results are believed to be more reliable than sample distribution and intensity would suggest. The data and interpretations presented may be modified by study of additional material, but it is believed that the major features of the distributions are essentially correct.

There is a suggestion of some depth zonation in this region, but this is confused by what appears to be faunal mixing of shallow and deep-water sediments. Probable depth zonation is more apparent in Baffin Bay than in Lancaster Sound, the only two areas from which there are samples having a significant depth range. In Baffin Bay the following species appear to be generally indicative of water depths less than about 250 m.:

*Angulogerina angulosa* (Williamson)
*Astrononion stellatum* Cushman and Edwards
*Cassidulina islandica* Nørvang var. *minuta* Nørvang
*Cassidulina norcrossi* Cushman
*Cibicides lobatulus* (Walker and Jacob)
*Elphidiella arctica* (Parker and Jones)
*Elphidium incertum* (Williamson) and vars.
*Eponides frigidus* (Cushman)
*Miliammina groenlandica* Cushman

In general these species show no similar depth restriction in Lancaster Sound, where the depths are somewhat greater, although *Elphidium* is not reported from this area. In Melville Sound there is one relatively deep sample (409 m.) which has a significantly different fauna from the other samples in the area which are from 124 m.

Considerable faunal mixing is obvious in the samples and it is suggested that this is caused by ice-rafting. Faunal mixing and thus absence of clearcut depth zonation may be a characteristic of Arctic areas, especially those areas in which there is considerable shallow water around an intricate coastline. Ice transportation of sedimentary materials, including Foraminifera from near shore zones and later deposition in deeper waters is probably one of the main sedimentary processes in Arctic and Antarctic regions.

The distribution of Arctic Foraminifera has been little studied, and it is not possible to compare the present fauna with others from the Arctic. It is believed that faunas from this region can be differentiated from other Arctic faunas, but it will be necessary to study a great deal of additional material from widely distributed areas before there can be any certainty of this. The present fauna appears to be related to the assemblage near Iceland by having the following species reported from these two regions:

*Cassidulina norcrossi* Cushman
*Cassidulina islandica* Nørvang var. *minuta* Nørvang
*Elphidiella arctica* (Parker and Jones)
*Miliammina groenlandica* Cushman

The fauna in the southern Gulf of Maine differs by containing numerous species which are also abundant south of Cape Cod.

Sediments from several of the areas covered in this report can be distinguished as to area of origin by distinctive faunal characteristics, such as relative frequencies, restricted distribution of certain species, relative population size, and relative abundance of species. The local faunal differences are relatively minor features superimposed on a general faunal similarity which is characteristic of the region as a whole. Baffin Bay is the one area which does not have any apparent faunal distinction. This may be the result of a large body of water having unlimited communication with several adjacent water areas. Under such conditions faunal mixing may prevent the development of a distinctive assemblage. Additional samples from Baffin Bay, on the other hand, may reveal features which can differentiate it from adjacent areas.

The Thule samples are distinctive in the high percentage of *Eggerella advena* (Cushman) and in the relatively low percentage of *Haplophragmoides glomeratum* (Brady).

The single Kane Basin sample has an unusually high population, an unusually high percentage of *Cibicides lobatulus* (Walker and Jacob), relatively high frequency of *Elphidiella arctica* (Parker and Jones), and also contains *Oolina costata* (Williamson). The Kennedy Channel sample apparently has no distinctive elements.

Lancaster Sound samples have the most persistent occurrences of *Ammodiscus gullmarensis* Höglund. *Trochammina quadriloba* Höglund is essentially restricted to this area, and most of the records of *Virgulina sp.* cf. *V. complanata* Egger are from here. *Nonion barleeanum* (Williamson) is essentially restricted to Baffin Bay and vicinity and Lancaster Sound.

Four of the five samples from Dundas Harbor are characterized by relatively high populations, by the presence of *Ammobaculites cassis* (Parker) and *Discorbis sp.* at most stations, high frequencies of *Elphidium incertum* (Williamson) and vars. at all stations, absence of or very low frequency of *Haplophragmoides glomeratum* (Brady), *Proteonina atlantica* Cushman, *Textularia earlandi* Parker (Ms.), *Textularia torquata* Parker (Ms.), and *Trochammina nana* (Brady), and high frequency of *Virgulina fusiformis* (Williamson).

The Toy Bay Samples have very low populations (20 or less/sample) and a small number of species. The fauna is almost exclusively composed of *Miliammina groenlandica* Cushman, *Spiroplectammina biformis* (Parker and Jones), and *Textularia torquata,* Parker (Ms.).

