyroidinoides depressus (Alth) 1850
Plate 6, fgure 9

Rotalina depressa ALTH 1850, p.266, pl. 13, fig. 21.
Gyroidina depressa (Alth). – CUSHMAN and JARVIS, 1932, p. 46, pl. 14, figs. 1a-c.– Sandidge, 1932, p. 283, pl. 43, figs. 16-18.
Gyroidinoides depressus (Alth). – DAILEY, 1983, p. 767, pl. 6, figs. 10-12. – BOLLI et al. 1994, p. 159, pl. 44, figs. 29, 30, 32-34.
Valvalabamina sp., evolute form. WIDMARK, 1997, p. 61-62, figs. 28a-c.

Description: Test trochospiral compressed, periphery rounded. Dorsal side evolute, flat to slightly convex, with sutures curved, depressed between later chambers. Umbilical side involute, convex with a depressed umbo; umbilical sutures almost straight. Eight to nine chambers visible in the last whorl, later ones somewhat inflated. Aperture a narrow slit extending from the periphery to the umbilicus. Wall calcareous, smooth.

Remarks: Gyroidinoides depressus is distinguished from other species of *Gyroidinoides* by its flat test, rounded periphery and depressed umbo. According to Loeblichand Tappan (1998), this species was considered a junior synonym of *Valvalabamina lenticula* (Reuss) by Reiss (1963). In our opinion, this is not certain. Bolli et al. (1994) state that the two species are different, because *G. depressus* lacks a flap over the umbo, whereas *V. lenticula* has a pronounced flap. The type description of *G. depressus* states that the species resembles *V. lenticula* closely, but has no flaps. We have not seen flaps in our specimens, although this might be caused by preservation. Widmarks's (1997) specimen, which he names '*Valvalabamina* sp. evolute form' resembles our material closely, and has no flap. Speijer's (1994) specimen, which he named *Valvalabamina depressa* (Alth), (p. 56, pl. 4, fig. 5) is not the same as our species, has a large flap over the umbo on the ventral side, and a more convex ventral side. In view of the uncertainty, we wish to keep the name *G. depressus* until the type material of the two taxa has been compared.

Occurrence: Abundant in the Méndez and Velasco Formation in all studied sections; common in section Los Ramones.

Gyroidinoides girardanus (Reuss) 1851
Plate 6, figure 10

Rotalina girardana REUSS 1851, p. 73, pl. 5, fig. 34.
Gyroidina girardana (Reuss). – CUSHMAN 1933b, p.311, pl. 36, figs. 1a-c. – CUSHMAN 1946, p. 140, pl. 58, fig. 9. – LEROY 1953, p. 35, pl. 5, figs. 10-12. – NAKKADY 1959, p. 460, pl. 3, figs. 1a-c.
Gyroidinoides tellburmaensis FUYTAN 1976, p. 532, pl. 81, figs. 10-12. – SPEIJER 1994, p. 62, pl. 3, fig. 1. – WIDMARK 1997, p. 75, pl. 35, figs. D-G.
Gyroidinoides gyrardanus (Reuss). – DAILEY 1983, p. 767, pl. 7, figs. 1-3. – WIDMARK and MALMGREN 1992a, p. 111, pl. 6, fig. 3. – SPEIJER 1994, p. 118, pl. 3, fig. 3.

Description: Test trochospiral planoconvex. Periphery with a distinct angle at the dorsal edge. Dorsal side flattened or even slightly concave, ventral side convex with an open umbilical region open. Chambers distinct, slightly inflated; sutures somewhat depressed and nearly radial on both sides. Aperture a low slit between the periphery and the umbilicus. The shape of the apertural face is very typical in this species, flaring out in a somewhat concave shape along the dorsal side. Wall calcareous, smooth.

Remarks: Gyroidinoides girardanus differs from other species of *Gyroidinoides* by its typical, somewhat concave apertural face, with an angular shoulder hanging toward the dorsal side. Several secondary types of *G. girardanus* were examined at the Smithsonian Institution (USNM Nos. G27114 and G27353), and were found consistent with the original description of the species. Speijer (1994) and Widmark (1997) describe a species *Gyroidinoides telburmaensis* (Fuytan), which in their description resembles *G. girardanus* closely, but has chamber sutures on the evolute side that are at less than right angles to the spiral suture, whereas these sutures are said to be at right angles in *G. girardanus*. We are not convinced that these are separate species. Widmark (1997) states that types of *G. girardanus* are consistent with specimens of *G. telburmaensis*. We commonly observe variability in the angle between chamber sutures and the spiral suture, even within one individual, as also seen in the figure in Cushman (1946). We therefore consider it probable that *G. telburmaensis* is a junior synonym of *G. girardanus*.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections.

Gyroidinoides globosus (Hagenow) **emend.** Alegret and Thomas
Plate 8, figures 1-5

Nonionina globosa HAGENOW 1842, p. 574.
Rotalina nitida REUSS 1845, p. 35, pl. 8, fig. 52, pl. 12, figs. 8, 20.
Gyroidina crassa (d'Orbigny). – WHITE 1928b, p. 292, pl. 40, figs. 1a-c (not d´Orbigny).
Gyroidina naranjoensis WHITE 1928b, p. 296, pl. 40, figs. 5a-c.
Gyroidina nitida (Reuss). – WHITE 1928b, p. 296, pl. 40, figs. 6a-c. – BROTZEN 1942, p. 19, fig. 6, 3
Gyroidinoides globosus (Hagenow). – DAILEY 1983, p. 767, pl. 7, figs. 4, 7, 8. – TJALSMA and LOHMANN 1983, p. 14, pl. 7, fig. 5. – VAN MORKHOVEN et al. 1986, pp. 329, 330, pl. 107. – WIDMARK 1997, p.71, pl. 35, figs. H-J.
Gyroidinoides globosa (Hagenow). – QUILTY 1992, p. 421, pl. 7, figs. 4, 5.

Description: Test stout, trochospiral, globular and inflated, unequally biconvex; subcircular in outline, periphery broadly rounded. Dorsal side slightly convex; sutures distinct, nearly straight. Umbilical side strongly convex, 6 to 7 chambers visible in the last whorl, somewhat inflated; sutures radial, slightly curved, depressed between the last chambers. Large apertural face, about four times longer than high; the aperture consists of a low interiormarginal slit extending from the periphery to the umbilicus. Specimens in our material show last chambers that are only slightly inflated.

There is considerable confusion in the literature between *G. globosus* (Hagenow) and *G. nitidus* (Reuss). Hagenow's (1842) description lacked a figure, and no holotype was designated. We cannot investigate the type specimen, because according to Dr. F. Roegl (Museum of Natural History, Vienna; pers. comm. 2001) Hagenow's material is no longer available. Reuss (1845) did not designate a holotype, but his material, originally described as being stored in the 'Mineral Kabinet of Lord Ferdinand von Lobkowitz', is available at the Museum of Natural History (Vienna), to which it was donated in the late 19th century. Dr. Roegl investigated the syntypes of the species, and we designated a lectotype, figured in Plate 8, fig. 3 (Coll. No. NHMW Inv. No. 2001Z0060/0001). One paralectotype (Plate 8, fig. 1) is present in the Museum in Vienna (Coll. No. NHMW Inv. No. 2001Z0060/0002), one was donated to the Natural History Museum (plate 8, fig. 2; London; Coll. No. PF67075), and one to the Smithsonian Institution (Coll. No. 516779).

We think that there is considerable overlap between the lectotype and paralectoypes of *G. nitidus* (Reuss) and the type description (in Ellis and Messina) of *G. globosus* (Hagenow), as well as between the paratypes of *G. nitidus* and the specimens that by various authors have been assigned to *G. globosus* (Hagenow), as also mentioned by van Morkhoven et al. (1986).

Reuss, in his description of *G. nitidus*, referred to a "lobate periphery when sutures are more depressed," and "chambers in the last whorl somewhat lobate." We consider that this lobate shape is due to the depressed sutures in the last whorl, and that those lobate chambers in the last whorl are only slightly inflated. Specimens in our material as well as in Reuss' original material show considerable variability in lobateness of the chambers, and in degree of roundness of the periphery. We include specimens in this species that do not have an angular periphery. Specimens with a bluntly angled periphery are included in *G. beisseli* White, and specimens with a very sharp periphery in *G. goudkoffi*. The umbilicus is very narrow, as also clearly seen in the description and figures of *G. nitidus* as the type species of the genus *Gyroidinoides* (Brotzen 1942).

Remarks: Gyroidinoides globosus differs from other species of *Gyroidinoides* by its typical globular, unequally convex test and the interiomarginal slit-like aperture, as well as the low and broad apertural face (about 4 times as broad as high).

We examined slides in White's collection containing specimens assigned *to G. crassa*, *G. nitida* and *G. naranjoensis* (a new species). *Gyroidinoides crassa* (White, not d'Orbigny) has a long slit-like aperture, not short and oval as d'Orbigny described. *G. nitida* (Reuss) presents a globular shape and a broadly rounded periphery. We consider all three to be specimens of *G. globosus*. White's slide labeled *G. naranjoensis* (No.19902) contained 5 specimens. We could recognize the figured specimen (Plate 8, fig. 4), so that we could label this as the holotype (No.19904-a). The remaining paratypes were labeled 19904-b. We consider this a junior synonym of *G. globosus*.

A slide labeled *Rotalina nitida* Reuss in the collection of the Smithsonian Institution contains 11 specimens selected and identified by Reuss, according to the documentation. These have a rounded periphery, large apertural face, high chambers on the spiral side and the flap-like extensions of the chambers of the last whorl around the umbilicus. In his original description, Reuss states that chambers of the last whorl are somewhat lobate and that the periphery becomes lobate when the sutures are more depressed. The specimens identified by Reuss are more lobate than the specimens illustrated by Reuss (1845). The specimen figured and determined by Loeblich and Tappan (1988) as *Gyroidinoides nitida* (USNM No. 433601) is very similar to those secondary types determined by Reuss himself.

We examined a slide labelled *Rotalia nitida* Reuss topotype (Cushman Collection No. 3154). Although the specimen it contains is rather small, the broadly rounded periphery, the low, broad apertural face (four times longer than high) and the globular, unequally biconvex test agree with the description of *Gyroidinoides globosus* (Hagenow). Other plesiotypes and secondary types of *G. nitidus* were found in the Cushman Collection. Not all of them correspond to *G. nitidus*; some belong to *G. girardanus* (Reuss) or *G. depressus* (Alth) or *G. beisseli*.

Since we consider *G. nitidus* a junior synonym of *G. globosus*, the latter species becomes the type species of the genus *Gyroidinoides*, because *G. nitidus* was designated the type species of this genus (Brotzen 1942).

Occurrence: Common to very rare in the Méndez and Velasco Formation in all studied sections; abundant in the upper Velasco Formation in section El Mulato.

Gyroidinoides goudkoffi (Trujillo) 1960
Plate 7, figures 11-12

Eponides goudkoffi TRUJILLO 1960, p. 333, pl. 48, fig. 6.
Eponides sp. cf. *beisseli* Schijfsma. – MCGUGAN 1964, p. 944, pl. 151, fig. 4.
Eponides sp. cf. *simplex* (White). – MCGUGAN 1964, p. 945, pl. 151, fig. 7.
Gyroidinoides goudkoffi (Trujillo). – SLITER 1968, p. 120, pl. 22, figd. 6a-c, not Trujillo. – WIDMARK 1997, p. 73, pl. 36, figs. A-C.

Description: Test trochospiral planoconvex, periphery angular with a sharp edge. Dorsal side evolute and nearly flat, sutures curved and depressed.Umbilical side convex and involute, umbilicus small and open, sutures sinuate and flush. Aperture consisting of a low interiomarginal slit, extending from the umbilicus to the periphery. Walls calcareous, finely perforated, smooth.

Remarks: G. goudkoffi (Trujillo) is distinguished from other *Gyroidinoides* by its angular periphery, with a sharp edge, tending towards a keel. There is considerable intraspecific variability in the degree of convexity on the ventral side, ranging from low trochospiral to strongly planoconvex.

Occurrence: Rare in the Méndez and Velasco Formation in all studied sections with the exception of the Méndez Formation in section La Ceiba where it is abundant.

Gyroidinoides subangulatus (Plummer) 1926
Plate 6, figure 11

Rotalia soldanii (d' Orbigny) var. *subangulata* PLUMMER 1926, p. 154, pl. 12, figs. 1a-c.
Gyroidina aubangulata (Plummer). – WHITE 1928b, p. 291, pl. 39, figs. 6a-c. – LEROY 1953, p. 35, pl. 3, figs. 23-25.
Gyroidinoides subangulata (Plummer). – OLSSON 1960, p. 36, pl. 5, figs. 24, 25.

Description: Test small, trochospiral planoconvex, periphery angular. Dorsal side flat to somewhat concave, sutures oblique; ventral side very convex, sutures radiate. Sutures slightly depressed between the last two or three chambers on both sides and around the umbilicus. Aperture a long narrow slit at the base of the apertural face, extending from near the periphery to the umbilicus. Wall calcareous, smooth.

Remarks: The depressed sutures around the umbilicus are the main characteristic features of *G. subangulatus* (Plummer). The specimen figured by White in 1928 (pl. 39, fig. 6) was found in a slide labelled *Gyroidina aubangulata* (Plummer); we consider this a mis-spelling. The specimens is consistent with the original description of *G. subangulatus* and is very similar to the specimens found in our sections.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral, El Mulato, El Peñón and El Tecolote; common in section Los Ramones.

***Haplophragmoides*? sp.** large variant
Plate 8, fgure 6

Description: Spcimens included in this taxon show a flattened large test, and chamber arrangement similar to that in the genus *Haplophragmoides*, nearly planispiral with one side involute, and the other side involute to slightly evolute. Wall coarsely agglutinated.

Occurrence: Rare to very rare at Méndez and Velasco Formations from all the studied sections; absent in section Los Ramones. Abundant to very abundant in a few samples from the Velasco Fm. at La Ceiba and El Mulato.

***Haplophragmoides*? sp.** small variant
Plate 8, fgure 7

Description: Test extremely flattened, nearly planispiral with one side somewhat more evolute than the other one. Specimens included in this group differ from *Haplophragmoides*? sp. large by its much smaller size, somewhat more evolute coiling, and more finely agglutinated wall.

*Occurrence:*Rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mulato and El Peñón; very rare in section Los Ramones. Abundant in the Velasco Formation in section El Mimbral.

Karreria fallax Rzehak 1895
Plate 8, figure 8

Karreria fallax RZEHAK 1895, p. 226, pl. 7, fig. 8. – WHITE 1928b, p. 299, pl. 41, fig. 2. – LOEBLICH and TAPPAN 1988, p. 642, pl. 724, fig. 1-7.

Description: Early stage of the test trochospirally enrolled; spiral side attached, free side involute, later uncoiling, with the shape and nature of the chambers varying according to the nature of the attachment. Sutures depressed, nearly straight. Aperture a curved slit at the base of the last chamber, on the periphery, extending a short distance along the suture line over the dorsal and the ventral sides. Wall calcareous, thick, smoothly finished.

*Remarks:*We examined the specimen figured by White in the American Museum of Natural History, and found it consistent with the characteristics of *Karreria fallax*.

Occurrence: Very rare in the Méndez Formation in sections El Mulato, El Peñón and Los Ramones.

Lenticulina macrodisca (Reuss) 1863
Plate 8, figure 9

Cristellaria macrodisca REUSS 1863, p. 78, pl. 9 figs. 5a, b.
Lenticulina macrodisca (Reuss). – WHITE 1928a, p. 198, pl. 28, fig. 7.
Robulus macrodiscus (Reuss). – CUSHMAN and JARVIS 1932, p. 23, pl. 7, figs. 3a, b. – CUSHMAN 1946, p. 54, pl. 17, fig. 14.

Description: Test planispiral, closely coiled, biumbonate; periphery subacute, in some specimens slightly keeled. Sutures flush and slightly curved, toward the center becoming tangent to the umbo's periphery. Umbo large and prominent. Aperture a short vertical slit at the end of the last chamber. Wall calcareous, smooth.

Remarks: Lenticulina macrodisca is easily distinguished from other *Lenticulina* species by its prominent umbo, and its commonly large size. A slide in White's collection is labeled *Lenticulina macrodisca* (Reuss) containing one specimen, which may be the one figured in 1928. It agrees with the original description of *L. macrodisca* and closely resembles our material.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections.

Lenticulina navarroensis (Plummer) 1926
Plate 8, figure 10

Cristellaria navarroensis PLUMMER 1926, p. 39, textfigs. 4a, b.
Robulus navarroensis (Plummer). – CUSHMAN 1941, p. 55, pl. 15, fig. 1. – CUSHMAN 1946, p. 51, pl. 16, figs. 6-8.

Description: Test closely coiled, planispiral biconvex, biumbonate; periphery actute with a sharp broad keel. Sutures very distinct, curved, limbate, fusing with the central, elevated boss. About 11 chambers visible, increasing gradually in size as added. Aperture broken in all the studied material. Wall calcareous, smooth.

Remarks: Lenticulina navarroensis was originally defined by Plummer (1926) in the Midway Formation in Texas, which has been considered as a shallow water formation (e.g., Berggren and Aubert 1975; van Morkhoven et al. 1986). We consider representatives of this species as allochthonous, reworked forms from a shelf environment and transported into the deep basin.

Occurrence: This species is very abundant in the spherule layer in section El Mulato section and occurs only in this layer.

Lenticulina spisso-costata (Cushman) 1938
Plate 8, fgure 11

Robulus spisso-costatus CUSHMAN 1938, p. 32, pl. 5, fig. 2. – CUSHMAN 1946, p. 52, pl. 16, figs. 11-14; pl. 17, fig. 1.

Description: Test compressed, planispiral, involute except for the last part in the adult, which is slightly evolute; periphery subacute. About 10 chambers visible, increasing gradually in size and rather uniform in shape. Sutures distinct, curved, raised and limbated, thickening toward the center and covering the umbo. Aperture radiate, at the outer periphery. Wall calcareous, smooth.

*Remarks:*Several paratypes of *L. spisso-costata* were examined (Cushman Collection No 28380, 24545, 24547, 24549); they closely resemble our material and are exactly as in the original description. This species is distinguished from *L. navarroensis* (Plummer) by its subacute, non-keeled periphery. Both species were described from the shallow-water Midway Formation by Plummer (1926), and are considered to be allochthonous forms reworked from the shelf and redeposited within the spherule layer.

Occurrence: L. navarroensis (Plummer) was found in the spherule layer in section El Mulato only.

Lenticulina velascoensis White 1928
Plate 8, figure 12

Lenticulina velascoensis WHITE 1928a, p. 199, pl. 28, fig. 8. – CUSHMAN 1946, p. 57, pl. 19, fig. 8. – BOLLI et al. 1994, p. 111, pl. 29, figs. 22, 23.

Description: "Test flattened, lenticular, with depressed umbos of clear shell material, through which chambers of the inner whorls may be seen; usually about ten chambers to the last volution; sutures flush, curved; periphery keeled, denticulate due to the breaking; aperture oval, obscurely radiate." (White, 1928a)

Remarks: L. velascoensis can be distinguished from other *Lenticulina* species by its much more compressed test and sharply keeled periphery. A slide in White´s collection at the American Museum of Natural History, labeled *Lenticulina velascoensis* n. sp. (No. 19884), was examined, but it did not contain the figured holotype. We assume that the other specimens are paratypes; these closely resemble the specimens found in our material.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla and El Tecolote.