The Burnett Creek sample has a large population with several species dominated by *Elphidium incertum* (Williamson) and vars., *Cassidulina islandica* Höglund var. *minuta* Höglund, and *Cassidulina norcrossi* Cushman.

The fauna in Wellington Channel is distinct in the high frequencies of *Cassidulina norcrossi* Cushman, presence of *Elphidiella arctica* (Parker and Jones) at most stations, low frequencies of *Haplophragmoides glomeratum* (Brady), relative abundance of *Nonion labradoricum* (Dawson), presence of *Oolina costata* (Williamson) at most stations, low frequency of *Proteonina atlantica* Cushman and *Trochammina nana* (Brady), and relative abundance of *Virgulina fusiformis* (Williamson).

Melville Sound is characterized by the following species which are completely or essentially restricted to that area:

*Psammosphaera fusca* F. E. Schultze
*Reophax nodulosa* Brady
*Reophax sp.* cf. *R. scorpiurus* Montfort
*Trochammina inflata* (Montagu)
*Trochamminella atlantica* Parker

*Labrospira crassimargo* (Norman) reaches its highest frequency here.



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Contributions from the Scripps Institution of Oceanography, New Series, No. 574.

Contribution No. 9 from the Marine Foraminifera Laboratory.


## LOCATION OF STATIONS

Orange Peel Samples

| No. | Depth-meters | Latitude | Longitude |
|---|---|---|---|
| OP 2 | 188 | 72°48′N | 58°30′W |
| OP 3 | 244 | 71°42′N | 57°51′W |
| OP 4 | 230 | 73°37′N | 59°32′W |
| OP 5 | 256 | 74°38′N | 62°47′W |
| OP 6 | 621 | 74°10′N | 60°54′W |
| OP 7 | 877 | 73°49′N | 59°06′W |
| OP 8 | 823 | 74°16′N | 59°05′W |
| OP 9 | 38 | 74°35′N | 82°11′W |
| OP 10 | 31 | 74°35′N | 82°11′W |
| OP 11 | 592 | 74°32′N | 79°50′W |
| OP 12 | 629 | 74°46′N | 74°25′W |
| OP 13 | 391 | 74°38′N | 78°28′W |
| OP 14 | 40 | 74°35′N | 82°11′W |
| OP 15 | 31 | 76°38′N | 68°48′W |
| OP 16 | 31 | 76°38′N | 68°48′W |
| OP 17 | 31 | 76°38′N | 68°48′W |
| OP 18 | 658 | 74°18′N | 82°30′W |
| OP 19 | | 74°25′N | 86°45′W |
| OP 20 | 276 | 74°26′N | 89°07′W |
| OP 21 | 31 | 76°38′N | 68°48′W |
| OP 22 | 439 | 73°57′N | 87°05′W |
| OP 24 | | 73°37′N | 80°42′W |
| OP 26 | 345 | 80°18′N | 67°42′W |
| OP 27 | 124 | 74°34′N | 110°40′W |
| OP 28 | 124 | 74°34′N | 110°40′W |
| OP 29 | 124 | 74°34′N | 110°40′W |
| OP 30 | 137 | 75°22′N | 93°22′W |
| OP 31 | 137 | 75°22′N | 93°22′W |

CORE SAMPLES

| No. | Depth-meters | Latitude | Longitude |
|---|---|---|---|
| C 1 | 38 | 74°35′N | 82°11′W |
| C 2 | 38 | 74°35′N | 82°11′W |
| C 3 | 31 | 76°38′N | 68°48′W |
| C 4 | 31 | 76°38′N | 68°48′W |
| C 5 | 457 | 74°03′N | 87°05′W |
| C 6 | 439 | 74°08′N | 87°05′W |
| C 7 | 419 | 74°13′N | 87°05′W |
| C 8 | 448 | 74°18′N | 87°05′W |
| C 9 | | 73°37′N | 80°42′W |
| C 10 | | 73°37′N | 80°42′W |
| C 11 | | 73°37′N | 80°42′W |
| C 12 | | 73°37′N | 80°42′W |
| C 13 | 124 | 78°53′N | 73°35′W |
| C 14 | 124 | 74°34′N | 110°40′W |
| C 15 | 124 | 74°34′N | 110°40′W |
| C 16 | 124 | 74°34′N | 110°40′W |
| C 17 | 409 | 74°15′N | 112°35′W |
| C 18 | 155 | 75°22′N | 93°22′W |
| C 19 | 155 | 75°22′N | 93°22′W |
| C 20 | 126 | 75°55′N | 93°14′W |

# 62. FORAMINIFERA FROM CRETACEOUS-TERTIARY-TRANSITIONAL STRATA OF THE HODNA MOUNTAINS, ALGERIA*

C. W. Drooger
(Utrecht, Holland)

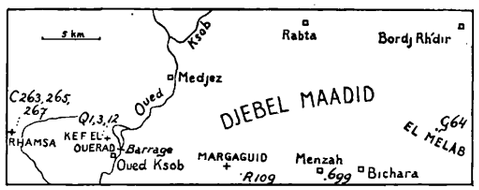
ABSTRACT—From Cretaceous-Tertiary transitional marly beds, considered to be entirely or for the larger part approximately Danian age, 43 species and varieties of Foraminifera are described, of which 9 species and two varieties are new. A short discussion of the age of the strata and of the ecology of the foraminiferal associations is given.

## INTRODUCTION

During a mapping survey in the mountainous country along part of the northern border of the Hodna Basin, Algeria (1947-1949), several samples were taken at random from marls out of a complex of alternating marls and limestones of about 80 meters thickness. These samples proved to contain many Foraminifera. The sequence of marls and limestones is stratigraphically of intermediate position between beds, which can be assigned with certainty to the Maestrichtian below and the Eocene above. The localities, from where the samples have been taken, are mainly scattered along a narrow strip of some 40 km. length. They have been plotted on the accompanying sketch-map (Text fig. 1).

The stratigraphy of the Cretaceous-Tertiary transitional beds of this region has been well-studied,

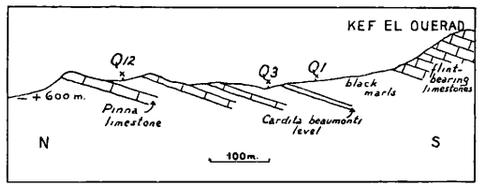
* Contribution of the Paleontological Department of the State University of Utrecht.



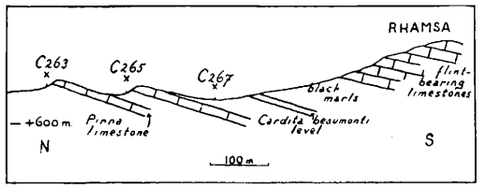

Text Fig. 1: Sample Localities, Hodna Basin, Algeria

especially by SAVORNIN (lit. 3) and FLANDRIN (lit. 2). During the geological mapping it was found, however, that a study of the detailed stratigraphy of these layers is severely hampered by the occurrence of lateral facies changes. In the region along and to the west of Oued Ksob two fairly constant levels could be mapped, which fortunately, are situated respectively near the base and close to the top of this complex. In the lower part of the sequence a thick, light-coloured limestone occurs, in which, in addition to other ill-preserved fossils, numerous fragments of *Pinna* sp. were observed. In the upper portion of the 80 meters' complex a thin, fossiliferous, yellowish, marly zone with numerous *Cardita beaumonti* d'Archiac was encountered, lying at the base of a series of dark gypsiferous clays, which in turn are overlain by the topographically protruding complex of Eocene (Ypresian) limestones with silex.

In two sections on the northern slopes of Rhamsa and of Kef el Ouerad, three samples of each of the sections contained smaller Foraminifera and a few larger ones. Their exact stratigraphic position has been marked on the accompanying drawings (Text figs. 2 and 3). Sample 699 has been taken from a level, slightly above that of *Cardita beaumonti,* in the




Text Fig. 2: Stratigraphic Section: Localities Q 1, Q 3, and Q 12 Dano-Montian, Kef el Ouerad, Algeria




Text Fig. 3: Stratigraphic Section: Localities C 263, C 265, and C 267 Dano-Montian, Rhamsa, Algeria

southern Djebel Maadid near Oued Menzah. Sample G 64 is a composite one, derived from beds directly below, in and slightly above this same horizon, in the isolated outcrop of these strata of El Melab, south of Bordj Rh'dir. The exact stratigraphical position of sample R 109 is unknown.

The megafauna of the higher part of the sequence involved, in and some distance below the level, marked by the abundance of *Cardita beaumonti,* is characterized by *Cardita beaumonti* d'Archiac, *Roudaireia drui* Munier-Chalmas and *Exogyra overwegi* von Buch. Moreover, especially near the Rhamsa, numerous, mainly fragmentary oysters, were encountered in several horizons throughout the section, even some meters below the *Pinna*-limestone. These strongly variable oysters may all be considered to belong to a single species, most likely *Alectryonia aucapitainei* (Coquand).