Marssonella indentata (Cushman and Jarvis) 1928
Plate 8, figure 13

Gaudryina indentata CUSHMAN and JARVIS 1928, p. 92, pl. 13, fig. 7. – CUSHMAN and JARVIS 1932, p. 17, pl. 4, fig. 11.
Marssonella indentata (Cushman and Jarvis). – MCGUGAN 1964, p. 940, pl. 150, figs. 10, 11.
Dorothia indentata (Cushman and Jarvis). – KAMINSKI et al. 1988, p. 195, pl. 9, fig. 7, 8.
Marssonella indentata (Cushman and Jarvis). – BOLLI et al. 1994, p. 93, pl. 24, fig. 37.

Description: Test elongate, tapering from the pointed initial part, circular in cross section. Early stage conical, sides of the biserial late portion nearly parallel. Middle portion of each chamber indented, sutures raised in ridges. Aperture small, interiomarginal, at the base of the last chamber. Wall agglutinated, smooth.

Remarks: The holotype (Cushman Collection No. 9733) and several paratypes (Cushman Collection No. 20651) were examined at the Smithsonian Institution and found consistent with our concept of *M. indentata*. If differs from *M. oxycona* (Reuss) by its indented, depressed chambers.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mulato, Los Ramones and El Tecolote; common in section El Peñón.

Marssonella oxycona (Reuss) 1860
Plate 8, figure 14

Gaudryina oxycona REUSS 1860, p. 229, pl. 12, figs. 3a-c. – CUSHMAN and JARVIS 1932, p. 18, pl. 5, figs. 1-2.
Marssonella oxyconus (Reuss). CUSHMAN 1946, p. 43, pl. 12, figs. 3-5. – LEROY 1953, p. 39, pl. 1, figs. 3-4.
Marssonella oxycona (Reuss). – MCGUGAN 1964, p. 940, pl. 150, fig. 12. – KLASZ and KLASZ 1990, p. 416, pl. 7, fig. 9.
Dorothia oxycona (Reuss). – SLITER 1968, p. 50, pl. 3, fig. 13a, b. – KAMINSKI et al. 1988, p. 195, pl. 9, fig. 9. – KUHNT and KAMINSKI 1993, p. 73, pl. 7, figs. 1-2, 4-5.
Marssonella oxycona oxycona (Reuss). – BOLLI et al. 1994, p. 94, pl. 25, figs. 5-6.

Description: Test elongated conical, circular in cross section and with a pointed initial part. Chambers distinct, non-inflated; trochospiral in the early stage and biserial in later stages. Sutures flush or slightly depressed. Aperture a low opening at the base of the last chamber; characteristic flat apertural face. Wall agglutinated, smooth to slightly roughened.

Remarks: We checked the syntypes (No. 19917) of *Textularia nacataensis* in White's collection at the Museum of Natural History. Some of these paratypes show a pointed initial part and a flat apertural face, and should be considered *M. oxycona*. The holotype of *Textularia nacataensis* differs from *M. oxycona* by its more rounded initial end and more depressed sutures.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, El Mimbral, El Mulato, El Peñón and El Tecolote; abundant in section La Lajilla.

Marssonella oxycona juvenile form

Description: Test conical, with a pointed initial part; rounded in cross section. Early part trochospiral, last whorl biserial. Two last chambers flattened (flat apertural face). Sutures indistinct, aperture hardly visible, at the base of the last chamber. Wall agglutinated.

Remarks: Specimens placed in this taxon are very similar to *M. oxycona* (Reuss), especially in the conical shape with a pointed initial part and a flat apertural face. They are smaller, and believed to be juvenile specimens of this species. This taxon always co-occurs with *M. oxycona* (Reuss).

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral, El Mulato and Los Ramones.

Nuttallides truempyi (Nuttall) 1930
Plate 9, figures 1-2

Eponides truempyi NUTTALL 1930, p. 287, pl. 24, figs. 9, 13, 14.
Nuttallides truempyi (Nuttall). – BELFORD 1958, p. 94, pl. 18, figs. 1-13. – TJALSMA and LOHMANN 1983, p. 17, pl. 6, fig. 4; pl. 17, figs. 4, 5; pl. 21, figs. 1-4. – VAN MORKHOVEN et al. 1986, p. 288, pl. 96A, figs. 1-4b; pl. 96B, figs. 1a-3c; pl. 96C, figs. 1a-4. – WIDMARK and Malmgren 1988, p. 69, pl. 1, fig. 7. – NOMURA 1991, p. 22, pl. 2, fig. 7. – WIDMARK and MALMGREN 1992a, p. 112, pl. 2, fig. 3. – SPEIJER 1994, p. 158, pl. 2, fig. 1. – WIDMARK 1997, p. 52, pl. 22, figs. G-I. – WIDMARK and SPEIJER 1997b, p. 149, pl. 1, fig. 4.

Description: Test trochospiral, unequally biconvex, circular in outline; periphery angled, with a narrow and rounded flange. Dorsal side slightly convex to flat, evolute; 3 or 4 whorls visible on dorsal side, sutures flush, oblique and curved. Ventral side strongly convex, commonly with a prominent boss of clear shell material in the centre. About 8 chambers visible in the last whorl; ventral sutures radial, with a characteristic sub-angular sinuosity near the umbilicus. Aperture an interiomarginal elongate slit, extending from the periphery to the umbilical boss. Wall calcareous, smooth.

Remarks: Three cotypes of *N. truempyi* were examined at the Smithsonian Institution (Cushman Collection No. 59491, 59492, 59493); van Morkhoven et al. (1986) designated the best preserved one as the lectotype (Cushman Collection No. 59492). All the specimens agree with our concept of *N. truempyi*, and they are very similar to our material. The biconvex cross section of the test, and the prominent boss on ventral side, as well as the sinuosity of the sutures near the umbilical boss are the main characteristics of *N. truempyi* (Nuttal).

Occurrence: Abundant to very abundant in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla and El Mulato. *N. truempyi* is common in section El Peñón and rare to very rare in sections El Tecolote and El Mimbral.

Nuttallinella coronula (Belford) 1958
Plate 9, figures 6-7

Nuttallina coronula BELFORD1958, p. 97, pl. 19, figs. 1-14; text-fig. 4.

Description: Test low trochospiral, planoconvex, periphery acute with a broad and sharp keel; test much compressed with a rounded outline. Dorsal side flat and evolute, sutures curved; the central part is raised in specimens with a slightly concave dorsal side; all chambers visible on dorsal side. Ventral side involute and slightly convex, about seven chambers visible in the last whorl; sutures sinuate and depressed. Umbilicus small and open. Aperture a long and narrow interiomarginal slit extending from the periphery to the umbilicus. Apertural face very low. Test calcareous, smooth.

Remarks: This species differs from *N. florealis* (White) by its broader keel and the more compressed test.

*Occurrence: N. coronula*is a rare species in the Méndez and Velasco Formation in all sections except Los Ramones, where it is common, and section La Ceiba, where it is abundant.

Nuttallinella florealis (White) 1928
Plate 9, figures 3-5

Gyroidina florealis WHITE 1928b, p. 293, pl. 40, figs. 3a-c.
Nuttallinella florealis (White). – VAN MORKHOVEN et al. 1986, p. 356, pl. 115, figs. 1-3. – NOMURA 1991, p. 22, pl. 2, fig. 11. – WIDMARK and MALMGREN 1992a, p. 112, pl. 2, fig. 4. – WIDMARK 1997, p. 53, pl. 23, figs. A-C.

Description: Test trochospiral planoconvex, subcircular in outline, periphery sharp with an irregular keel. Dorsal side flat, evolute; sutures flush, curved and strongly oblique, commonly glassy in texture. Ventral side strongly convex, involute, with a small depression in the umbilical area; about 7 chambers in the last whorl. Dorsal sutures radial, depressed; thickened and prominent around the umbilical depression. Aperture is an interiomarginal slit extending from the periphery to the umbilicus. Wall calcareous, smooth.

Remarks: A slide labelled *Gyroidina florealis* n. sp. (No. 19899) in White's collection at the Museum of Natural History contains seven syntypes; the holotype was not designated. All have a strongly convex umbilical side; the dorsal side in the figured specimen, which could be recognized, is flat, but the syntypes vary in the degree of convexity of this side. Similar variability was found in our material, although the umbilical side is usually less convex than in the specimens described by White. In most specimens the keel is partly broken. Some specimens are slightly biconvex and do not show a clear depression in the umbilical area, and then resemble *Nuttalides truempyi* (Nuttall); the latter species differs by its strongly curved sutures on the involute side. *N. florealis* (White) is distinguished from *Nuttalinella coronula* (Belford) by its much more strongly convex ventral side, and narrower keel.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral and El Mulato sections; in section La Ceiba, it is very abundant in the Velasco Formation.

Oridorsalis umbonatus (Reuss) 1851
Plate 9, figures 8-9

Rotalina umbonata REUSS 1851, p. 75, pl. 5, fig. 35.
Oridorsalis umbonatus (Reuss). – DAILEY 1983, p. 767, pl. 6, figs. 1-3. – TJALSMA and LOHMANN 1983, p. 18, pl. 6, figs. 8a-b. – BOLLI et al. 1994, p. 372, pl. 58, figs. 10-13.

Description: Test trochospiral, biconvex. Periphery subacute, general outline slightly lobate. Dorsal side evolute, with chambers long and narrow, chamber sutures at right angles to spiral suture, distinct; small, secondary apertures which are difficult to distinguish along the intersection of spiral and radial sutures on the evolute side. About 6 chambers visible at the umbilical side, involute, sutures radial, slightly curved towards the umbo, and raised in the cnetral part of the test.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections, except section Los Ramones.

Osangularia cordieriana (d'Orbigny) 1840
Plate 9, figure 10

Rotalina cordieriana d'ORBIGNY 1840, p. 33, pl. 3, figs. 9-11.
Osangularia cf. *cordieriana* (d'Orbigny). – MCGUGAN 1964, p. 946, pl. 152, fig. 2. – SLITER 1968, p. 118, pl. 21, fig. 9. – GAWOR-BIEDOWA 1992, p. 151, pl. 33, figs. 7, 8; pl. 34, fig. 13. – DAILEY 1983, p. 767, pl. 6, figs. 4, 7, 8. – WIDMARK and MALMGREN 1992a, p. 112, pl. 8, fig. 3.

Description: Test trochospiral, biconvex, rounded outline; periphery subacute, not keeled. Thick lenticular shape in cross section. Dorsal side evolute, all chambers visible on dorsal side; those of the last whorl are depressed and limited by dorsal sutures, oblique and limbate. Ventral side involute, chambers indistinct in the studied material, sutures slightly depressed. Aperture a short interiomarginal slit on ventral side. Wall calcareous.

Remarks: According to the original description by d'Orbigny, this species is distinguished by its keel-less periphery, and lenticular shape. We agree that the specimens figured by Dailey belong in this species, and consider the strongly elevated dorsal sutures, and a circle formed by the depressed chambers on the dorsal side, as the main features to distinguish *O. cordieriana* (d'Orbigny) from other *Osangularia* species.

Occurrence: Very rare in the Velasco Formation in sections La Lajilla, El Mimbral and El Mulato; rare in the Méndez and Velasco Formation in section La Ceiba.

Osangularia plummerae Brotzen 1940
Plate 9, figure 11

Truncatulina culter (Parker and Jones). – PLUMMER 1926, p. 147, pl. 10, fig. 1; pl. 15, fig. 2; (non Parker and Jones).
Osangularia plummerae BROTZEN 1940, p. 30, text-fig. 8. – BERGGREN and AUBERT 1975, p. 147, pl. 3, figs. 6a-g; pl. 9, fig. 2; pl. 10, fig. 4; pl. 13, fig. 11; pl. 14, fig. 10; pl. 17, fig. 6; pl. 18, fig. 3). – SPEIJER 1994, p. 56, pl. 7, fig. 5.
Parrella expansa TOULMIN 1941, p. 604, textfigs. 3, 4F-G.

Description: Test trochospiral, planoconvex to slightly biconvex; subcircular in outline, periphery acute with a broad, thin keel. Dorsal side flat to slightly convex, all chambers visible on dorsal side; sutures broad, oblique, curved and slightly elevated, spiral suture limbate. Ventral side convex, 8 chambers visible in the last whorl; ventral sutures radial and curved, limbate in the earlier parts of the last whorl, and depressed between the last chambers. Aperture consists of two slits, one extending obliquely from the base of the last chamber to the periphery across the apertural face, and a second slit forming an angle with the first one and extending toward the umbilical area. Wall calcareous, smooth.

Remarks: The four paratypes examined (Cushman Collection No 38531) are very flat, and have a sharp, transparent keel. The limbate spiral suture and the broad keel, as well as the aperture, when visible, allowed us to distinguish *O. plummerae* Brotzen from other species. It resembles *O. velascoensis* (Cushman), but the peripheral keel is narrower. *O. expansa* (Toulmin) is an objective synonym of *O. plummerae* Brotzen; both names were proposed as *nomina nova* for *Truncatulina culter* Plummer, not Parker and Jones.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral, El Mulato, El Peñón and El Tecolote; it is abundant in section Los Ramones.

Osangularia velascoensis (Cushman) 1925
Plate 9, figure 12

PLATE 1

Alabamina, Allomorphina, Ammodiscus, Angulogavelinella, Anomalinoides, Stensioeina. All scale bars 100µm

1 *Alabamina creta*, Sample Mi-85-90; 1a, Umbilical view; 1b, Peripheral view; 1c, Spiral view.

2 *Alabamina midwayensis*, Sample L-55-60; 2a, Umbilical view; 2b, Peripheral view; 2c, Spiral view.

3 *Alabamina wilcoxensis*, Sample Mi-4-6; 3a, Umbilical view; 3b, Peripheral view; 3c, Spiral view.

4 *Allomorphina velascoensis*, Sample Mu-0-2; 4a, Side view; 4b, Dorsal view.

5 *Ammodiscus cretaceus*, Sample Mu-85-90; dorsal view.

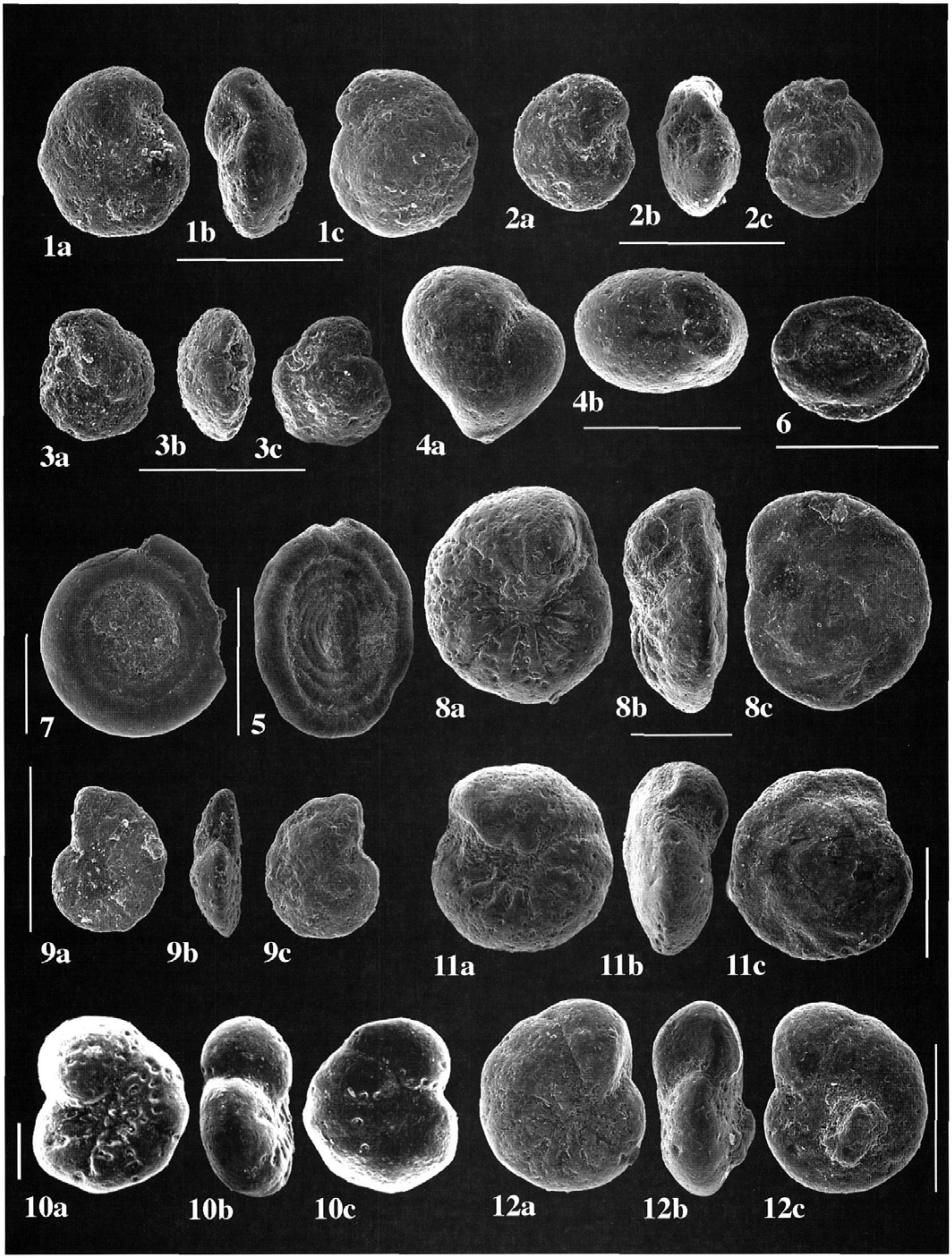
6 *Ammodiscus latus*, Sample Mi+6+8; dorsal view.

7 *Ammodiscus macilentus*, Sample L+120+125; dorsal view.

8 *Angulogavelinella avnimelechi*, Sample Mu+695+700; 8a, Umbilical view; 8b, Peripheral view; 8c, Spiral view.

9 *Anomalinoides acutus*, Sample Mu+0+2; 9a, Umbilical view; 9b, Peripheral view; 9c, Spiral view.

10-12 *Stensioeina beccariiformis*; 10, Lectotype No. 19892-a, American Museum of Natural History; 10a, Umbilical view; 10b, Peripheral view; 10c, Spiral view; 11, Sample Ce+150+155; 11a, Umbilical view; 11b, Peripheral view; 11c, Spiral view; 12, Sample L-18-20; 12a, Umbilical view; 12b Peripheral view; 12c Spiral view.


1a
1b
1c
2a
2b
2c
3a
3b
3c
4a
4b
6
7
5
8a
8b
8c
9a
9b
9c
11a
11b
11c
10a
10b
10c
12a
12b
12c

Truncatulina velascoensis CUSHMAN 1925, p. 20, pl. 3, figs. 2a-c.
Rotalia velascoensis (Cushman). – WHITE 1928b, p. 290, pl. 39, fig. 5.
Pulvinulinella velascoensis (Cushman). – CUSHMAN and JARVIS 1932, p. 48, pl. 14, figs. 6a-c. – CUSHMAN 1946, p. 145, pl. 60, fig. 3.
Osangularia velascoensis (Cushman). – TJALSMA and LOHMANN 1983, p. 18, pl. 7, fig. 14. – WIDMARK and MALMGREN 1992a, p. 113, pl. 9, fig. 1. – BOLLI et al. 1994, p. 157, pl. 43, figs. 36-38.

Description: Test trochospiral, biconvex, nearly bilaterally symmetrical. Periphery sharp, with a broad and very thin keel. All chambers visible on dorsal side, with an excavated area over each chamber; sutures raised. Ventral side involute, 10 chambers in the last whorl; ventral sutures slightly depressed and curved. Aperture narrow and elongate, on the ventral side of the last formed chamber and near the periphery. Wall calcareous, smooth.