The three first mentioned species of these mollusks in the higher part of the Cretaceous-Tertiary transitional strata are now generally considered to characterize the North African Danian. *Alectryonia aucapitainei* is considered by SAVORNIN to be restricted to the Danian in the vicinity of Oued Ksob. It should be remarked, however, that the age of the layers, dealt with here, is evaluated differently by SAVORNIN and FLANDRIN. As far as can be concluded from his general description, SAVORNIN places the complex between the *Pinna*-limestone and the *Cardita beaumonti*-level nearly entirely in the Danian; the latter horizon, however, he considers to be Montian. On the other hand, FLANDRIN places the majority of our section in the Uppermost Maestrichtian, whereas he considers the Danian to range from about 25 meters below to 35 meters above the *Cardita beaumonti*-horizon. The upper limit of FLANDRIN's Danian is evidently based on the occurrence of some oyster-beds, which contain a. o. *Alectryonia villei* (Coquand), near the top of the dark gypsiferous clays. This *A. villei* is generally considered to be a typical Cretaceous species, occurring abundantly in the Campanian and the Maestrichtian of this part of North Africa. Unfortunately, the oysters, collected during our mapping survey, are too poorly preserved to allow a specific determination, but some fragments from these oyster-beds were observed, which, indeed, strongly resemble the well-known Cretaceous species.

The stratigraphical problems concerning our strata, are not yet satisfactorily solved. It is therefore thought recommendable at present either to name these beds simply "Cretaceous-Tertiary transitional strata" or possibly to use the name Dano-Montian, introduced by FLANDRIN (lit. 2) and SIGAL (lit. 4). The writer is inclined to place the larger part of or even the entire section in the Danian, as in none of his samples a typical Maestrichtian microfauna was encountered. On the other hand, however, no criterions are available to separate the Danian from the Paleocene.



The microfaunal assemblages of the samples have a rather different aspect with respect to associations, known from other localities of the Algerian Cretaceous-Tertiary transitional sediments (lit. 1 and 4). The latter have a more cosmopolitan character and compare better with several described fauna of America, as for instance the Midway of Texas, and also with those from the Caucasus and Sweden. This difference in faunal composition may be explained by assuming that the corresponding sediments along the northern border of the Hodna Basin were deposited under rather extreme, i. e. comparatively shallow, and possibly partly brackish water conditions. The lateral facies changes of the individual layers, the numerous oyster-beds and the gypsum content of many of the samples support this opinion. Further evidence is found in several of the species which were reported as shallow water forms elsewhere or which may be anticipated as such. The occurrence of many of the species with numerous individuals of relatively small, but constant, size in samples with a rather low number of species, together with the comparatively high amount of new species, may also point to the former existence of some special environmental influence during sedimentation.

The established stratigraphical ranges of earlier described species in our samples indicate a dominance of Danian-Paleocene forms. Only three of the determined species have so far been recorded from Upper Senonian strata only: *Loxostomum plaitum, Siphogenerinoides parva* and *Omphalocyclus macropora.* Especially the latter is an important species of the European Uppermost Cretaceous (excluding Danian), for instance of the Maestrichtian at its type-locality Maastricht. REY (in FLANDRIN, lit. 2, p. 155), however, reports this species from the Algerian Danian. Only three species are probably restricted, as far as known, to the Eocene: *Nonion acutidorsatus, Gümbelitria triserialis* and *Globorotalia wilcoxensis* var. *acuta.* The majority of the other earlier described 25 species are known from, and in many cases restricted to, Danian, Paleocene or Danian-Paleocene. Comparing the foraminiferal associations from the Hodna region with those of about the same age in the neighbourhood of Constantine (lit. 1 and 4), a somewhat better correlation is indicated with the fauna of the Velasco shale and Tabasco formations of Mexico and with the Lizard Springs marls of Trinidad. Relations exist also with the fauna of the Paleocene of El-Guss-Abu-Said, Egypt, and of the Netherlands. It has been pointed out already that distinct Maestrichtian markers are absent in our material, but the conclusion herefrom is weakened by the scarcity of pelagic species, though those that are present, point to levels, younger than Upper Senonian.