Remarks: The holotype of *O. velascoensis* was examined (Cushman Collection No. 4344), and it is more biconvex and has a wider keel than *O. plummerae*. The first whorls on the dorsal side are somewhat elevated in the holotype. The nearly symmetric, biconvex cross section of the test, and the narrow, very thin, broad keel are the main characteristics to distinguish *O. velascoensis* (Cushman) from other *Osangularia* species. Specimens determined by White as *O. velascoensis* were examined; they present the characteristic broad thin keel of this species.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mulato, El Mimbral and El Tecolote.

Paralabamina hillebrandti (Fisher) 1969
Plate 9, figure 13

Rotalia cf. *partschiana* (d'Orbigny). – WHITE 1928b, p. 288, pl. 38, fig. 10.
Neoeponides hillebrandti FISHER 1969, p. 196. – DAILEY 1983, p. 767, pl. 3, figs. 11-12. – TJALSMA and LOHMANN 1983, p. 16, pl. 7, fig. 9.
Paralabamina hillebrandti (Fisher). – WIDMARK and MALMGREN 1992a, p. 112, pl. 3, figs. 1a-c. – WIDMARK 1997, p. 79, pl. 39, figs. A-C.

Description: Test trochoid, planoconvex; circular outline, periphery subacute. Dorsal side strongly convex, evolute, 3 or 4 whorls visible, with numerous narrow chambers; sutures flush, curved. Ventral side involute, flat to slightly concave; only chambers of the last whorl visible. Ventral sutures limbate, radial, thickening toward the umbilicus; umbilical boss in the center of the ventral side. Aperture consists of a simple depressed arc in the apertural face, extending toward the umbilical side. Wall calcareous, finely perforated to smooth on dorsal side, coarsely perforated on ventral side, with radial grooves between the sutures.

Remarks: In White's collection we noticed the specimen that he probably figured in 1928, and named *Rotalia* cf. *partschiana* (d'Orbigny). The characteristics of this specimen (and the other specimens contained in the same slide) agree with those of *Neoeponides hillebrandti*, renamed by Fisher in 1969.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral, El Mulato and El Peñón.

Paralabamina lunata (Brotzen) 1948
Plate 9, figure 14

Eponides lunata BROTZEN 1948, p. 77, pl. 10, figs. 17, 18. – MCGUGAN 1964, p. 945, pl. 151, fig. 9.
Neoeponides cf. *lunata* (Brotzen). – TJALSMA and LOHMANN 1983, p. 16, pl. 7, fig. 10.
Paralabamina lunata (Brotzen). – WIDMARK and MALMGREN 1992a, p. 112, pl. 3, fig. 3. – WIDMARK 1997, p. 80, pl. 39, figs. G-I.

Description: Test small, trochospiral, unequally biconvex, lenticular in cross section. Periphery sharply acute, with an hialine border; outline somewhat lobate. Dorsal side evolute, slightly convex; all chambers visible, longer than broad; sutures distinct, curved. Ventral side involute, more high-conical than dorsal side. About 6 chambers visible on ventral side, slightly

---

PLATE 2
Anomalinoides, Aragonia, Arenobulimina, Bathysiphon, Bolivinoides, Bulimina
All scale bars 100μm

1 *Anomalinoides affinis*, Sample L-155-160; 1a, Umbilical view; 1b, Peripheral view; 1c, Spiral view.

2-3 *Anomalinoides ammonoides*; 2, Sample Ce+20+25; spiral view; 3, Sample L-18-20; 3a, Umbilical view; 3b, Peripheral view; 3c, Spiral view.

4-5 *Anomalinoides midwayensis;* 4, Sample LRM; spiral view; 5, Sample LRM; 5a, Umbilical view; 5b, Peripheral view; 5c, Spiral view.

6 *Anomalinoides rubiginosus*, Sample Te 1,5; 6a, Umbilical view; 6b, Peripheral view; 6c, Spiral view; 7, Aragonia velascoensis, Sample Mu+695+700; front view.

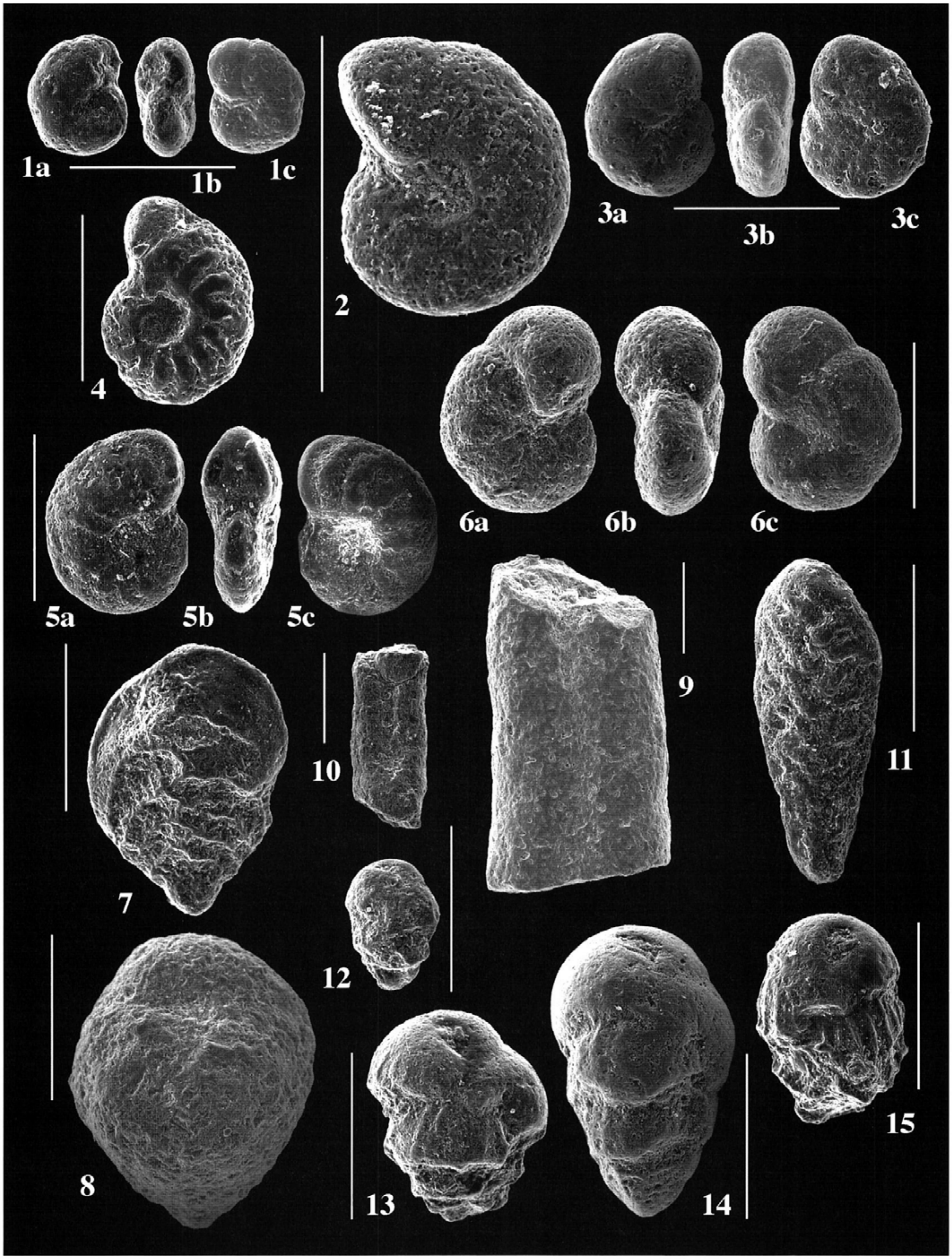
8 *Arenobulimina truncata,* Sample Ce+325+330; side view.

9 *Bathysiphon* sp. B, Sample Mu-10-12; side view.

10 *Bathysiphon* sp. C, Sample Ce+0+5; side view.

11 *Bolivinoides delicatulus,* Sample Mu+295+300; front view.

12-15 *Bulimina trinitatensis;* 12, Sample Mi+300+305; side view; 13, Sample Mu+695+700; side view; 14, Sample Mi+300+305; side view; 15, Sample Mu+695+700; side view.


1a
1b
1c
2
3a
3b
3c
4
5a
5b
5c
6a
6b
6c
7
8
9
10
11
12
13
14
15

inflated; sutures curved, depressed. Aperture an interiomarginal slit extending toward the umbilicus. Wall calcareous, smooth.

Remarks: All the specimens determined as *P. lunata* are small, and have been identified on the basis of their lenticular cross-section and lobate outline, as well as the shape of the chambers and sutures on ventral side.

Occurrence: Very rare in the Méndez and the lowermost Velasco Formation in sections La Ceiba, La Lajilla and El Peñón; *P. lunata* is abundant in marly clasts in the clastic unit in section La Lajilla.

Praebulimina kickapooensis (Cole) 1938
Plate 10, figure 1

Bulimina kickapooensis COLE 1938, p. 45, pl. 3, fig. 5. – CUSHMAN 1946, p. 123, pl. 51, figs. 11, 12, 14; pl. 66, fig. 12. – MELLO 1969, p. 75, pl. 8, figs. 14, 15.
Bulimina kickapooensis kickapooensis Cole. – BOLLI et al. 1994 p. 132, pl. 35, figs. 18, 19.

Description: Test small, elongate, tapering; periphery rounded. Chambers numerous, slightly inflated; sutures distinct and somewhat depressed. Aperture loop-shaped, at the apex of the test, ovate. Wall calcareous, smooth.

Remarks: This species is distinguished from other *Praebulimina* species by its small size, numerous chambers and slightly depressed sutures; all the studied specimens have a pointed initial part.

Occurrence: Rare to very rare in the Méndez Formation in sections La Lajilla, El Peñón and El Tecolote.

Praebulimina reussi (Morrow) 1934
Plate 10, figure 2

Bulimina reussi MORROW 1934, p. 195, pl. 29, fig. 12. – CUSHMAN and PARKER 1935, p. 99, pl. 15, figs. 8, 10.
Praebulimina reussi (Morrow). – DAILEY 1983, p. 768, pl. 2, fig. 7. – GAWOR-BIEDOWA 1992, p. 116, pl. 21, figs. 5-8. – BOLLI et al. 1994, p. 132, pl. 35, figs. 26-28. – SPEIJER 1994p. 48, pl. 1, fig. 11. – WIDMARK 1997, p. 38, pl. 14, fig. F.

Description: Test fusiform, subcircular in cross section; periphery rounded. Chambers triserially arranged, rapidly flaring from the more or less pointed initial part; sutures slightly depressed. Aperture subterminal, comma shaped. Wall calcareous, smooth.

Remarks: P. reussi (Morrow) is distinguished from *Sitella cushmani* (Sandidge) by its triserial test and, when visible, by its comma-shaped aperture. The variability in this species is expressed in the degree of elongation of the tests, ranging from low and globular to elongate and fusiform.

Occurrence: Rare in the Méndez Formation in sections El Mimbral, El Mulato, El Peñón and El Tecolote, abundant in the Méndez Formation in section La Lajilla.

Praeglobobulimina quadrata (Plummer) 1926
Plate 10, figure 3

Bulimina quadrata PLUMMER 1926, p. 72, pl. 4, figs. 4, 5.
Bulimina (Desinobulimina) quadrata Plummer. – CUSHMAN 1951, p. 41, pl. 11, figs. 27-30.
Praebulimina (?) *quadrata* (Plummer). – BOLLI et al. 1994, p. 132, pl. 35, figs. 24, 25.

Description: Test almost cilindrical, increasing only very slightly in diameter from the blunt initial part of the test. Chambers slightly inflated, low and broad; sutures somewhat depressed. Aperture a slit in the inner side of the last chamber. Wall calcareous, smooth.

Remarks: P. quadrata is clearly distinguished from other species of *Praebulimina* by its globular, almost cilindrical shape, low chambers and the slit-like aperture.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral, El Mulato and El Tecolote; common in section Los Ramones.

Pullenia coryelli White 1929
Plate 10, figure 4

Pullenia coryelli WHITE 1929, p. 56, pl. 5, figs. 22a, b. – CUSHMAN 1946, p. 147, pl. 60, figs. 10, 11. – MCGUGAN 1964, p. 947, pl. 152, fig. 7 (not White). – SLITER 1977, p. 675, pl. 8, fig. 5. – TJALSMA and LOHMANN 1983, p. 18, pl. 5, fig. 5. – WIDMARK and MALMGREN 1992a, p. 112, pl. 9, fig. 4. – BOLLI et al. 1994, p. 151, pl. 41, figs. 23, 24. – SPEIJER 1994, p. 160, pl. 1, fig. 2. – WIDMARK 1997, p. 55, pl. 25, figs. C, D.

Description: Test planispiral, subspherical, completely involute; periphery broadly rounded, biumbonate. Six to seven chambers in the final whorl; last chamber with low apertural face. Sutures slightly if at all depressed. Aperture an elongate interiomarginal slit, extending from one umbo to the other.

PLATE 3
Bulimina, Buliminella, Cibicidoides
All scale bars 100µm

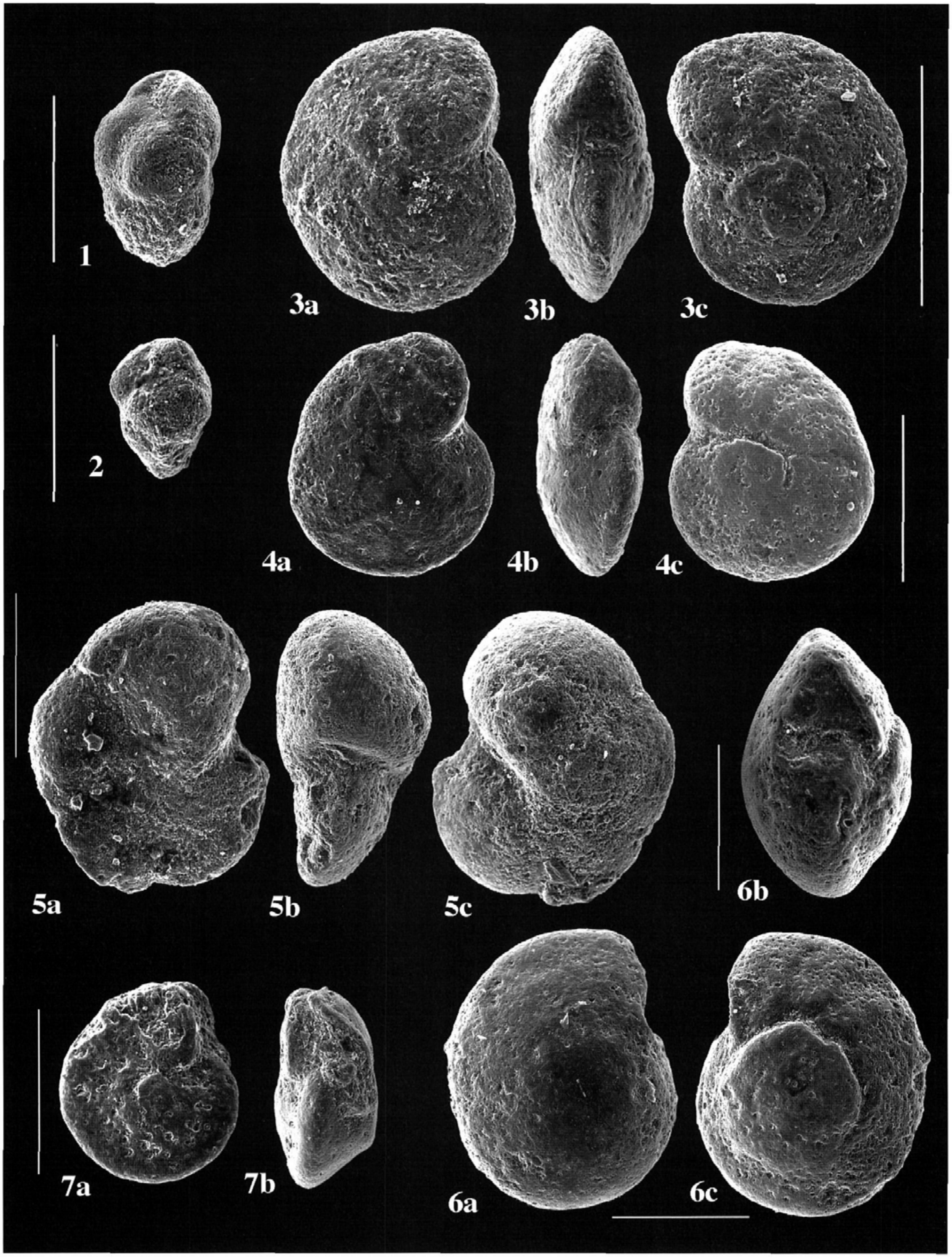
1 *Bulimina velascoensis,* Sample Te 4, side view.

2 *Buliminella grata,* Sample Te 2, side view.

3-4 Cibicidoides dayi; 3, Sample Ce+200+205; 3a, Umbilical view; 3b, Peripheral view; 3c, Spiral view; 4, Sample Ce+250+255; 4a, Umbilical view; 4b, Peripheral view; 4c, Spiral view.

5 *Cibicidoides howelli,* Sample L+120+125; 5a Umbilical view; 5b, Peripheral view; 5c, Spiral view.

6-7 *Cibicidoides hyphalus;* 6 Sample L-55-60; 6a, Umbilical view; 6b, Peripheral view; 6c, Spiral view; 7, Sample L+145+150; 7a, Spiral view; 7b, Peripheral view.


1
2
3a
3b
3c
4a
4b
4c
5a
5b
5c
6b
7a
7b
6a
6c

Remarks: Pullenia coryelli is distinguished from other *Pullenia* species by its nearly spherical shape. A slide with several syntypes in White's collection (No. 19928) was examined, but the holotype could not be distinguished from the other specimens. All specimens are very similar and the author did not designate a holotype.

Occurrence: Very rare in the Velasco Formation, section La Ceiba.

Pullenia cretacea Cushman 1936
Plate 10, figure 5

Pullenia cretacea CUSHMAN 1936, p. 75, pl. 13, figs. 8a, b. – CUSHMAN 1946, p. 146, pl. 60, fig. 9. – BOLLI et al. 1994, p. 152, pl. 41, figs. 27, 28.
Pullenia cf. *cretacea* Cushman. – WIDMARK and MALMGREN 1992a, p. 112, pl 9, fig. 5. – WIDMARK 1997, p. 55, pl. 25, figs. A, B.

Description: Test planispiral involute, subglobular and somewhat compressed in apertural view, slightly biumbilicate; periphery broadly rounded, 5 to 6 chambers in the last whorl, increasing gradually in size, slightly if at all inflated. Sutures slightly depressed, straight to somewhat curved and radial. Aperture consisting of an elongate interiomarginal slit, extending from one umbilicus to the other. Wall calcareous, smooth.

Remarks: We examined the holotype of *P. cretacea* (Cushman Collection No 23527), as well as several paratypes (Cushman Collection No 23528). *Pullenia cretacea* differs from other *Pullenia* species by the degree of crompression of the test. *P. cretacea* is more globular than *P. jarvisi* Cushman, but more compressed than *P. coryelli* White. Some of the specimens determined as *P. cretacea* present a distinct inflated last chamber. There is considerable intraspecific variability in how globular or inflated the last chamber is, as well as in size.

Occurrence: Very rare in the Méndez and Velasco Formation in all studied sections.

Pullenia jarvisi Cushman 1936
Plate 10, figure 6

Pullenia quinqueloba Reuss. – CUSHMAN and JARVIS 1932, p. 49, pl. 15, figs. 4a, b (not Reuss).
Pullenia jarvisi CUSHMAN 1936, p. 77, pl. 13, figs. 6a, b. – CUSHMAN 1946, p. 147, pl. 60, fig. 15. – GAWOR-BIEDOWA 1992, p. 146, pl. 30, fis. 3, 4. – BOLLI et al. 1994, p. 152, pl. 42, figs. 1-3. – WIDMARK 1997, p. 56, pl. 25, figs. E, F.