When combining our individual samples to a tentative single stratigraphical sequence, no distinct zoning is observed from the vertical distribution of the spe-

| | C 263 | Q 12 | C 265 | C 267 | Q 3 | G 64 | 699 | Q 1 |
|---|---|---|---|---|---|---|---|---|
| Haplophragmoides eggeri Cushman | × | | | | | | × | |
| Trochammina bradyi (Schwager) | | × | | | × | | × | × |
| Nodosaria bacillum Defrance | | | | | × | | × | |
| Vaginulina legumen (Linné) | | | | | × | × | | |
| Nonion acutidorsatus Dam | × | × | × | | | × | × | |
| Nonionella insecta (Schwager) | × | × | | | | | | |
| Gümbelina morsei Kline | × | | | | | × | × | |
| Bulimina trigonalis Dam | × | | | | × | | | |
| Virgulina troosteri Drooger n. sp. | × | × | | | | | × | × |
| Valvulineria koenigswaldi Drooger n. sp. | × | | | | | × | × | × |
| Valvulineria palmi Drooger n. sp. | aff. | × | | | | | | |
| Rotalia sigali Drooger n. sp. | | | × | × | | | | |
| Globigerina voluta White | × | × | × | | × | × | | |
| Cibicides praecursorius (Schwager) and vars. | × | × | × | × | | | | |
| Anomalina midwayensis (Plummer) and vars. | | | | | × | × | | |
| Anomalina newmanae ksobensis Drooger n. var. | | | | | | × | × | × |
| Virgulina cruysi Drooger and new var. | | | | | | × | × | |

Table 1: Distribution Chart of some of the Dano-Montian Hodna Mountains Beds in Algeria with tentative stratigraphic sequence of localities indicated on Text figs. 1, 2, and 3.

cies. This negative result is probably mainly due to a lack of sufficient data. Possibly the middle of the "section" (C 265 and C 267) represents an intercalation of sediments, deposited under extremely aberrant environmental conditions. Although this may have been of local importance only, it may explain the interrupted occurrences of some, otherwise common species, as for instance *Virgulina troosteri* and *Valvulineria koenigswaldi*.

The author is gratefully indebted to H. Cruys, Q. A. Palm and Th. Raven, who collected part of the samples, and to G. Bétier, Directeur du Service de la Carte géologique de l'Algérie, who allowed a substantial grant for making the drawings. Many thanks are due to H. E. Thalmann for valuable assistance in correcting the English, to P. Marks for his helpful criticism and the drawing of the figures, and to J. H. van Dijk for the making of the photographs.

## DESCRIPTION OF THE SPECIES

### Family AMMODISCIDAE

Genus **Ammodiscoides** Cushman, 1909

**Ammodiscoides turbinatus** Cushman

*Ammodiscoides turbinatus* CUSHMAN, 1909, Proc. U. S. Nat. Museum, vol. 36, no. 1676, p. 423, pl. 33, f. 1-6; CUSHMAN and STAINFORTH, 1946, Cushman Lab. Foram. Res., Spec. Publ. 18, p. 15, pl. 1, f. 28, 29.

As far as known this species evidently has a long stratigraphical range: Upper Cretaceous to Recent.

*Occurrence*—Rare in C 263.

### Family LITUOLIDAE

Genus **Haplophragmoides** Cushman, 1910

**Haplophragmoides eggeri** Cushman

Plate 15, figure 1

*Haplophragmoides eggeri* CUSHMAN, 1926, Bull. Am. Ass. Petr. Geol., vol. 10, p. 583, pl. 15, f. 1; CUSHMAN and JARVIS, 1932, Proc. U. S. Nat. Museum, Bull. 80, art. 14, p. 12, pl. 3, f. 2; GALLOWAY and MORREY, 1932, Journ. of Pal., vol. 5, p. 333, pl. 37, f. 6; GLAESSNER, 1937, Probl. Paleont., Moscow Univ., vols. 2-3, p. 361, pl. 1, f. 10.

*Remarks*—Many of the Algerian specimens, considered to belong to this species, have been somewhat distorted, resulting in rather varying external appearances of the test, because of different directions of distortion for the separate specimens. In some individuals the sutures appear strongly limbate (see Pl. 15, fig. 1).

*Occurrence*—Few in 699 and R 109, rare in C 263.

Originally described from the Velasco shale of Mexico. Reported from Uppermost Cretaceous (about Danian) deposits in Mexico and Trinidad and from the Paleocene of the Caucasus.

### Family TEXTULARIIDAE

Genus **Spiroplectammina** Cushman, 1927

**Spiroplectammina raveni** Drooger, n. sp.

Plate 15, figures 2a-3b

*Description*—Test minute, about 1½ times as long as broad, gradually tapering to the broadly rounded initial end, compressed, early portion distinctly coiled, later part biserial with inter-fingering chambers; periphery sharp, slightly keeled and often indented; chambers distinct, in the biserial portion about twice as broad as high; sutures strongly limbate, occasionally raised in the early portion, in the adult usually slightly depressed and somewhat curved, forming an angle with the median line of about 70 degrees in their inner portion; wall arenaceous, rather roughly finished; aperture a narrow slit at the base of the final chamber. Maximum observed length 0.25 mm.