Description: Test planispiral much compressed, completely involute and biumbilicate; subcircular to lobate in outline, periphery rounded. Five chambers in the last whorl, somewhat inflated, increasing rapidly in size as added. Sutures distinct, curved and depressed. Aperture an interiomarginal slit extending from one umbilicus to the other.

Remarks: The holotype at the Smithsonian Institution was examined (Cushman Collection No. 15459) and found consistent with our material. The same slide contains a plesiotype of *P. quinqueloba* Reuss, which in our opinion is also *P. jarvisi*. *P. jarvisi* differs from other *Pullenia* species by its more compressed test.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections.

Quadrimorphina allomorphinoides (Reuss) 1860
Plate 10, figure 7

Valvulina allomorphinoides REUSS 1860, p. 223, pl. 11, fig. 6.
Discorbis allomorphinoides (Reuss). – CUSHMAN 1926a, p. 606, pl. 20, figs. 18, 19; pl. 21, fig. 5.
Allomorphina allomorphinoides (Reuss). – WHITE 1928b, p. 304, pl. 41, figs. 8a-c.
Valvulineria allomorphinoides (Reuss). – CUSHMAN 1931, p. 43, pl. 6, figs. 2a-c. – BROTZEN 1936, p. 153, pl. 11, figs. 1a-c; text fig 56. – CUSHMAN 1946, p. 138, pl. 57, figs. 6, 7.
Quadrimorphina allomorphinoides (Reuss). – SLITER 1977, p. 675, pl. 8, fig. 1. – DAILEY 1983, p. 768, pl. 4, fig. 9. – NOMURA 1991, p. 23, pl. 1, fig. 23. – BOLLI et al. 1994, p. 153, pl. 42, figs. 14, 15. – WIDMARK 1997, p. 59, pl. 26, figs. F, G.

Description: Test trochospiral, biconvex, ovoid in outline, slightly longer than broad; periphery rounded. Chambers distinct, slightly inflated, with the earlier whorls visible on the dorsal side; dorsal sutures distinct, slightly depressed and curved. Ventral side involute, 3 to 4 chambers visible in final whorl; last chamber elongate and inflated, constitutes about a half of the test. Ventral sutures straight and depressed. Umbilicus usually covered by an extension of the last chamber. Aperture a low, narrow interiomarginal slit extending from the periphery to the umbilicus, below an overhanging, plate-like lip.

Remarks: Three plesiotypes were examined at the Smithsonian Institution (Cushman Collection Nos. 5219, 5220, 5221). *Quadrimorphina allomorphinoides* is distinguished from other

---

PLATE 4
Cibicidoides, Coryphostoma
All scale bars 100μm

1 *Cibicidoides naranjoensis*, Sample L+145+150; 1a, Umbilical view; 1b, Peripheral view; 1c, Spiral view.

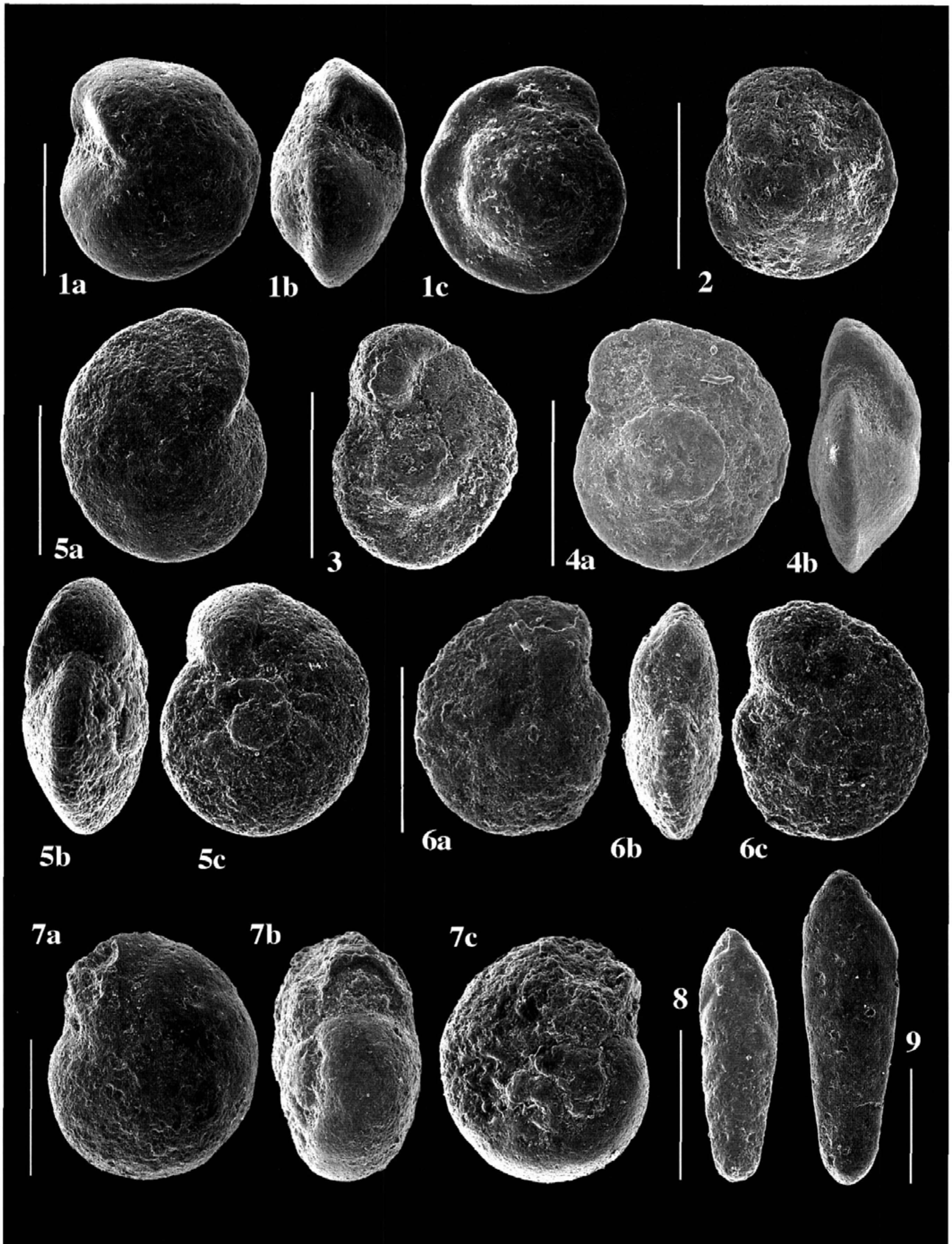
2-4 *Cibicidoides proprius*; 2, Sample L-0-2; umbilical view; 3, Sample L+120+125; spiral view; 4, Sample Mu-0-2; 4a, Spiral view; 4b, Peripheral view.

5 *Cibicidoides pseudoacutus*, Sample Te 4,5; 5a, Umbilical view; 5b, Peripheral view; 5c, Spiral view.

6 *Cibicidoides* sp. A, Sample Te 1,5; 6a, Umbilical view; 6b, Peripheral view; 6c, Spiral view.

7 *Cibicidoides velascoensis*, Sample Mu+25+30; 7a, Umbilical view; 7b, Peripheral view; 7c, Spiral view.

8-9 *Coryphostoma incrassata*, 8, Sample Mu+25+30; side view; 9, Sample L+4+8; side view.


1a
1b
1c
2
5a
3
4a
4b
5b
5c
6a
6b
6c
7a
7b
7c
8
9

species of *Quadrimorphina* by its elongate, inflated last chamber. In White's collection at the American Museum of Natural History we noticed two slides labelled *Allomorphina allomorphinoides* (Reuss); among them we could identify the specimen figured in 1928. All are consistent with the original description of the species.

Occurrence: Very rare in the Méndez and Velasco Formation in sections La Ceiba, El Mimbral, El Mulato, El Peñón and El Tecolote, abundant in the Velasco Formation in section La Lajilla.

Reophax globosus Sliter 1968
Plate 10, figure 8

Reophax globosus SLITER 1968, p. 43, pl. 1, fig. 12. – KAMINSKI et al. 1988, p. 187, pl. 3, fig. 4. – BOLLI et al. 1994, p. 72, pl. 19, figs. 23, 24.

Description: Test elongate, uniserial. Chambers embracing and distinct, somewhat elongate and much compressed; sutures indistinct. Aperture terminal, without a neck. Wall coarsely agglutinated.

Remarks: No complete specimens of *R. globosus* Sliter have been found in our material, only broken pieces consisting of 2 or 3 chambers, so no changes in chambers size could be observed. *Reophax globosus* is distinguished from *S. velascoensis* (Cushman) by its more compressed, nearly flat and somewhat more elongate chambers, more embracing but less overlapping than those of *S. velascoensis*.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral and El Mulato.

Repmanina charoides (Jones and Parker) 1860
Plate 10, figure 11

Trochammina squamata JONES and PARKER var. *charoides* Jones and Parker 1860, p. 304.
Glomospira charoides (Jones and Parker). – WHITE 1928a, p. 187, pl. 27, figs. 7a-c. – LEROY 1953, p. 33, pl. 1, figd. 23, 24. – KAMINSKI et al. 1988, p. 185, pl. 3, figs. 14, 15. – KLASZ and KLASZ 1990, p. 405, pl. 2, figs. 6, 7. – BUBÍK 1993, p. 80, pl. 1, fig. 14; pl. 8, fig. 2. – KUHNT and KAMINSKI 1993, p. 73, pl. 2, fig. 3. – MUFTAH 1993, pp. 176-177, pl. 1, fig. 7; pl. 3, fig. 1. – KAMINSKI et al. 1996, p. 10, pl. 1, fig. 12.

Description: Test consisting of a proloculus, followed by a second undivided chamber trochospirally coiled about a straight axis; late portion coiling streptospirally about the whole test. Aperture at the end of the tubular chamber. Wall finely agglutinated.

Remarks: The specimen figured by White in his collection at the Museum of Natural History is consistent with the characteristics of *R. charoides* (Jones and Parker). This species has been often included (see synonymy) into the genus *Glomospira*. We follow the generic classification of Loeblich and Tappan (1988), who assigned this species to the genus *Repmanina*.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral, El Mulato and El Peñón.

Saccammina placenta (Grzybowski) 1898
Plate 10, figure 12

Reophax placenta GRZYBOWSKI 1898, p. 276, pl. 10, figs. 9-10.
Pelosina complanata Franke. – CUSHMAN and JARVIS 1932, p. 5, pl. 1, figs. 4, 6.
Saccammina placenta (Grzybowski). – KAMINSKI et al. 1988, p. 183, pl. 2, fig. 9. – KLASZ and KLASZ 1990, p. 402, pl. 1, fig. 5. – BUBÍK 1993, p. 87, pl. 8, fig. 1. – KAMINSKI and GEROCH 1993, p. 249, pl. 2, figs. 5-7. – KUHNT and KAMINSKI 1993, p. 75, pl. 1, fig. 14.
Saccammina cf. *placenta* (Grzybowski). – KUHNT and KAMINSKI 1993, p. 75, pl. 1, fig. 12-13, 15.

PLATE 5
Clavulinoides, Coryphostoma, Dorothia, Euuvigerina
All scale bars 100μm

1-3 *Clavulinoides amorpha;* 1, Sample L+55+60; side view; 2, Sample Pe-85-90; side view; 3, Sample Pe-85-90; side view.

4-5 *Clavulinoides amorpha* juvenile form; 4, Sample L-2-4; side view; 5, Sample L-2-4; side view.

6-8 *Clavulinoides trilatera*; 6, Sample Pe-85-90; side view; 7, Sample L-2-4; side view; 8, Sample Te 0; side view.

9-10 *Clavulinoides trilatera* juvenile form; 9, Sample Ce-0; side view; 10, Sample Te 3,5; side view.

11 *Coryphostoma incrassata* forma *gigantea*, Sample Mi+16+19; side view.

12 *Dorothia bulleta*, Sample L-0-2; side view.

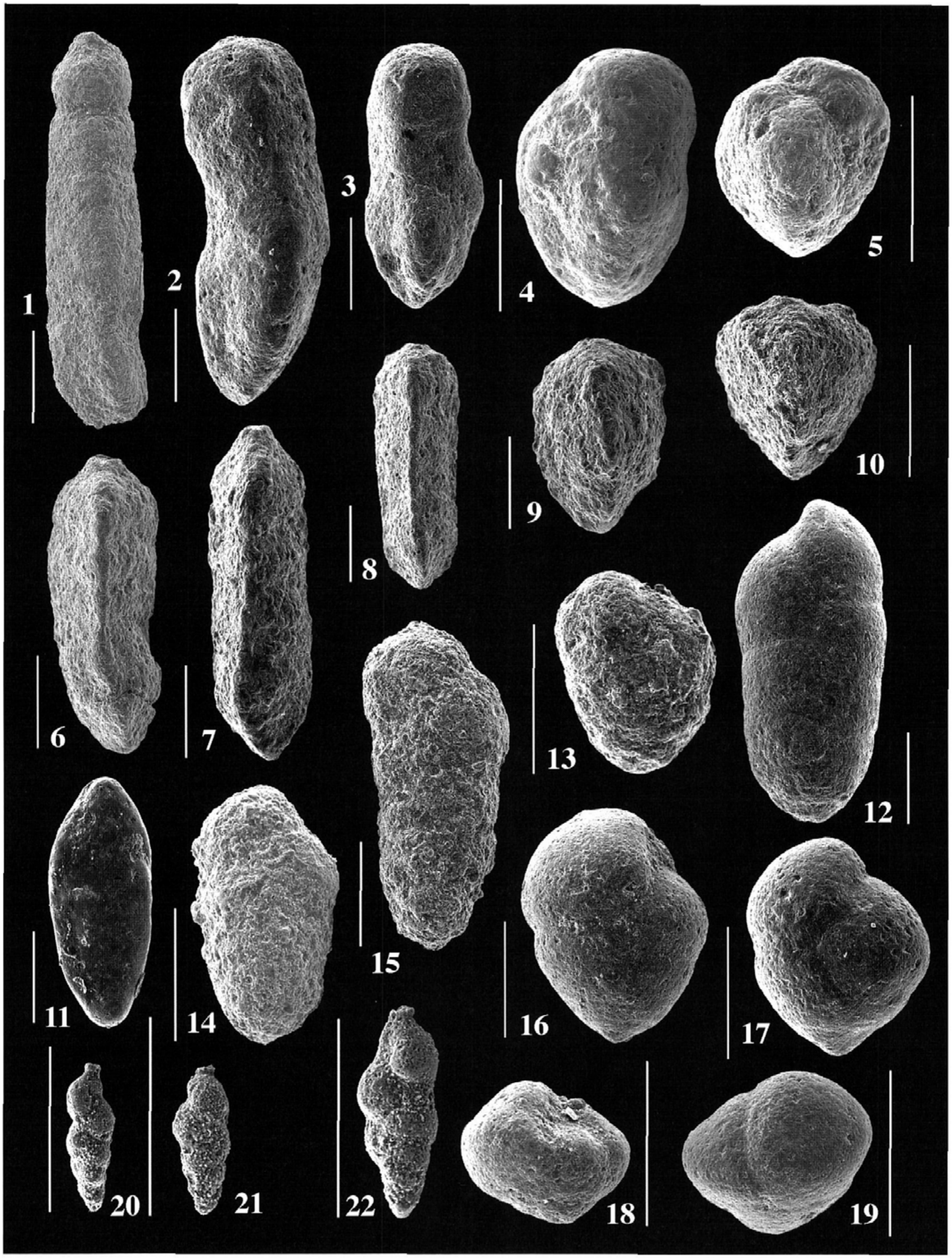
13 *Dorothia bulleta* juvenile form, Sample Mu+695+700; side view.

14-15 *Dorothia bulleta* coarsely agglutinated variant; Sample L+16+20; side views.

16-17 *Dorothia pupa*; 16, Sample L+55+60; side view; 17, Sample Mu+695+700; side view.

18-19 *Dorothia pupa* juvenile form; 18, Sample L-0-2; side view; 19, Sample Mu+695+700; side view.

20-22 *Euuvigerina elongata;* 20, 22 Sample L+145+150; side views; 21, Sample Mi+100+105; side view.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

Description: Test large, unilocular, commonly compressed, with a concave depression in the central area, and a thickened periphery; circular in outline. Aperture a small, simple opening at the end of a short neck. Wall agglutinated, smooth surface.

Remarks: Typical specimens of *S. placenta* present a concave depression in the center and a thickened periphery. Our specimens have a smooth, finely agglutinated wall; they agree with the species concept of Geroch (large specimens, finely agglutinated and smoothly finished), which is an emendation of the original description. Geroch (1960) also mentioned the presence of a neck, although it is not visible in all specimens; when visible, it is more delicate than the neck of *S. complanata* (Franke).

Occurrence: Rare to very rare in the Méndez and Velasco Formation in all studied sections, except section Los Ramones, and it is abundant in a few samples in the Velasco Formation in section La Ceiba.

Sitella cushmani (Sandidge) 1932
Plate 10, figure 13

Buliminella cushmani SANDIDGE 1932, p. 280, pl. 42, figs. 18-19. – CUSHMAN 1946, p. 119, pl. 50, fig. 15. – LEROY 1953, p. 22, pl. 8, fig. 12.
Buliminella sp. 1. NOMURA 1991, pl. 1, fig. 17.
Sitella cushmani (Sandidge). – SPEIJER 1994, p. 50, pl. 1, fig. 9.

Description: Test spirally coiled, compact, involute, circular in cross section. Initial part of test pointed; four to five chambers visible in the last whorl, sutures flush. Aperture Y-shaped, opening at the end of the last chamber; wall calcareous, smooth.

Remarks: Several secondary types were examined at the Smithsonian Institution, and they are very similar to our material. The Y-shape of the aperture and the numerous chambers on the last whorl, as well as the overall shape of the test, allow us to distinguish *S. cushmani* from other species. *S. cushmani* resembles *S. colonensis* (Cushman and Hedberg), but is more slender and less closely coiled.

Occurrence: Very abundant in section El Tecolote section and abundant in section Los Ramones (Méndez Fm.); very rare in the Mendez and Velasco Formation in sections La Lajilla and El Mimbral.

Spiroplectammina chicoana Lalicker 1935
Plate 10, figure 14

Spiroplectammina chicoana LALICKER 1935, p. 7, pl. 1, figs. 8,9. – TRUJILLO 1960, p. 310, pl. 44, figs. 6a, b. – SLITER 1968, p. 46, pl. 2, fig. 8a, b. – GAWOR-BIEDOWA 1992, p. 27, pl. 1, figs. 6, 7.

Description: Test elongate and much compressed, rapidly increasing in width from the initial part of the test, greatest width near the apertural end. Greatest thickness along the vertical axis, thinning towards the periphery, sharp and abrupt; periphery irregular, acute in cross section. Chambers numerous, low and broad, planispirally coiled in the early portion, later biserially arranged. Sutures distinct, straight, slightly raised and thickened in the biserial stage. Aperture a low arch at the base of the last chamber. Wall coarsely agglutinated, smoothly finished.

Remarks: We examined the holotype (Cushman Collection No. 10043) and a paratype (Cushman Collection No. 21607) of *S. chicoana*; these specimens are larger than those in our material, but they present the same morphology: all rapidly become thinner from the center to the periphery. *S. chicoana* is more elongate than *S. israelsky* Hillebrandt, and has a more irregular periphery. It differs from other species of *Spiroplectammina* by its small, thin and compressed test, rapidly increasing in size from the initial portion to near the apertural end.

Occurrence: Rare to very rare in the Méndez Formation in sections La Ceiba, La Lajilla, El Mimbral and El Tecolote.