*Remarks*—Except for its much smaller size *S. raveni* differs from *S. richardi* Martin (1943, Publ. Stanford Univ., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 104, pl. 5, f. 3) from the Eocene-Paleocene Lodo formation of California by its strongly limbate sutures, which show a different arrangement near the median line, whereas the early coiled stage is relatively better developed in the Algerian species.

*Occurrence*—Rare in Q 1.

Genus **Textularia** Defrance, 1824

**Textularia plummerae** Lalicker

Plate 15, figures 4a-5

*Textularia cocaena* PLUMMER (non Gümbel), 1926, Univ. Texas Bull. 2644, p. 67, pl. 3, f. 2.

*Textularia plummerae* LALICKER, 1935, Contrib. Cushman Lab. Foram. Res., vol. 11, p. 50, pl. 6, f. 10; GLAESSNER, 1937, Probl. Paleont., Moscow Univ., vols. 2-3, p. 364.

*Remarks*—Typical specimens are rare in our material, but many others were found with obviously the same features, but in which the test is strongly compressed, probably due to collapse of the chamber walls (see Pl. 15, fig. 5). In these specimens the sutures appear as somewhat limbate and often slightly elevated ridges.

The Algerian specimens differ from *T. plummerae* in being of much smaller size (maximum length 0.35 mm.). Megalospheric specimens resemble best those pictured by Lalicker; microspheric ones are closest to the specimen pictured by Plummer.

*Occurrence*—Few in Q 1.

*T. plummerae* has been reported from the Upper Midway of Texas and the Paleocene of the Causasus.

### Family VERNEUILINIDAE

Genus **Gaudryina** Orbigny, 1839

**Gaudryina laevigata** Franke var. **pyramidata** Cushman

Plate 15, figure 6

*Gaudryina laevigata* Franke var. *pyramidata* CUSHMAN, 1926, Bull. Am. Ass. Petr. Geol., vol. 10, p. 587, pl. 16, f. 8; CUSHMAN and JARVIS, 1928, Contrib. Cushman Lab. Foram. Res., vol. 4, p. 92, pl. 13, f. 6; WHITE, 1928, Journ. of Pal., vol. 2, p. 313, pl. 42, f. 7; REY, 1948, in Flandrin, Contribution à l'Etude stratigraphique du Nummulitique Algérien, p. 155.

*Gaudryina pyramidata* Cushman, CUSHMAN and RENZ, 1946, Cushman Lab. Foram. Res., Spec. Publ. 18, p. 21, pl. 2, f. 21; CUSHMAN and RENZ, 1948, Cushman Lab. Foram. Res., Spec. Publ. 24, p. 13, pl. 3, f. 4.

*Occurrence*--Common in Q 3.

Originally described from the Velasco shale of Mexico. Furthermore recorded from the Upper Cretaceous —lower zone of the Lizard Springs formation—and the Eocene of Trinidad and from the Danian of Algeria.



### Family TROCHAMMINIDAE

Genus **Trochammina** Parker and Jones, 1859

**Trochammina bradyi** (Schwager)

Plate 15, figures 7a-c

*Haplophragmium bradyi* SCHWAGER, 1883, Palaeontogr., vol. 30, pt. 1, pal. pt., p. 117, pl. 29, f. 19.

*Haplophragmoides diagonis* CARSEY, 1926, Univ. Texas Bull. 2612, p. 22, pl. 3, f. 1.

*Trochammina diagonis* (Carsey) CUSHMAN, 1927, Contrib. Cushman Lab. Foram. Res., vol. 2, p. 84, pl. 10, f. 7; GALLOWAY and MORREY, 1931, Journ. of Pal., vol. 5, p. 332, pl. 37, f. 4.

*Haplophragmoides* sp.? WHITE, 1928, Journ. of Pal., vol. 2, p. 307, pl. 41, f. 4.

*Description*—Test slightly, often indistinctly, trochoid, strongly compressed. usually flattened by later distortion; periphery narrowly rounded, usually sharp, lobulate; chambers about six in the final whorl; sutures straight to moderately and often irregularly curved; wall finely arenaceous, generally smoothly finished; aperture indistinct. Maximum diameter 0.4 mm.

*Remarks*—It is highly probable that in all the above quoted references one and the same species is meant, the individuals of which are usually completely flattened by compression of the embedding sediment (see Pl. 15, fig. 7). As a result of this action the early characteristics of the test have mostly been obliterated, often giving a bilaterally symmetrical appearance to the test.