Spiroplectammina israelsky Hillebrandt 1962
Plate 10, figure 15

Spiroplectammina israelsky HILLEBRANDT 1962, p. 30, pl. 1, figs. 5-7. – KUHNT 1990, p. 325, pl. 6, fig. 16-17. – KUHNT and KAMINSKI 1993, p. 75, pl. 6, fig. 4.
Spiroplectammina sp. B WIDMARK and MALMGREN 1992a, p. 133, pl. 10, fig. 6.

PLATE 6
Eouvigerina, Gaudryina, Globorotalites, Glomospirella, Gyroidinoides
All scale bars 100μm

1-2 *Eouvigerina subsculptura*; 1, Sample Te 2; side view; 2, Sample L-125-130; side view.

3 *Gaudryina laevigata,* Sample Pe-0-2; side view.

4 *Gaudryina pyramidata,* Sample L+170+175; side view.

5 *Gaudryina* sp. flattened, Sample L+55+60; 5a, Side view; 5b, Apertural face.

6 *Globorotalites* sp. A, Sample Mu+25+30; 6a, Umbilical view; 6b, Peripheral view; 6c, Spiral view.

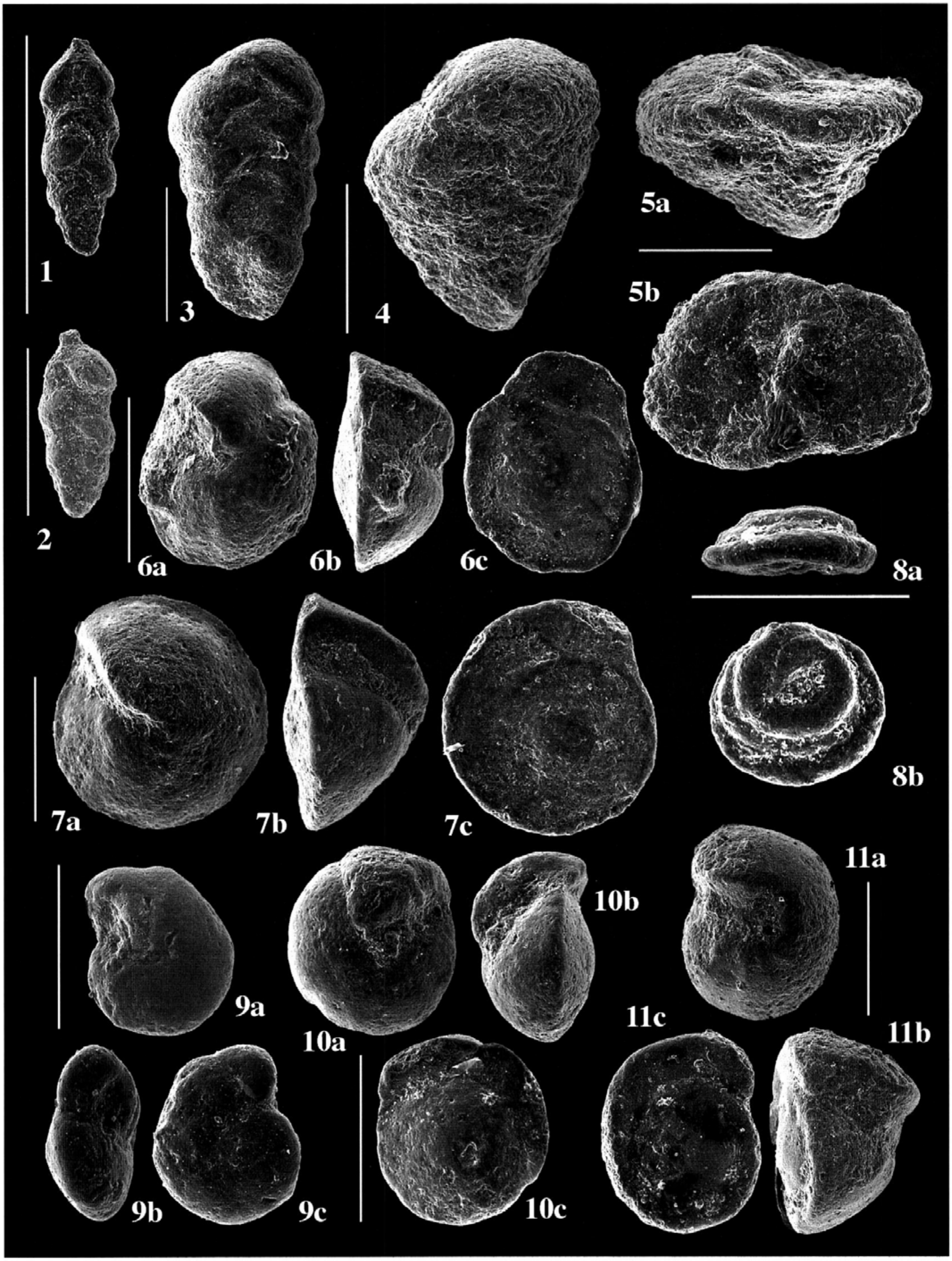
7 *Globorotalites multiseptus,* Sample Te 2; 7a, Umbilical view; 7b, Peripheral view; 7c, Spiral view.

8 *Glomospirella grzybowski,* Sample Ce+325+330; 8a, Side view; 8b, Dorsal view.

9 *Gyroidinoides depressus*, Sample L-18-20; 9a, Umbilical view; 9b, Peripheral view; 9c, Spiral view.

10 *Gyroidinoides girardanus,* Sample L+4+8; 10a, Umbilical view; 10b, Peripheral view; 10c, Spiral view.

11 *Gyroidinoides subangulatus,* Sample L+55+60; 11a, Umbilical view; 11b, Peripheral view; 11c, Spiral view.


1
2
3
4
5a
5b
6a
6b
6c
7a
7b
7c
8a
8b
9a
9b
9c
10a
10b
10c
11a
11b
11c

Description: Test kite-shaped, more or less elongated; rhomboidal cross section. Early stage rounded, planispiral, later portion biserial. Periphery angular, irregular in the biserial part. Chambers low and broad; sutures oblique and straight, distinct and depressed in the biserial portion. Aperture a simple and low arc at the base of the last chamber. Wall coarsely agglutinated.

Remarks: The large size of the robust test and the kite-like shape are the most characteristic features of *S. israelsky* (Hillebrandt). In White's collection at the American Museum of Natural History a slide labeled *Spiroplectinoides clotho* (Grzybowski) contained several specimens consistent with the description of *S. israelsky*. The slide did not , however, contain the specimen figured by White in 1929 (p. 32, pl. 4, figs. 5a-b); this figure resembles *S. spectabilis*. We think that White must have included several species of *Spiroplectammina* into *S. clotho* group.

Occurrence: Rare to very rare in the Méndez and lowermost Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral, El Mulato, El Peñón and Los Ramones.

Spiroplectammina laevis (Roemer) 1841
Plate 10, figure 16

Textularia laevis ROEMER 1841, p. 97, pl. 15, fig. 17.
Textularia subhaeringensis GRZYBOWSKI 1896, p. 285, pl. 9, figs. 13, 16.
Spiroplectammina laevis (Roemer). – SLITER 1968, p. 46, pl. 2, fig. 9a, b. – QUILTY 1992, p. 414, pl. 1, fig. 9. – BUBÍK 1993, p. 87, pl. 14, figs. 6a-7.
Spiroplectammina subhaeringensis (Grzybowski). – TJALSMA and LOHMANN 1983, p. 20, pl. 2, fig. 3.

Description: Test tapering, nearly as long as broad; early portion coiled, rapidly becomes biserial. Greatest width toward the apertural end, thickest at the apertural end through the middle of the test; periphery subacute. Chambers low and broad, not inflated; sutures flush to slightly raised, oblique to the axis of elongation. Apertural end nearly flat, widest at the center and tapers rapidly to the acute peripheries. Aperture an arched opening at the center of the apertural face. Wall finely agglutinated.

Remarks: S. laevis (Roemer) is not as elongated as other species of *Spiroplectammina*, and is about equidimensional. This feature, together with the wide apertural face, are its main distinguishing characteristics.We consider that our specimens are very similar to the type description of *S. subhaeringensis*, and to the specimens figured by Tjalsma and Lohmann (1983), and include this species in the synonymy of *S. laevis*.

Occurrence: Very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mulato, El Peñón and El Tecolote; common in section Los Ramones.

Spiroplectammina navarroana Cushman 1932
Plate 10, figure 17

Spiroplectammina navarroana CUSHMAN 1932, p. 96, pl. 11, fig. 14. – CUSHMAN 1946, p. 27, pl. 5, figs. 13, 14. – MCGUGAN 1964, p. 939, pl. 150, fig. 4. – KUHNT et al. 1998, p. 400, pl. 6, figs. 2, 3.
Spiroplectammina (?) *navarroana* Cushman. – BOLLI et al. 1994, p. 83, pl. 22, figs. 10-12.

Description: Test elongate, periphery rounded; early stage planispiral, later portion biserial and elongate. Chambers nearly equidimensional, rounded at the periphery and somewhat inflated; sutures distinct, depressed. Aperture hardly visible, a slit at the inner margin of the apertural face. Wall coarsely agglutinated.

PLATE 7
Gyroidinoides
All scale bars 100μm

1-10 *Gyroidinoides beisseli*

1 *G. beisseli,* lectotype No.19897-a, White's collection, AMNH; 1a, Umbilical view; 1b, Peripheral view; 1c, Spiral view.

2 *G. beisseli* (*G. comma*, holotype No.19898-a), White's collection, AMNH; 2a, Umbilical view; 2b, Peripheral view; 2c, Spiral view.

3 *G. beisseli* (*G. mendezensis*, holotype No.19900-a), White's collection, AMNH; 3a, Umbilical view; 3b, Peripheral view; 3c, Spiral view.

4 *G. beisseli* (*G. sparski,* lectotype No.19904-a), White's collection, AMNH; 4a, Umbilical view; 4b, Peripheral view; 4c, Spiral view.

5 *G. beisseli* (*G. simplex*, lectotype No.19903-a), White's collection, AMNH; 5a, Umbilical view; 5b, Peripheral view; 5c, Spiral view.

6 *G. beisseli* (*G. vortex*, lectotype No.19905-a), White's collection, AMNH; 6a, Umbilical view; 6b, Peripheral view; 6c, Spiral view.

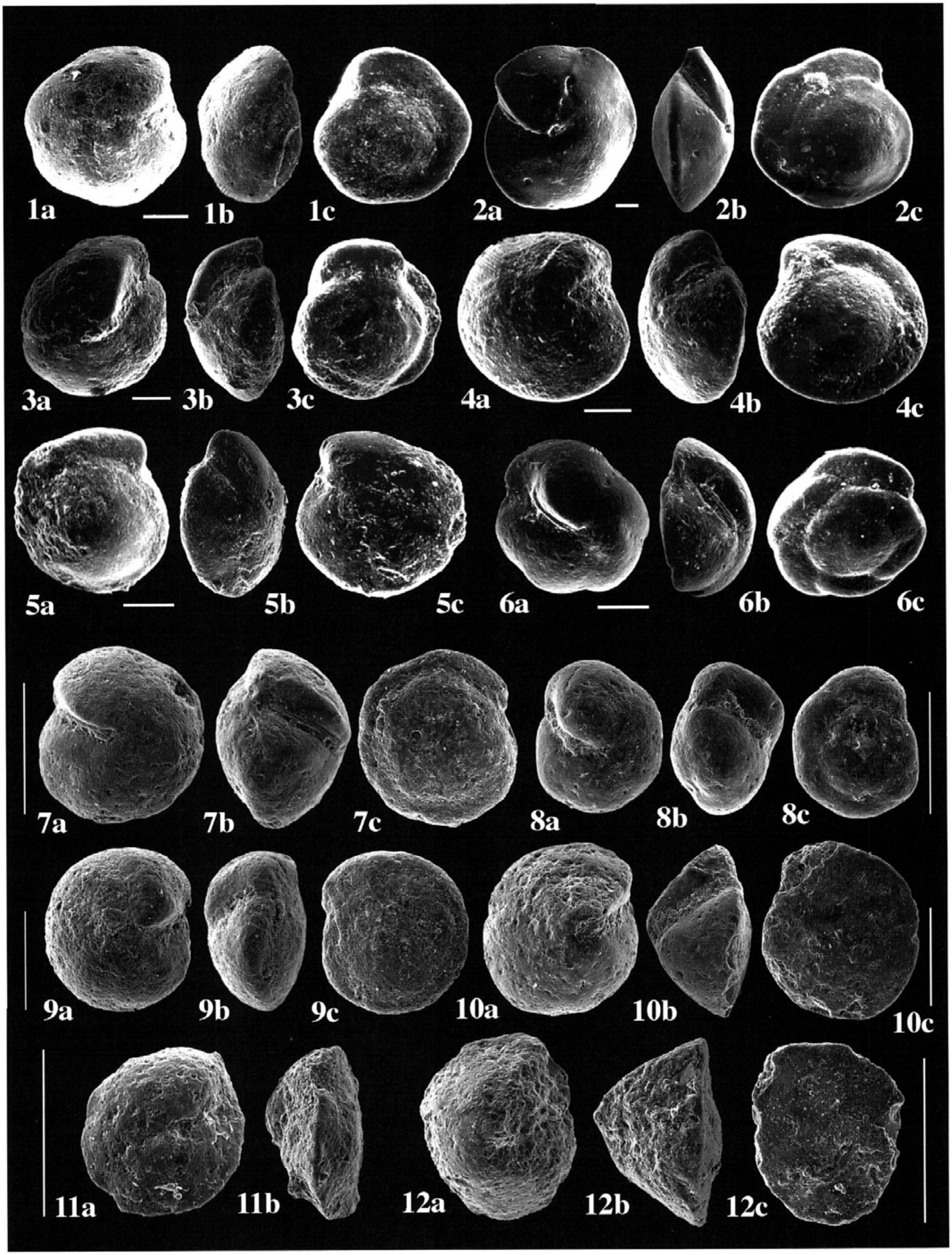
7 *G. beisseli*, Sample Ce-280; 7a, Umbilical view; 7b Peripheral view; 7c, Spiral view.

8 *G. beisseli*, Sample Mi+300+304; 8a, Umbilical view; 8b, Peripheral view; 8c, Spiral view.

9 *G. beisseli*, Sample Ce-348; 9a, Umbilical view; 9b, Peripheral view; 9c, Spiral view.

10 *G. beisseli*, Sample L-85-90; 10a, Umbilical view; 10b, Peripheral view; 10c, Spiral view.

11-12 *Gyroidinoides goudkoffi*; 11, Sample Ce-200; 11a, Umbilical view; 11b, Peripheral view; 12, Sample Mi-4-6; 12a, Umbilical view; 12b, Peripheral view; 12c, Spiral view.


1a
1b
1c
2a
2b
2c
3a
3b
3c
4a
4b
4c
5a
5b
5c
6a
6b
6c
7a
7b
7c
8a
8b
8c
9a
9b
9c
10a
10b
10c
11a
11b
12a
12b
12c

Remarks: The holotype (USNM No 371545) and a paratype (Cushman Collection No 26887) were examined at the Smithsonian Institution. They are consistent with the original description of *S. navarroana*, and very similar to our material. *S. navarroana* differs from other species of *Spiroplectammina* by its inflated chambers, equidimensional, with rounded periphery, as well as a coarsely agglutinated wall.

Occurrence: Very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla and Los Ramones.

Spiroplectammina spectabilis (Grzybowski) 1898
Plate 10, figures 18-19

Spiroplecta spectabilis GRZYBOWSKI 1898, p. 293, pl. 12, fig. 12.
Spiroplectinoides clotho (Grzybowski). – WHITE 1929, p. 32, pl. 4, fig. 5.
Spiroplectammina mexiaensis Lalicker. – CUSHMAN 1951, p. 6, pl. 1, figs. 25, 26.
Spiroplectammina grzybowskii Frizzel. – MCGUGAN 1964, p. 939, pl. 150, fig. 1.
Spiroplectammina spectabilis (Grzybowski). – SZCZECHURA and POZARYSKA 1974, p. 30, pl. 1, figs. 1-4. – TJALSMA and LOHMANN 1983, p. 20, pl. 1, fig. 11; pl. 9, figs. 8-10. – KAMINSKI 1984, p. 31, pls. 12-13. – KAMINSKI et al. 1988, p. 193, pl. 7, figs. 16-18. – WIDMARK and MALMGREN 1992a, p. 113, pl. 10, fig. 7. – BUBÍK 1993, p. 87, pl. 14, figs. 9, 10, 13.

Description: Test elongate and compressed, parallel sides, lenticular in cross section; periphery angular. Early stage planispiral, later portion biserial and elongate. Chambers low and broad; sutures distinct, depressed, more or less straight in the biserial stage, curved backwards in the planispiral portion. Aperture a low arch at the end of the last chamber. Wall agglutinated, smooth.

Remarks: Spiroplectammina spectabilis can be distinguished from other *Spiroplectammina* species by its elongate test with parallel sides. Kaminski (1984) described the morphological variability in this species, and remarked that chambers in the microspheric forms increase gradually in size, but tend to present parallel sides in the later portion. In this case, *S. spectabilis* resembles *S. chicoana* Lalicker, but the latter is thinner and commonly smaller than *S. spectabilis*.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Lajilla, El Mimbral, El Mulato and El Tecolote; rare to abundant in sections La Ceiba, El Peñón and Los Ramones.

Stensioeina beccariiformis (White) 1928
Plate 1, figures 10-12

Rotalia beccariiformis WHITE 1928b, p. 287, pl. 39, figs. 2a-4c.
Stensioeina beccariiformis (White). – SZCZECHURA and POZARYSKA 1974, p. 116, pl. 24, figs. 1-7; pl. 27, figs. 4,5. – VAN MORKHOVEN et al. 1986, p. 346, pl. 113A, figs. 1a-c; pl. 113B, figs. 1a-2c; pl. 113C, figs. 1a-3b. – NOMURA 1991, p. 23, pl. 1, figs. 8a-c, 9. – GAWOR-BIEDOWA 1992, p. 157, pl. 37, figs. 9-11.
Gavelinella beccariiformis (White). – TJALSMA and LOHMANN 1983, p. 12, pl. 6, figs. 1-3. – NYONG and OLSSON 1984, p. 473, pl. 6, figs. 11, 12. – WIDMARK and MALMGREN 1992a, p. 111, pl. 5, fig. 3. – SPEIJER 1994, p. 62, pl. X, fig. 4. – BOLLI et al. 1994, p. 161, pl. 46, figs. 4-6. – WIDMARK 1997, p. 77, pl. 38, figs. A-C.

PLATE 8
Gyroidinoides, Haplophragmoides, Karreria, Lenticulina, Marssonella
All scale bars 100µm

1-5 *Gyroidinoides globosus*

1 *G. globosus* (*G. nitidus*, paralectotype, Coll. No. NHMW Inv. No. 2001z0060/0002, Naturhistorisches Museum, Vienna, Austria); largest diameter 375µm. 1a, Umbilical view; 1b, Peripheral view; 1c, Spiral view.

2 *G. globosus* (*G. nitidus*, paralectotype (Coll. No. PF67075, The Natural History Museum, London, UK), largest diameter 365µm. 2a, Umbilical view; 2b, Peripheral view; 2c, Spiral view.

3 *G. globosus*, lectotype (*G. nitidus*, Coll. No. NHMW Inv. No. 2001z0060/0001, Naturhistorisches Museum, Vienna, Austria), largest diameter 385µm. 3a, Umbilical view; 3b, Peripheral view; 3c, Spiral view.

4 *Gyroidina naranjoensis*, holotype No.19904-a (White's collection, AMNH); 4a, Umbilical view; 4b, Peripheral view; 4c, Spiral view.

5 *Gyroidinoides globosus*, Sample Ce+0+5; 5a, Umbilical view; 5b, Peripheral view; 5c, Spiral view.

6 *Haplophragmoides*? sp. large variant; Sample Mu+5+8; spiral view.

7 *Haplophragmoides*? sp. small variant; Sample Mu+8+11; spiral view.

8 *Karreria fallax*, Sample Mu-55-60; 8a, Ventral view; 8b, Dorsal view.

9 *Lenticulina macrodisca*, Sample –215-220; 9a, Peripheral view; 9b, Side view.

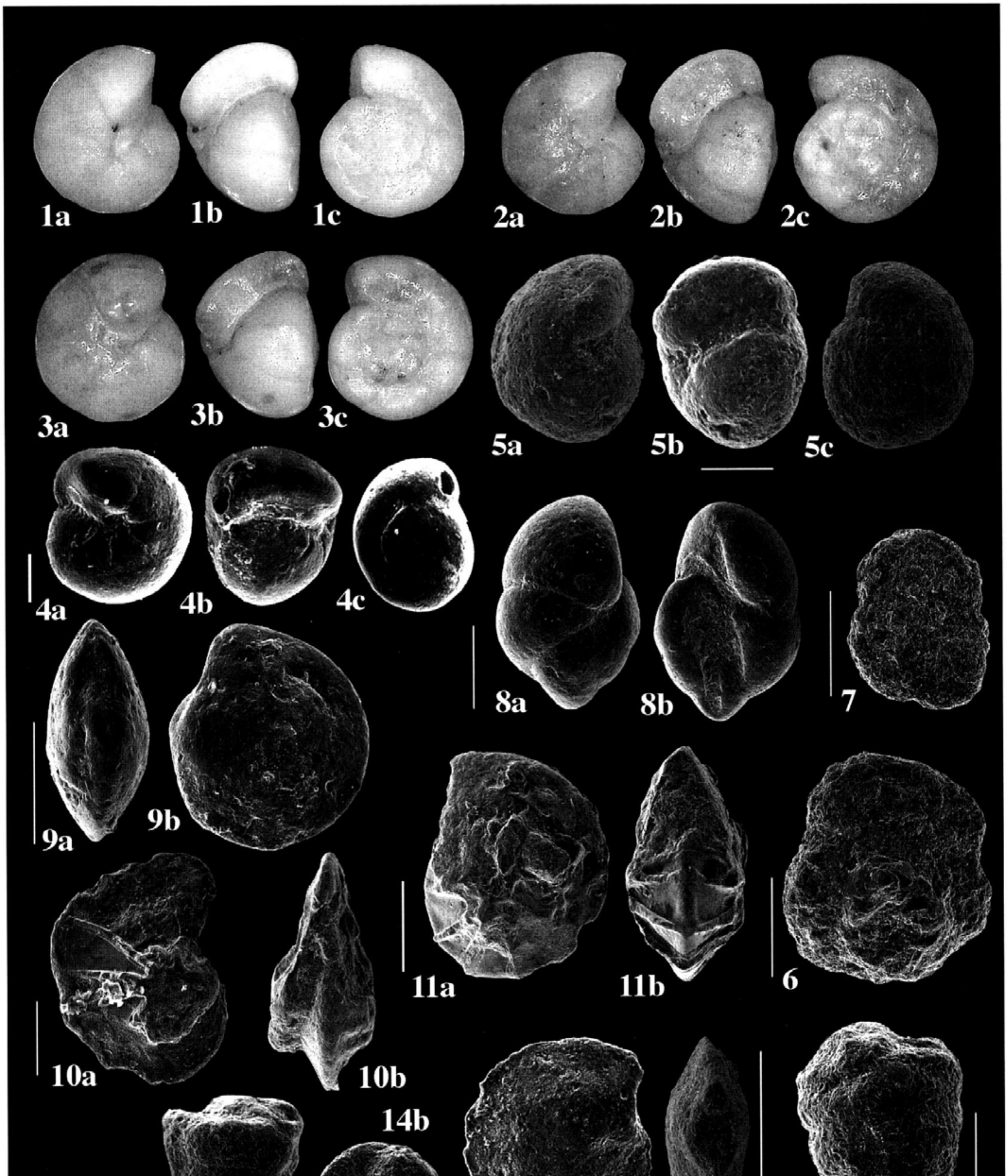
10 *Lenticulina navarroensis*, Spherules layer from El Mulato section; 10a, Side view; 10b, Peripheral view.

11 *Lenticulina spisso-costata*, Spherules layer from El Mulato section; 11a, Side view; 11b, Peripheral view.

12 *Lenticulina velascoensis*, Sample Ce +100+105; 12a, Side view; 12b, Peripheral view.

13 *Marssonella indentata*, Sample Ce+250+255; side view.

14 *Marssonella oxycona*, Sample Ce+250+255; 14a, Side view; 14b, Apertural face.


1a
1b
1c
2a
2b
2c
3a
3b
3c
5a
5b
5c
4a
4b
4c
8a
8b
7
9a
9b
11a
11b
6
10a
10b
14b
14a
12a
12b
13

Description: Test trochospiral, planoconvex to unequally biconvex, periphery broadly rounded, outline rounded to somewhat lobate. Dorsal side relatively flat, evolute, 2 or 3 whorls visible, with 8 to 10 chambers in the last whorl; sutures distinct, flush and curved. Last chamber commonly overlapping the umbilicus. Ventral side involute, slightly convex and depressed and ornamented toward the centre; sutures distinct, broad and depressed. In well-preserved specimens flaps cover the umbilicus, at least in part. Ornamentation closely covers the umbilicus and the flaps. More or less prominent thread-like lines and small depressions radiating from the umbilicus also show as ornamentation. Aperture an interiomarginal slit extending from the periphery toward the umbilicus. Wall calcareous perforate, more coarsely perforated on the ventral side.

Remarks: Seven syntypes of this species were identified in a slide (No. 19892) in White's collection at the American Museum of Natural History. We could not with certainty identify the figured specimen; all specimens have much less inflated chambers than the figure of White (pl. 39, figs. 2a-c). We choose a lectotype from the syntypes that most closely resembled the figured specimen (Plate 1, fig. 10); this is now labeled 19892-a, the remaining paratypes are labeled 19892-b. This taxon presents a wide intra-specific variability, well represented in the two varieties figured by White (pl. 39, figs. 3a-c and 4a-c). The same variability has been found among the studied *S. beccariiformis* from our sections. *Stensioeina beccariiformis* can be distinguished from *Angulogavellinella avnimelechi* (Reiss) by its rounded periphery, the different, more rounded chamber shape and by the overgrowth of the final chamber covering a narrow umbilicus on the ventral side.

The aperture of *S. beccariiformis* from our material is often obscured or covered by a flap.

Occurrence: Stensioeina beccariiformis is abundant in the Méndez Formation and abundant to very abundant in the Velasco Formation in all studied sections; it is very abundant in section Los Ramones.

Stensioeina excolata (Cushman) 1926
Plate 10, figure 20

Truncatulina excolata CUSHMAN 1926b, p. 22, pl. 3, fig. 2.
Gyroidina excolata (Cushman). – WHITE 1928b, p. 293, pl. 40, fig. 2.
Stensioina excolata (Cushman). – VAN MORKHOVEN et al. 1986, p. 380, pl. 125, figs. 1-3. – BOLLI et al. 1994, p. 161, pl. 45, figs. 31-33.

Description: This distinctive species has a trochospiral test, planoconvex, periphery angled. Dorsal side flat, irregularly ornamented with costae along the sutures, commonly twisted; intermediate areas usually roughened. Ventral side highly convex, smooth, about 10 chambers visible in the last whorl; ventral sutures distinct, limbate. Aperture a slit at the base of the last chamber on the ventral side. Wall calcareous.

Remarks: The holotype of *S. excolata* was examined in Cushman Collection at the Smithsonian Institution (No. 5104), and it is very similar to our material. The specimen figured by White in 1928 was found in his collection at the American Museum of Natural History labeled *Gyroidina excolata* (Cushman), and although it is less well-preserved than our material, it clearly shows the characteristics of *S. excolata*.

Occurrence: Rare to very rare in the Méndez and Velasco Formations in sections La Lajilla, El Mimbral, El Mulato, El Peñón and El Tecolote, abundant in the Velasco Formation in section La Lajilla.

Subreophax velascoensis (Cushman) 1926
Plate 10, figures 9-10

Nodosinella velascoensis CUSHMAN 1926a, p. 583, pl. 20, figs. 9a-b.
Nodellum velascoense (Cushman) Cushman and Jarvis. – CUSHMAN 1946, p. 17, pl. 1, figs. 28-31.
Hormosina velascoensis (Cushman). – KUHNT and KAMINSKI 1990, p. 475, pl. 1, figs. k, l.

PLATE 9
Nuttallides, Nuttallinella, Oridorsalis, Osangularia, Paralabamina
All scale bars 100µm

1-2 *Nuttallides truempyi*; 1, Sample L+120+125; 1a, Peripheral view; 1b, Ventral view; 2, Sample Ce-6-8; 2a, Ventral view; 2b, Peripheral view; 2c, Dorsal view

3-5 *Nuttallinella florealis*; 3, Sample Ce+200+205; 3a, Peripheral view; 3b, Ventral view; 4, Sample Ce+40+45; 4a, Ventral view; 4b, Peripheral view; 4c, Dorsal view; 5, Sample Mu+395+400; 5a, Ventral view; 5b, Peripheral view; 5c, Dorsal view

6-7 *Nuttallinella coronula;* 6, Sample Ce-27-30; 6a, Ventral view; 6b, Peripheral view; 6c, Dorsal view; 7, Sample Ce+20+25; peripheral view

8-9 *Oridorsalis umbonatus;* 8, Sample Mu+25+30; spiral view; 9, Sample L-175-180; 9a, Spiral view; 9b, Peripheral view

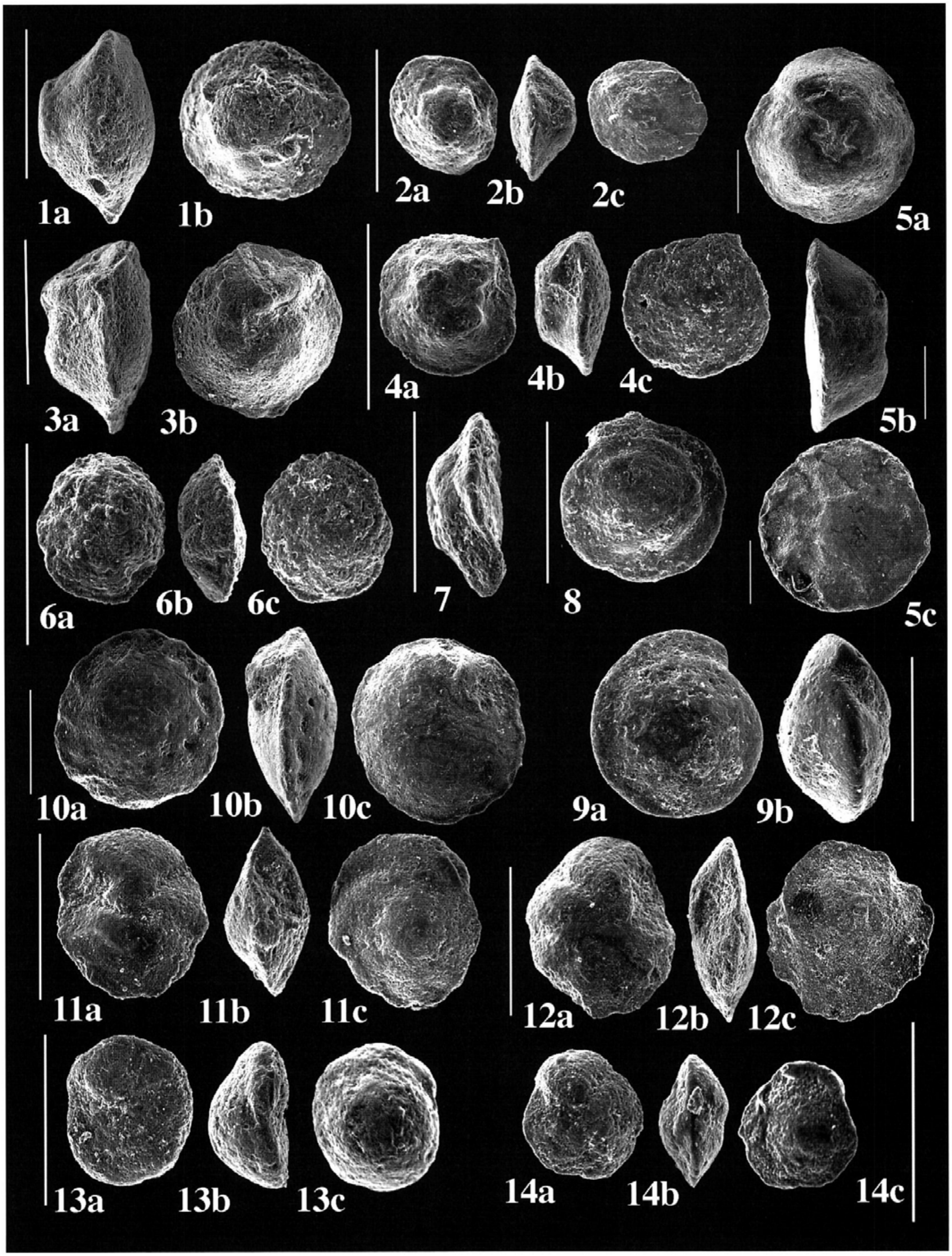
10 *Osangularia cordieriana,* Sample Ce+0+5; 10a, Spiral view; 10b, Peripheral view; 10c, Umbilical view

11 *Osangularia plummerae,* Sample Te 1,5; 11a, Umbilical view; 11b, Peripheral view; 11c, Spiral view

12 *Osangularia velascoensis,* Sample LRM; 12a, Umbilical view; 12b, Peripheral view; 12c, Spiral view

13 *Paralabamina hillebrandti,* Sample Ce-200; 13a, Umbilical view; 13b, Peripheral view; 13c, Spiral view

14 *Paralabamina lunata,* Sample LRM; 14a, Umbilical view; 14b, Peripheral view; 14c, Spiral view.


1a
1b
2a
2b
2c
5a
3a
3b
4a
4b
4c
5b
6a
6b
6c
7
8
5c
10a
10b
10c
9a
9b
11a
11b
11c
12a
12b
12c
13a
13b
13c
14a
14b
14c

Subreophax velascoensis (Cushman). – BOLLI et al. 1994, p. 73, pl. 19, fig. 38.

Description: Test elongate, uniserial. Chambers distinct, slightly inflated, partially compressed, each chamber overlapping the previous one unequally. Sutures hardly visible, overlapped and obscured by the compressed chambers. Last chamber with the terminal aperture not always present; when the aperture is visible, it is rounded and faces toward the more overlapping side of the test. Wall agglutinated, smoothly finished.

Remarks: The holotype was examined at the Smithsonian Institution (Cushman Collection No. 5208), and it is very similar to our material, although no complete specimens of *S. velascoensis* (Cushman) have been found in our sections. They are frequently small, broken pieces consisting of two or three chambers. *Subreophax velascoensis* is distinguished from *R. globosus* Sliter by its distinctly overlapping flattened chambers.

Occurrence: Rare to very rare in the Méndez and Velasco Formation in sections La Ceiba, La Lajilla, El Mimbral and El Mulato.

ACKNOWLEDGMENTS

We thank I. Arenillas, J. A. Arz, C. Liesa, A. Meléndez, E. Molina and A. R. Soria for their collaboration in sampling of some of the studied sections, and for providing samples from the other ones; we also wish to thank them for making valuable suggestions for the improvement of the paper, and specially I. Arenillas and J. A. Arz for sharing biostratigraphical information.

We are very grateful to John Van Couvering and Bushra Hussaini (American Museum of Natural History, N.Y.) and Brian Huber (Smithsonian Institution) for access to the collections of White, Cushman and other holotypes; as well as to Fred Rögl at the Museum of Natural History in Vienna and Norman MacLeod at the Museum of Natural History in London for providing us some of the pictures (*G. nitida*). We also wish to thank the reviewers, Bill Berggren, Mimi Katz and Robert Speijer, for their helpful comments and suggestions, which significantly improved the paper.

Most of this contribution was developed under the project DGES (Dirección General de Enseñanza Superior) FP97-1016 granted by the Ministerio de Ciencia y Tecnología (Spain). This institution is also responsible for the predoctoral grant to L. Alegret. E. Thomas thanks Wesleyan University for funding the use of the Scanning Electron Microscope for several plates, and for publication of the plates.

REFERENCES

ALEGRET, L., ARENILLAS, I., ARZ, J. A. and MOLINA, E. (In press). Eventoestratigrafía del límite Cretácico/Terciario en Aïn Settara (Tunicia): disminución de la productividad y oxigenación oceánicas. Revista Mexicana de Cincias Geológicas.

PLATE 10

Praebulimina, Praeglobobulimina, Pullenia, Quadrimorphina, Reophax, Repmanina, Saccammina, Sitella, Spiroplectammina, Stensioeina, Subreophax

All scale bars 100μm

1 *Praebulimina kickapooensis,* Sample Te 4; side view;

2 *Praebulimina reussi,* Sample L-190-200; side view;

3 *Praeglobobulimina quadrata,* Sample LRM; side view;

4 *Pullenia coryelli,* Sample Ce+425+430; apertural view;

5 *Pullenia cretacea*, Sample Mu+695+700; apertural view;

6 *Pullenia jarvisi,* Sample Mu+8+11; 6a, Apertural view; 6b, Side view

7 *Quadrimorphina allomorphinoides,* Sample Mu+8+11; 7a, Ventral view; 7b, Dorsal view

8 *Reophax globosus,* Sample Mu+8+11; side view;

9-10 *Subreophax velascoensis;* 9, Sample L+16+20; side view; 10, Sample Mi-35-40; side view

11 *Repmanina charoides,* Sample Ce-20-25; 11a Side view; 11b, Dorsal view

12 *Saccammina placenta,* Sample Ce+150+155; side view;

13 *Sitella cushmani*, Sample Te 7,5; side view;

14 *Spiroplectammina chicoana,* Sample Ce-400, front view;

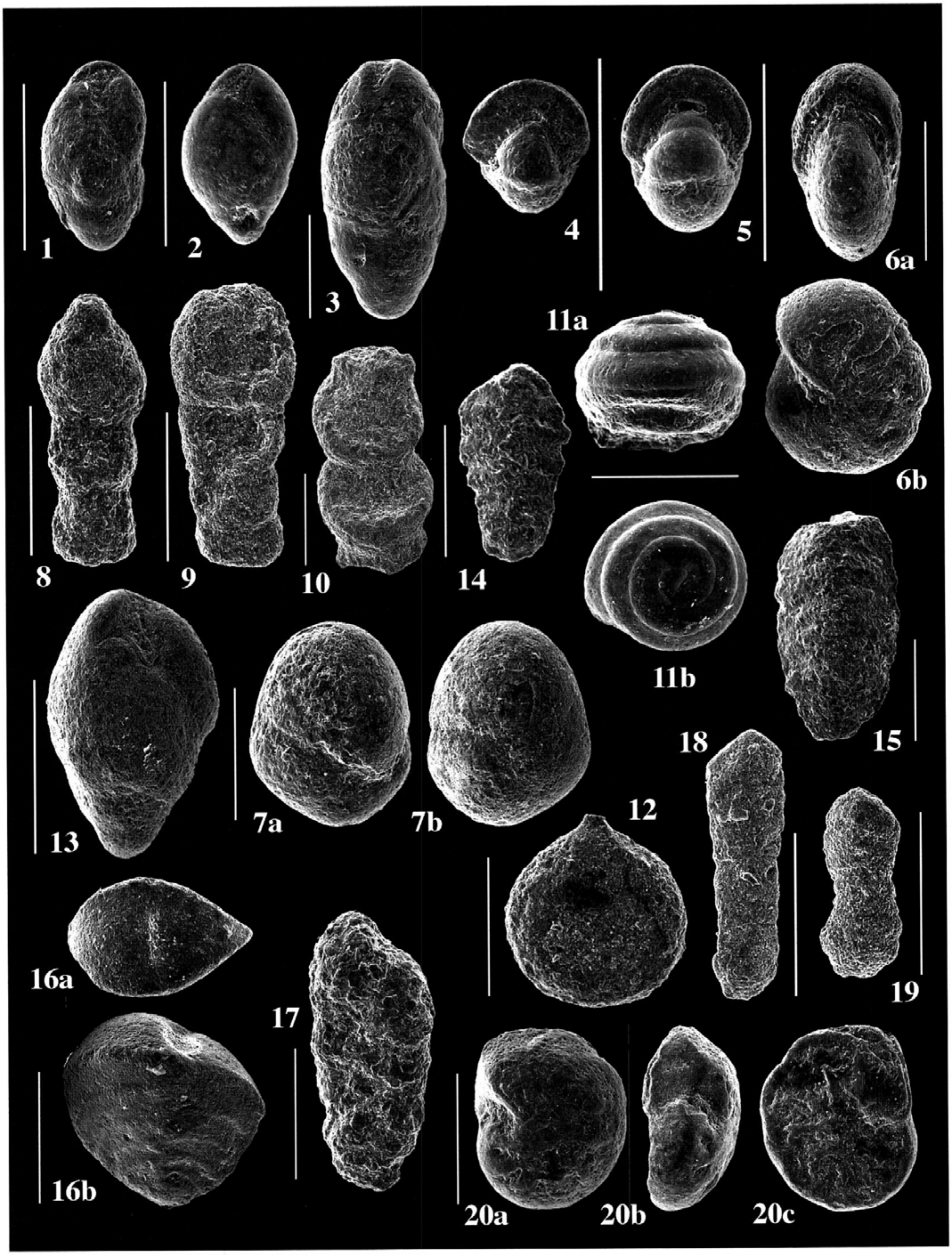
15 *Spiroplectammina israelsky,* Sample Ce-240, front view;

16 *Spiroplectammina laevis,* Sample Mu+595+600; 16a, Apertural face; 16b Front view

17 *Spiroplectammina navarroana*, Sample Ce-200, front view;

18-19 *Spiroplectammina spectabilis,* Sample L+16+20, front views;

20 *Stensioeina excolata,* Sample Mu+8+11; 20a, Umbilical view; 20b Peripheral view; 20c Spiral view.