*Occurrence*—Common in Q 1, Q 3 and 699, few in Q 12.

The species was originally described from the Paleocene of El-Guss-Abu-Said, Egypt. It also occurs in beds of Taylor and Navarro age in Texas and in the Uppermost Cretaceous (about Danian) of Mexico.

### Family LAGENIDAE

Genus **Lenticulina** Lamarck, 1804

**Lenticulina** sp. cf. **L. velascoensis** (White)

*Astacolus velascoensis* WHITE, 1928, Journ. of Pal., vol. 2, p. 202, pl. 28, f. 12.

*Remarks*—The few specimens, found in the Algerian material, are rather badly preserved. In most of them the sutures are moderately raised and for which reasons they are tentatively referred to White's species.

*Occurrence*—Rare in Q 3.

Reported from Upper San Felipe to Velasco of Mexico.

Genus **Dentalina** d'Orbigny, 1826

**Dentalina** sp. cf. **O. inornata** Orbigny

*Dentalina inornata* ORBIGNY, 1846, Foram. Foss. Bass. Tert. Vienne, p. 44, pl. 1, f. 50, 51.

*Dentalina* aff. *inornata* Orbigny, SCHWAGER, 1883, Palaeontogr., vol. 30, pt. 1, pal. pt., p. 107, pl. 26, f. 3.

*Remarks*—Few fragmentary specimens were found, which resemble the one pictured by Schwager from the Paleocene of Egypt.

*Occurrence*—Rare in C 265.

Genus **Nodosaria** Lamarck, 1812

**Nodosaria bacillum** Defrance

Plate 15, figure 8

*Nodosaria bacillum* DEFRANCE, 1826, Dict. des Sc. Nat., vol. 35, p. 127, pl. 13, f. 4; D'ORBIGNY, 1846, Foram. Foss. Bass. Tert. Vienne, p. 40, pl. 1, f. 40-47.

*Remarks*—Many fragments of a large costate *Nodosaria* were found, usually consisting of single chambers only, showing the following characteristics: chambers globular to somewhat longer than broad, variably ornamented with 8-25 heavy, longitudinal costae, which pass in diminishing strength, but uninterrupted, over the broad, deeply depressed sutures. Maximum observed breadth of a single chamber 0.8 mm.

In the literature numerous specific names were given to similar forms of *Nodosaria,* occurring in sediments from many parts of the world and from widely varying stratigraphic levels. Several of these forms have been referred to *N. affinis* Orbigny, which in our opinion is identical with Defrance's species. Thus the Algerian fragments are considered to belong to the earlier described *N. bacillum.*

*Occurrence*—Rare in Q 3, 699 and R 109.

In addition to the rare occurrences in some of the samples from the southern slopes of the Djebel Maadid, this species is abundant in several samples from the Cretaceous-Tertiary transitional strata of the neighbourhood of Aïn Fakroun and Oued Athmenia (Dept. of Constantine).

Genus **Vaginulina** Orbigny, 1826
**Vaginulina legumen** (Linné)
Plate 15, figures 9, 10

*Nautilus legumen* Linné, 1758, Syst. Nat., ed. 10, vol. 1, p. 711, (Plancus, pl. 1, f. 7g-i).

*Occurrence*—Common in Q 3, few in G 64, rare in E 29D (collection Cruys). It is the only species present in E 29D from the Cretaceous-Tertiary transitional marls in the vicinity of Bordj Rh'dir.

Originally described as a recent species from the Adriatic sea, *V. legumen* has subsequently been widely reported from numerous different stratigraphical levels from Mesozoic to Recent. Many of these references, however, do not seem to belong to this species.

Family NONIONIDAE
Genus **Nonion** Montfort, 1808
**Nonion acutidorsatum** Dam
Plate 15, figures 11a, b

*Nonion acutidorsatum* Dam, 1944, Meded. Geol. Stichting, Ser. C, vol. 5, no. 3, p. 108, pl. 3, f. 19.

*Remarks*—Part of our specimens closely resemble the one, pictured by ten Dam, whereas others are somewhat more rounded in outline or with a slightly thicker test (see Pl. 15, fig. 11). The average number of chambers in the final whorl is eight, thus slightly less than in the typical form. Some specimens approach the type of the recent *N. labradoricum* (Dawson) (1860, Canad. Naturalist, vol. 5, p. 191, f. 4), whereas others again are slightly oblique and *Nonionella*-like. Notwithstanding these minor differences it is considered preferable to place the group of Algerian specimens as a whole in *N. acutidorsatum*.