1
2
3
4
5
6a
11a
6b
8
9
10
14
11b
15
18
13
7a
7b
12
19
16a
17
16b
20a
20b
20c

ALEGRET, L., MOLINA, E. and THOMAS, E., 2001. Benthic foraminifera at the Cretaceous/Tertiary boundary around the Gulf of Mexico. Geology, 29: 891-894.

ALTH, A., 1850. Geognostisch-paläontologische Beschreibung der nächsten Umgebung von Lemberg. Haiding. Naturwissenschaften Abhandlunge, 3, Abteiliung 2: 171-284.

ALVAREZ, A. L., ALVAREZ, W., ASARO, F. and MICHEL, H. V., 1980. Extraterrestrial cause of the Cretaceous-Tertiary extinction. Science, 208: 1095-1108.

ARENILLAS, I., ALEGRET, L., ARZ, J. A., LIESA, C., MELÉNDEZ, A., MOLINA, E. and SORIA, A. R., In press. Cretaceous/Tertiary boundary planktic foraminiferal mass extinction and biochronology at La Ceiba and Bochil (Mexico) and El Kef (Tunisia): Timing of K/T units deposition. Geological Society of America Special Paper, ch. 18.

ARZ, J. A., ARENILLAS, I., SORIA, A. R., ALEGRET, L., GRAJALES-NISHIMURA, J. M., LIESA, C. L., MELÉNDEZ, A., MOLINA, E. and ROSALES, M. C., In press. Micropaleontology and sedimentology across the Cretaceous/Tertiary boundary at La Ceiba (Mexico): impact-generated sediment gravity flows. Journal of South American Earth Sciences.

BELFORD, J. P., 1958. The Genera *Nuttallides* Finlay, 1939, and *Nuttallina* n. gen. Contributions of Cushman Foundation for Foraminiferal Research, 9 (4): 93-98.

BERGGREN, W. A., 1972. Cenozoic biostratigraphy and paleobiogeography of the North Atlantic. In: Laughton, A. S., Berggren, W. A., et al. Initial Reports of the Deep Sea Drilling Project, volume 12, Washington, D.C.: U.S. Government Printing Office, 965-975.

BERGGREN, W. A. and AUBERT, J., 1975. Paleocene benthonic foraminiferal biostratigraphy, paleobiogeography and paleoecology of Atlantic-Tethyan regions: Midway-type fauna. Palaeogeography, Palaeoclimatology, Palaeoecology, 18: 73-192.

BERNHARD, J. M., 1986. Characteristic assemblages and morphologies of benthic foraminifera from anoxic, organic-rich deposits: Jurassic through Holocene. Journal of Foraminiferal Research, 16: 207-215.

BOLLI, H. M., BECKMANN, J. P. and SAUNDERS, J. B., 1994. Benthic foraminiferal biostratigraphy of the South Caribbean region. Cambridge University Press, 408 pp.

BOLTOVSKOY, E., 1981. Foraminiferos Bentonicos del Sitio 360 del "Deep Sea Drilling Project" (Eoceno medio - Plioceno inferior). Asociacion Geologica Argentina, Revista, 36: 389-423.

———, 1987. Tertiary benthic foraminifera in bathyal deposits of the Quaternary world ocean. Journal of Foraminiferal Research, 17: 279-285.

BOLTOVSKOY, E., and BOLTOVSKOY, D., 1988. Cenozoic deep-sea benthic foraminifera: faunal turnovers and paleobiogeographic differences. Revue de Micropaléontologie, 31: 67-81.

———, 1989. Paleocene-Pleistocene Benthic Foraminiferal Evidence of Major Paleoceanographic Events in the eastern South Atlantic (DSDP Site 525, Walvis Ridge). Marine Micropaleontology, 14: 283-316.

BOLTOVSKOY, E., and OCAMPO, J. V., 1993. Benthic Foraminifers rom DSDP Site 219 (Eocene-Pleistocene, Arabian Sea). Revista Espanola de Micropaleontologia, 25: 127-156

BOLTOVSKOY, E., WATANABE, S., TOTAH, V., and OCAMP, J .V., 1995. Benthic Foraminifers from DSDP Site 516 (Upper Maestrichtian - Quaternary, South Atlantic). Revista Española de Micropaleontología, 27: 111-139

BRAGA, G., DE BIASE, R., GRUENIG, A., AND PROTO-DECIMA, F., 1975. Foraminiferi bentonici del Paleocene ed Eocene della Sezione de Possagno, Schweizerische Palaeontologisch Abhandlungen, Mémoires Suisses Paléontologiques, 97: 85-111.

BRALOWER, T. J., PAULL, C. K., and LECKIE, R. M., 1998. The Cretaceous/Tertiary boundary cocktail: Chicxulub impact triggers marine collapse and extensive sediment gravity flows. Geology, 26: 331-334.

BROTZEN, F., 1936. Foraminiferen aus dem schwedischen, untersten Senon von Eriksdal in Schonen. Sveriges Geologiska Undersökning, ser. C, nº 396, 30 (3), 206 pp., 14 pls.

———, 1940. Flintrännans och Trindelrännans geologi (Öresund). Sveriges Geologiska Undersökning, ser. C, nº 435, 34 (5): 3-33, 1 pl.

———, 1942. Die Foraminiferengattung *Gavelinella* nov. gen. und die Systematik der Rotaliiformes. Sveriges Geologiska Undersökning, ser. C, nº 451, v. 36: 1-60.

———, 1948. The Swedish Paleocene and its foraminiferal fauna. Sveriges Geologiska Undersökning, ser. C, nº 493,42,(2): 140 pp, 19 pl.

BUBÍK, M., 1993. Cretaceous to Paleogene agglutinated foraminifera of the Bílé Karpaty unit (West Carpathians, Czech Republic). In: Kaminski, M. A., et al., Eds., Proceedings of the Fourth International Workshop on Agglutinated Foraminifera. Krakow: Grzybowski Foundation, pp. 71-116.

CARSEY, D. O., 1926. Foraminifera of the Cretaceous of central Texas. University of Texas Bulletin 2612: 1-53.

COCCIONI, R., FABBRUCCI, L. and GALEOTTI, S., 1993. Terminal Cretaceous deep-water benthic foraminiferal decimation, survivorship and recovery at Caravaca (SE Spain). Paleopelagos, 3: 3-24.

COLE, W. S., 1927. A foraminiferal fauna from the Guayabal Formation in Mexico. Bulletins of American Paleontology, 14 (51), 46 pp.

———, 1938. Stratigraphy and micropaleontology of two deep wells in Florida. Florida Geological Survey Bulletin, 16: 22-53.

CORLISS, B. H. and CHEN, C., 1988. Morphotype patterns of Norwegian Sea deep-sea benthic foraminifera and ecological implications. Geology, 16: 716-719.

CUSHMAN, J. A., 1925. Some new foraminifera from the Velasco Shale of México. Contributions of the Cushman Laboratory for Foraminiferal Research, 1 (1): 18-23.

———, 1926 a. The foraminifera of the Velasco Shale of the Tampico embayment. American Association of Petroleum Geologists Bulletin, 10: 581-612.

———, 1926 b. Some foraminifera from the Méndez Shale of Eastern México. Contributions of the Cushman Laboratory for Foraminiferal Research, 2 (1): 16-26.

———, 1927 a. American Upper Cretaceous species of *Bolivina* and related species. Contributions of the Cushman Laboratory for Foraminiferal Research, 2 (4): 85-91.

———, 1927 b. Some characteristic Mexican fossil Foraminifera. Journal of Paleontology, 1 (2): 147-172.

———, 1931. Cretaceous foraminifera from Antigua, B. W. I. Contributions of the Cushman Laboratory for Foraminiferal Research, 7(2): 33-46.

———, 1932. Textularia and related forms from the Cretaceous. Contributions of the Cushman Laboratory for Foraminiferal Research, 8: 86-97.

———, 1933a. New American Cretaceous Foraminifera. Contributions of the Cushman Laboratory for Foraminiferal Research, 9 (3): 49-64.

———, 1933b. Foraminifera: their classification and economic use. Cushman Laboratory for Foraminiferal Research, Special Publication 4: 1-349.

———, 1936. Cretaceous foraminifera of the family Chilostomellidae. Contributions of the Cushman Laboratory for Foraminiferal Research, 12: 71-78.

———, 1937a. A monograph of the foraminiferal family Verneuilinidae. Cushman Laboratory for Foraminiferal Research, Special Publication, 7: 1-157.

———, 1937b. A monograph of the foraminiferal family Valvulinidae. Cushman Laboratory for Foraminiferal Research, Special Publication, 8: 1-210.

———, 1937c. A monograph of the subfamily Virgulininae of the foraminiferal family Bulimindae. Cushman Laboratory for Foraminiferal Research, Special Publication, 9, I-XV, 1-228.

———, 1938. Additional new species of American Cretaceous foraminifera. Contributions of the Cushman Laboratory for Foraminiferal Research, 14 (2): 31-51.

———, 1941. American Upper Cretaceous Foraminifera belonging to *Robulus* and related genera. Contributions of the Cushman Laboratory for Foraminiferal Research, 17 (3): 55-69.

———, 1946. Upper Cretaceous foraminifera of the Gulf Coastal region of the United States and adjacent areas. United States Geological Survey, Professional Paper, 206, 241 pp.

———, 1951. Paleocene Foraminifera of the Gulf Coastal Region of the United States and adjacent areas. United States Geological Survey, Professional Paper, 232, 75 pp.

CUSHMAN, J. A. and TRAGER, E. A., 1924. New Formation in Tampico Embayment Region: Geological Society of America Bulletin V: 100.

CUSHMAN, J. A. and JARVIS, P. W., 1928. Cretaceous foraminifera from Trinidad. Contributions of the Cushman Laboratory for Foraminiferal Research, 4 (4): 85-103.

———, 1932. Upper Cretaceous Foraminifera from Trinidad. Proceedings U. S. National Museum, 80, art. 14: 1-60.

CUSHMAN, J. A. and PONTON, G. M., 1932. An Eocene foraminiferal fauna of Wilcox age from Alabama. Contributions of the Cushman Laboratory for Foraminiferal Research, 8: 51-72.

CUSHMAN, J. A. and PARKER, F. L., 1935. Some American Cretaceous *Buliminas*. Contributions of the Cushman Laboratory for Foraminiferal Research, 11 (4): 96-101.

CUSHMAN, J. A. and RENZ, H. H., 1946. The foraminiferal fauna of the Lizard Springs Formation of Trinidad, British West Indies. Cushman Laboratory for Foraminiferal Research, Special Publication 18: 1-48.

———, 1948. Eocene Foraminifera of the Navet and Hospital Hill Formations of Trinidad, B. W. I. Cushman Laboratory for Foraminiferal Research, Special Publication 24: 1-42.

DAILEY, D. H., 1983. Late Cretaceous and Paleocene benthic foraminifera from deep sea drilling project site 516, Rio Grande Rise, Western South Atlantic Ocean. In: Baker, P. F., Carlson, R. L., Johnson, D. A. et al., Eds., Initial Reports of the Deep Sea Drilling Project, volume 72. Washington, DC: US Government Printing Office, 757-782.

DE GOLYER, E. L., 1915. The Febrero Oil Field, México. American Institiute of Minimng and Engineering, Transactions and Bulletin, 105: 1890-1911.

DOUGLAS, R., and WOODRUFF, F., 1981. Deep Sea Benthic Foraminifera, In: Emiliani, C., Ed., The Oceanic Lithosphere, The Sea, Vol. 7. New York: Wiley Interscience, 1233-1327

D'HONDT, S., DONAGHAY, P., ZACHOS, J. C., LUTTENBERG, D. and LINDINGER, M., 1998. Organic Carbon fluxes and Ecological Recovery from the Cretaceous-Tertiary Mass Extinction. Science, 282: 276-279.

FINLAY, H. J., 1940. New Zealand Foraminifera: key species in stratigraphy n° 4. Transactions, Royal Society of New Zealand, 69: 448-472.

FISHER, M. J., 1969. Benthonic foraminifera from the Maestrichtian Chalk of Galicia Bank, West of Spain. Paleontology, 12 (2): 189-200.

FRANKE, A., 1914. Die Foraminiferen und Ostracoden des Emschers, besonders von Overeving und Derne, noerdlich Dortmund. Deutsche Geologisches Ges., Zeitschr., A, Abhandlungen, Berlin, Deutschland 1914, Bd. 66, Heft 3, p. 431, pl. 27, figs. 1-2.

FUYTAN, A. L., 1976. Late Mesozoic and Early Cenozoic benthic foraminifera from Jordan. Palaeontology, 19 (3): 517-537.

GAWOR-BIEDOWA, E., 1992. Campanian and Maastrichtian Foraminifera from the Lublin Upland, Eastern Poland. Palaeontologica Polonica, 52, 187 pp.

GRZYBOWSKI, J., 1898. Otwornice pokladów naftonosnych okolicy Krosna. Rozprawy Akademii Umiejetnosci w Krakowie, Wydziat Matematyczno-Przyrodniczy, Kraków, ser. 2, 33: 257-305.

JEFFREY, C., 2001. Heart urchins at the Cretaceous/Teriary boundary: a tale of two clades. Paleobiology, 27: 140-158.

HAGENOW, F. von, 1842. Monographie der Rügen'schen Kreide-Versteinerungen; Abtheilung III- Mollusken. Neues Jahrbuch für Mineralogie, Geognosie, Geologie und Petrefakten-Kunde, Stuttgart, 528-575.

HANTKEN, M. ,1875. Die Fauna der *Clavulina szaboi*-Schichten; Theil I- Foraminiferen. Königliche Ungarische Geologische Anstalt, Mitteilungen und Jahrbuch, Budapest, 4: 1-93.

HILDEBRAND, A. R., PENFIELD, G. T., KRING, D. A., PILKINGTON, M., CAMARGO, A. Z., JACOBSEN, S. B. and BOYNTON, W. V., 1991. Chicxulub Crater: a possible Cretaceous/Tertiary boundary impact crater on the Yucatan Peninsula, Mexico. Geology, 19: 867-871.

HILLEBRANDT, A., 1962. Das Paleozän und seine Foraminiferenfauna im Becken von Reichenhall und Salzburg. Bayer. Akad. Wiss., Math.-Nat. Kl., Abh., n. ser., 108: 9-182.

JONES, R.W. and CHARNOCK, M. A., 1985. "Morphogroups" of agglutinated foraminifera. Their life positions and feeding habits and potential applicability in (Paleo)Ecological studies. Revue de Palèobiologie, 4 (2): 311-320.

JONES, T. R. and PARKER, W. K., 1860. On the rhizopodal fauna of the Mediterranean compared with that of the Italian and some Tertiary deposits. Quarterly Journal of the Geological Society of London, 16: 292-307.

JORISSEN, F. J., STIGTER, H. C. and WIDMARK, J. G. V., 1995. A conceptual model explaining benthic foraminiferal microhabitats. Marine Micropaleontology, 26: 3-15.

JURKIEWICZ, H., 1960. Foraminifera of the Czarnorzeki shales in the eastern part of the Silesian Unit (Carpathians). Rocznik Polskiego Towarzystwa Geologicznego, 30 (3): 333-343.

KAIHO, K., 1998. Phylogeny of deep-sea calcareous trochospiral benthic foraminifera: evolution and diversification. Micropaleontology, 44 (3): 291-311.

KAMINSKI, M. A., 1984. Shape variation in *Spiroplectammina spectabilis* (Grzybowski). Acta Palaeontologica Polonica, 29 (1-2): 29-49.

KAMINSKI, M. A. and GEROCH, S., 1993. A revision of foraminiferal species in the Grzybowski Collection. In: Kaminski, M. A. et al., Eds., The Origin of Applied Micropaleontology: the School of Jósef Grzybowski. Grzybowski Foundation, Special Publication 1: 239-323.

KAMINSKI, M. A., GRADSTEIN, F. M., BERGGREN, W. A., GEROCH, S., and BECKMANN, J. P., 1988, Flysch-type agglutinated benthic foraminiferal assemblages from Trinidad: taxonomy, stratigraphy and paleobathymetry. Abhandlungen der Geologischen Bundesanstalt, 41: 155-227.

KAMINSKI, M. A., KUHNT, W. and RADLEY, J. D., 1996. Paleocene-Eocene deep water agglutinated foraminifera from the Numidian Flysch (Rif, Northern Morocco): their significance for the paleoceanography of the Gibraltar gateway. Journal of Micropaleontology, 15: 1-19.

KELLER, G., 1988. Biotic turnover in benthic foraminifera across the Cretaceous-Tertiary boundary at El Kef, Tunisia. Paleogeography, Paleoclimatology, Paleoecology, 66: 157-171.

KELLER, G., STINNESBECK, W. and LOPEZ-OLIVA, J. G., 1994. Age, deposition and biotic effects of the Cretaceous-Tertiary boundary event at Mimbral, NE Mexico. Palaios, 9: 144-157.

KELLER, G. and STINNESBECK, W., 1996. Sea-level changes, clastic deposits, and mega-tsunamis across the Cretaceous-Tertiary boundary. In: MacLeod, N. and Keller, G., Eds., Cretaceous-Tertiary Mass Extinctions: biotic and environmental crises. New York: W. W. Norton and Co. p. 415-449.

KELLER, G., LOPEZ-OLIVA, J. G., STINNESBECK, W., and ADATTE, T., 1997, Age, stratigraphy and deposition of near-K/T siliciclastic deposits in Mexico: relation to bolide impact? Geological Society of America Bulletin, 109: 410-428.

KLASZ, I. and KLASZ, S., 1990. Danian deep water (bathyal) agglutinated foraminifera from Bavaria and their comparison with approximately coeval agglutinated assemblages from Senegal and Trinidad. In: In: Hemleben, C. et al., Eds., Paleoecology, Biostratigraphy, Paleoceanography and Taxonomy of Agglutinated Foraminifera. Kluwer Academic Publishers, 387-431.

KOCH, W., 1977. Biostratigraphie in der Oberkreide und Taxonomie von Foraminiferen. Geologisches Jahrbuch, Reihe A 38: 11-123, plates 1-17.

KROGH, T. E., KAMO, S. L., SHARPTON, V. L., MARIN, L. E. and HILDEBRAND, A. R., 1993. U-Pb ages of single shocked zircons linking distal K/T ejecta to the Chicxulub Crater. Nature, 366: 731-734.

KUHNT, W., 1990. Agglutinated foraminifera of Western Mediterranean Upper Cretaceous pelagic limestones (Italy and Betic Cord. Spain). Micropaleontology, 36 (4): 297-330.

KUHNT, W. and KAMINSKI, M. A., 1990. Paleoecology of late Cretaceous to Paleocene deep-water agglutinated foraminifera from the North Atlantic and Western Tethys. In: Hemleben, C. et al., Eds., Paleoecology, Biostratigraphy, Paleoceanography and Taxonomy of Agglutinated Foraminifera. Kluwer Academic Publishers, 433-505.

———, 1993. Changes in the community structure of deep water agglutinated foraminifers across the K/T boundary in the Basque Basin (Northern Spain). Revista Española de Micropaleontología, 25: 57-92.

KUHNT, W., MOULLADE, M. and KAMINSKI, M. A., 1998. Upper Cretaceous, K/T boundary, and Paleocene agglutinated foraminifers from hole 959 D (Côte d'Ivoire-Ghana transform margin). Proceedings of the Ocean Drilling Project, Scientific Results 159: 389-411.

LALICKER, C. G., 1935. New Cretaceous Textulariidae. Contributions of the Cushman Laboratory for Foraminiferal Research, 11: 1-13.

LEROY, L. W., 1953. Biostratigraphy of the Maqfi Section, Egypt. Geological Society of America, Memoir nº 54: 1-73.

LOEBLICH, A. R. and TAPPAN, H., 1988. Foraminiferal genera and their classification. 2 vol., 1182 pp., New York: Van Nostrand Reinhold Company.

LONGORIA, J. F. and GAMPER, M. A., 1993. Paleogeographic development of México during the latest Cretaceous-early Tertiary. Revista de la Sociedad Mexicana de Paleontología, 6 (2): 29-36.

LONGORIA, J. F., SILVA, L. E. and HINOJOSA, J. J., 1993. Lithostratigraphic synopsis of units across the K/T boundary in northeastern México. Revista de la Sociedad Mexicana de Paleontología, 6 (2): 23-27.

LOPEZ-OLIVA, J. G. and KELLER, G., 1996. Age and stratigraphy of near-K/T boundary siliciclastic deposits in Northeastern Mexico. Geological Society of America Special Paper, 307: 227-242.

McGUGAN, A., 1957. Upper Cretaceous Foraminifera from northern Ireland. Journal of Paleontology, 31: 329-348

———, 1964. Upper Cretaceous Zone Foraminifera, Vancouver Island, British Columbia, Canada. Journal of Paleontology, 38: 933-951.

McNEIL, D. H. and CALDWELL, W. G. E., 1981. Cretaceous Rocks and their foraminifera in the Manitoba escarpment. The Geological Association of Canada, Special Paper 21: 1-439.

MELLO, J. M., 1969. Foraminifera and stratigraphy of the upper part of the Pierre Shale and lower part of the Fox Hills Sandstone (Cretaceous) North-Central South Dakota. United States Geological Survey, Professional Paper, 611. 121 pp, 11 pl.

MORGAN, J., WARNER, M., BRITTAN, J., BUFFLER, R., CAMARGO, A., CHRISTESON, G., DENTON, P., HILDERBAND, A. R., HOBBS, R., MACINTYRE, H., MACKENZIE, G., MAGUIRE, P., MARIN, L., NAKAMURA, Y., PILKINGTON, M., SHARPTON, V., SNYDER, D., SUAREZ, G., and TREJO, A., 1997. Size and morphology of the Chicxulub Crater. Nature, 390: 472-476.

MORKHOVEN, F. P. C. M. VAN, BERGGREN, W. A. and EDWARDS, A. S., 1986. Cenozoic cosmopolitan deep-water benthic foraminifera. Bulletin Centre Research Exploration et Production, Elf-Aquitaine, Memoire 11, 421 pp.

MORROW, A. L., 1934. Foraminifera and Ostracoda from the Upper Cretaceous of Kansas. Journal of Paleontology, 8: 186-205.

MUFTAH, A. M., 1993. Agglutinated foraminifera from Danian sediments of the northeastern Sirte Basin. In: Kaminski, M. A., et al. Eds., Proceedings of the Fourth International Workshop on Agglutinated Foraminifera. 173-180.

MURRAY, J. W., 2001, The niche of benthic foraminifera, critical thresholds and proxies. Marine Micropaleontology 41: 1-8

MYATLYUK, E. V., 1970. Foraminifery flishevykh otlozhenii Vostokhnykh Karpat (mel-paleogen). Trudy VNIGRI, 282, 360 pp, Leningrad.

NAKKADY, S. E., 1950. A new foraminiferal fauna from Esna Shales and Upper Cretaceous Chalk of Egypt. Journal of Paleontology, 24 (6): 675-692.

———, 1959. Biostratigraphy of the Um Elghanayem section, Egypt. Micropaleontology, 5 (4): 453-472.

NOMURA, R., 1991, Paleoceanography of Upper Maestrichtian to Eocene benthic foraminiferal assemblages at sites 752, 753 and 754, Eastern Indian Ocean. Proceedings of the ODP, Scientific Results, 121: 3-29.

NOMURA, R., 1995, Paleogene to Neogene deep-sea paleoceanography in the eastern Indian Ocean: benthic foraminifera from ODP Sites 747, 757 and 758. Micropaleontology, 41: 251-290.

NUTTALL, W. L. F., 1930. Eocene foraminifera from Mexico. Journal of Paleontology, 4: 271-293.

NYONG, E. E. and OLSSON, R. K., 1984. A paleoslope model of Campanian to Lower Maestrichtian foraminifera in the North American Basin and adjacent Continental Margin. Marine Micropaleontology, 8: 437-477.

OLSSON, R. K., 1960. Foraminifera of latest Cretaceous and earliest Tertiary Age in New Jersey Coastal Plain. Journal of Paleontology, 34: 1-58.

d'ORBIGNY, A., 1840. Mémoire sur les Foraminifères de la Craie blanche du Bassin de Paris. Mémoires Societe Geologie France, 4: 1-51.

PARKER, F. L. and BERMÚDEZ, P. J., 1937. Eocene species of the genera *Bulimina* and *Buliminella* from Cuba. Journal of Paleontology, 11 (6): 513-516.

PENFIELD, T. and CAMARGO, A., 1981. Definition of a major igneous zone in the central Yucatán platform with aeromagnetics and gravity, in Technical program, abstract and biographies (Society of Exploration Geophysicists 51st Annual International Meeting). Los Angeles: Society of Exploration Geophysicists, p. 37.

PERYT, D., LAHODYNSKY, R. and DURAKIEWICZ, T., 1997. Deep-water agglutinated foraminiferal changes and stable isotope profiles across the Cretaceous/Paleogene Boundary in the Rotwandgraben section, Eastern Alps (Austria). Palaeogeography, Palaeoclimatology, Palaeoecology, 132: 287-307.

PFLUM, C. E., and FRERICHS, W.E., 1976. Gulf of Mexico deep-water foraminifers. Cushman Founation of Foraminiferal Research, Special Publication, 14: 125 pp.

PINDELL, J. L., and BARRETT, S., 1990. Geological evolution of the Caribbean region: a plate tectonic perspective. In: Dengo, G., and Case, J., eds., The Caribbean Region. Boulder, CO: Geological Society of America, Geology of North America, v. H., 405-432.

PLUMMER, H. J., 1926. Foraminifera of the Midway Formation in Texas. University of Texas Bulletin, nº 2644, 201 pp.

QUILTY, P. G., 1992. Upper Cretaceous benthic foraminifers and paleoenvironments, southern Kerguelen plateau, Indian Ocean. In: Wise, S. W. et al., Eds., Proceedings of the Ocean Drilling Project, Scientific Results 120: 393-443.

REISS, Z., 1952. On the Upper Cretaceous and lower Tertiary microfaunas of Israel. Research Council of Israel. Bulletin, 2: 37-50.

———, 1963.Reclassification of perforate foraminifera. Bulletin of the Geological Survey of Israel, 35: 1-111

REUSS, A. E., 1844. Geognostische Skizzen aus Böhmen.Prague: C. W. Medau, V. 2, 304 pp, 3 pl.

———, 1845. Die Versteinerungen der Böhmischen Kreideformation, Erste Abtheilung. Stuttgart: Schweizerbart, 1.148.

———, 1851. Die Foraminiferen und Entomostraceen des Kreidemergels von Lemberg. Naturwissenschaftliche Abhandlungen, Wien, 4: 17-52.

———, 1860. Die Foraminiferen der westphälischen Kreideformation. Sitzungsber. K. Akad. Wiss, math.-naturwiss. Kl., Vienna, 40: 147-238.

———, 1863. Die Foraminiferen des norddeutschen Hils und Gault. Sitzungsber. K. Akad. Wiss, math.-naturwiss. Kl., Vienna, 46 (1862): 5-100.

REVETS, S. A., 1996. The generic revision of five families of Rotaliine foraminifera. Part II: The Anomalinidae, Alabaminidae, Cancrisidae and Gavelinellidae. Cushman Foundation for Foraminiferal Research, Special Publication 34: 57-113.

ROEMER, F. A., 1841. Die Versteinerungen des norddeutschen Kreidegebirges. Hahn'schen Hofbuchhandlung, Hannover: 1-245.

RZEHAK, A., 1895. Ueber einige merkwürdige Foraminiferen aus dem Österrechischen Tertiär. Annalen des K. K. Naturhistorisches Hofmuseum, Wien, 10 (2): 213-230.

SANDIDGE, J. R., 1932. Foraminifera from the Ripley formation of western Alabama. Journal of Paleontology, 6: 265-287.

SCHNITKER, D., 1979. Cenozoic Deep Water benthic foraminifers, Bay of Biscay. In: Montadert, L., Roberts, D. G., et al. Initial Reports of the Deep Sea Drilling Project. Washington, DC: U.S. Government Printing Office, volume 48:377-414.

SCHULZ, P. H., and D'HONDT, S., 1996. Cretaceous-Tertiary (Chicxulub) impact angle and its consequences. Geology, 24: 963-967.

SHEEHAN, P. M., and HANSEN, T. A., 1986. Detritus feeding as a buffer to extinction at the end of the Cretaceous. Geology, 14: 868-870.

SLITER, W. V., 1968. Upper Cretaceous Foraminifera from Southern California and Northwestern Baja California, México. The University of Kansas Publications, 7: 1-141.

———, 1977. Cretaceous benthic foraminifers from the western South Atlantic, Leg. 39, Deep Sea Drilling Project. Initial Reports of the Deep Sea Drilling Project, volume 39: 657-697.

SMIT, J., MONTANARI, A., SWINBURNE, N. H. M., ALVAREZ, W., HILDERBAND, A., MARGOLIS, S., CALEYS, P., LOWRIE, W., and ASARO, F., 1992. Tektite bearing deep-water clastic unit at the Cretaceous-Teriary boundary in northeastern Mexico. Geology, 20: 99-103.

SMIT, J., ROEP, T. B., ALVAREZ, W., CLAYES, P., and MONTANARI, A., 1994. Cretaceous- Tertiary boundary sediments in northeastern Mexico and the Gulf of Mexico: comment. Geology, 22: 953-954.

SMIT, J., ROEP, TH. B., ÁLVAREZ, W., MONTANARI, A., CLAEYS, P., GRAJALES-NISHIMURA, J. M. and BERMUDEZ, J., 1996. Coarse-grained, clastic sandstone complex at the K/T boundary around the Gulf of Mexico: Deposition by tsunami waves induced by the Chicxulub impact? In: Ryder, G., Fastovsky, D. and Gartner, S. Eds., The Cretaceous-Tertiary Event and Other Catastrophes in Earth History: Boulder, Colorado, Geological Society of America Special Paper 307, p. 151-182.

SORIA, A. R., LIESA, C., MATA, M. P., ARZ, J. A., ALEGRET, L., ARENILLAS, I. and MELÉNDEZ, A., 2001. Slumping and a sandbar deposit at the K-T boundary in the El Tecolote sector (northeastern Mexico): An impact-induced sediment gravity flow. Geology, 29 (3): 231-234.

SPEIJER, R. P., 1994. Extinction and recovery patterns in benthic foraminiferal paleocommunities across the Cretaceous-Paleogene and Paleogene-Eocene boundaries. Geologica Ultraiectina, 124, 191 pp.

———, 1995. The late Paleocene benthic foraminiferal extinction as observed in the Middle East. In: Laga, P., Ed., Paleocene-Eocene Boundary Events. Bulletin de la Societe Belge de Geologie, 103: 267-280.

SPEIJER, R. P. and VAN DER ZWAAN, G. J., 1996. Extinction and survivorship of southern Tethyan benthic foraminifera across the Cretaceous/Paleogene boundary. Geological Society of London SpecialPublication 102: 343-371

SWISHER, C. C. III, GRAJALES-NISHIMURA, J. M., MONTANARI, A., MARGOLIS, S. V., CLAEYS, P., ALVAREZ, W., RENNE, P., CEDILLO-PARDO, E., MAURASSE, F. J.-M. R., CURTIS, G. H., SMIT, J., and McWILLIAMS, M. O., 1992. Coeval 40Ar/39Ar ages of 65.0 million years ago from Chicxulub Crater melt rock and Cretaceous-Tertiary boundary tektites. Science, 257: 954-958.

SZCZECHURA, J. and POZARYSKA, K., 1974. Foraminiferida from the Paleocene of the Polish Carpathians (Babica Clays). Palaeontologica Polonica, 31: 3-142.

STINNESBECK, W., BARBARIN, J. M., KELLER, G., LOPEZ-OLIVA, J. G., PIVNIK, D. A., LYONS, J. B., OFFICER, C. B., ADATTE, T., GRAUP, G., ROCCHIA, R., and ROBIN, E., 1993. Deposition of channel deposits near the Cretaceous-Tertiary boundary in northeastern Mexico: catastrophic or "normal" sedimentary deposits? Geology, 21: 797-800.

STINNESBECK, W., KELLER, G., ADATTE, T., LOPEZ-OLIVA, J. G., and MACLEOD, N., 1996, Cretaceous-Tertiary boundary clastic deposits in NE Mexico: impact tsunami or sea-level lowstand? In: MacLeod, N. and Keller, G., Eds., Cretaceous-Tertiary Mass Extinctions: biotic and environmental crises. New York: Norton and Co. p. 501-547.

THOMAS, E., 1990a. Late Cretaceous through Neogene deep-sea benthic foraminifers (Maud Rise, Weddell Sea, Antarctica). Proceedings ODP, Scientific Results, 113: 571-594

———, 1990b. Late Cretaceous-early Eocene mass extinctions in the deep sea. Geological Society of America Special Publication, 247, 481-495.

THOMAS, E., ZACHOS, J. C., and BRALOWER, T. J., 2000, Deep-Sea Environments on a Warm Earth: latest Paleocene - early Eocene.B. Huber, K. MacLeod, and S. Wing, Eds., Warm Climates in Earth History, Cambridge University Press, 132-160.

TJALSMA, R. C. and LOHMANN, G. P., 1983. Paleocene-Eocene bathyal and abyssal benthic foraminifera from the Atlantic Ocean. Micropaleontology, Special Publication, 4: 1-90.

TOULMIN, L. D., 1941. Eocene smaller foraminifera from the Salt Mountain Limestone of Alabama. Journal of Paleontology, 15 (6): 567-611.

TRUJILLO, E. F., 1960. Upper Cretaceous foraminifera from near Redding, Shasta County, California. Journal of Paleontology, 34: 290-346.

VAN DER ZWAAN, G. J., JORISSEN, F. J., and DE STIGTER, H. C., 1990. The depth dependency of planktonic/benthic foraminiferal ratios: constraints and applications. Marine Geology, 95: 1-16.

WEIDICH, K. F., 1995. The genus *Angulogavelinella* Hofker, 1957, and its species (Foraminiferida: Rotaliina; Upper Cretaceous – Lower Tertiary). Journal of Foraminiferal Research, 25: 309-333.

WHITE, M. P., 1928a. Some index foraminifera of the Tampico Embayment area of Mexico. Part I. Journal of Paleontology, 2: 177-215.

———, 1928b. Some index foraminifera of the Tampico Embayment area of Mexico. Part II. Journal of Paleontology, 2: 280-317.

———, 1929. Some index foraminifera of the Tampico Embayment area of Mexico. Part III. Journal of Paleontology, 3: 30-58.

WICHER, C. A., 1949. On the age of the higher Upper Cretaceous of the Tampico Embayment area in Mexico, as an example of the worldwide existence of microfossils and the practical consequences arising from this. Belgrade, Museum Histoires Naturelles Pays Serbe, Bull., ser. A, no. 2, pp. 57 (Serbian), p. 85 (English), pl. 5, figs. 2-3.

———, 1956. Mit beitrag von Bettenstaedt, F., Die Gosauschichten im Becken von Gams (Oesterreich) und die Foraminiferengliederung der hoeheren Oberkreide in der Tethys. Palaeontologische Zeitschrift, 30 (Sonderhefte): 87-136.

WIDMARK, J. G. V., 1997. Deep-sea benthic foraminifera from Cretaceous-Paleogene boundary strata in the South Atlantic- taxonomy and paleoecology. Fossils and Strata, 43: 1-94.

———, 2000. Biogeography of terminal Cretaceous benthic foraminifera: deep-water circulation and trophic gradients in the deep South Atlantic. Cretaceous Research, 21: 367-379.

WIDMARK, J. G. V. and MALMGREN, B., 1988. Differential dissolution of Upper Cretaceous deep-sea benthic foraminifera. Marine Micropaleontology, 13: 47-78.

———, 1992a. Benthic foraminiferal changes across the Cretaceous-Tertiary boundary in the deep sea; DSDP sites 525, 527 and 465. Journal of Foraminiferal Research, 22 (2): 81-113.

———, 1992b. Biogeography of terminal Cretaceous Deep-sea Benthic Foraminifera from the Atlantic and Pacific oceans. Palaeogeography, Palaeoclimatology, Palaeoecology, 92: 375-405.

WIDMARK, J. G. V. and SPEIJER, R. P., 1997a. Benthic foraminiferal faunas and trophic regimes at the terminal Cretaceous Tethyan seafloor. Palaios, 12: 354-371

———, 1997b. Benthic foraminiferal ecomarker species of the terminal Cretaceous (late Maastrichtian) deep-sea Tethys. Marine Micropaleontology, 31: 135-155.

ZACHOS, J. C., and ARTHUR, M. A., 1986, Paleoceanography of the Cretaceous/Tertiary event: inferences from stable isotope and other data. Paleoceanography, 1: 5-26.

Manuscript received June 5, 2001
Manuscript accepted July 23, 2001