*Occurrence*—Common in Q 12 and C 265, few in C 263, 699 and G 64.

Originally described from the Eocene (Lutetian) of the Netherlands.

**Nonion sublaeve** Dam
Plate 15, figure 12

*Nonion sublaeve* Dam, 1944, Meded. Geol. Stichting, ser. C, vol. 5, no. 3, p. 109, pl. 3, f. 8.

*Occurrence*—Few in C 265.

Originally described from the brackish-water Paleocene of the Netherlands.

Genus **Nonionella** Cushman, 1926
**Nonionella insecta** (Schwager)
Plate 15, figures 13a-c

*Anomalina insecta* Schwager, 1883, Palaeontogr., vol. 30, pt. 1, pal. pt., p. 128, pl. 28, f. 2a-d.

*Nonionella insecta* (Schwager) Cushman and Ponton, 1932, Contrib. Cushman Lab. Foram. Res., vol. 8, p. 65, pl. 8, f. 13, 14; Glaessner, 1937, Probl. Paleont., Moscow Univ., vols. 2-3, p. 368.

*Remarks*—The Algerian representatives of this species are small (larger diameter about 0.2 mm.) and closest to the young stage of the species, pictured by Cushman and Ponton. They show a faint resemblance with some of the individuals of *Nonion acutidorsatum* Dam, occurring in the same samples, but it was impossible to find convincing transient specimens between them and immature individuals of *Nonion acutidorsatum*. For this reason they are treated as belonging to a separate species.

*Occurrence*—Few in Q 12 and C 263.

Originally described from the Paleocene of El-Guss-Abu-Said, Egypt. Reported furthermore from the Wilcox Eocene of Alabama and the Paleocene of the Caucasus.

**Nonionella ovata** Brotzen

*Nonionella ovata* Brotzen, 1948, Sver. Geol. Unders., Avh., ser. C, no. 493, årsb. 42, no. 2, p. 68, pl. 10, f. 13, 14.

*Remarks*—In sample Q 1, slightly above the *Cardita beaumonti*-level near the river Ksob, a single specimen of *Nonionella* was found, which is considered to belong to Brotzen's species. The only differing feature is in the very slight depression of the sutures in the Algerian specimen. Because of this characteristic there is some resemblance with the Upper Cretaceous *N. austinana* Cushman (1933, Contrib. Cushman Lab. Foram. Res., vol. 9, p. 57, pl. 7, f. 2), which is, however, considerably more compressed.

*Occurrence*—Rare in Q 1.

Described from the Paleocene of Sweden.

Family HETEROHELICIDAE
Genus **Gümbelina** Egger, 1899
**Gümbelina morsei** Kline
Plate 15, figure 14

*Gümbelina morsei* Kline, 1943, Bull. Miss. Geol. Survey, no. 53, p. 44, pl. 7, f. 12.

*Remarks*—An insignificant number of small and strongly variable *Gümbelina* specimens from some of the samples seems to be closest to this species. Since variation among them is rather wide, several of the specimens approach the types of other species, but specific determination of these more or less aberrant forms would be impossible because of the lack of sufficient material. As a matter of fact, in the genus *Gümbelina* several of the described species are less different from one another than the specimens of a single fossil assemblage, which are reasonably considered to belong to one and the same species. When the variation of the individuals in a newly established species is insufficiently described as is often the case, later specific determination is severely hampered. Among the material of our samples some larger specimens are close to *G. striata* (Ehrenberg) and *G. ultimatumida* White, others again approach the type of *G. midwayensis* Cushman.



*Occurrence*—Few in C 263, 699 and G 64.

Originally described from the Paleocene Midway series of Mississippi.

Genus **Gümbelitria** Cushman, 1933
**Gümbelitria triseriata** (Terquem)
Plate 15, figures 15, 16

*Textilaria triseriata* Terquem, 1882, Mém. Soc. Géol. France, sér. 3, tome 2, p. 145, pl. 15, f. 10.

(?) *Gümbelitria stavensis* Bandy, 1949, Bull. Am. Paleont., vol. 32, no. 131, p. 124, pl. 24, f. 5.

*Remarks*—Many of the Algerian specimens are somewhat twisted or irregular in the later stages of individual development. The aperture is a semicircular opening at the base of the final chamber. Measured length up to 0.20 mm.

It should be remarked that in our material *G. triseriata* is found together with numerous representatives of *Bulimina trigonalis* Dam. In general appearance both species are very similar, the main distinguishing feature being the shape of the aperture. Unfortunately, in many specimens the aperture is rather ill-preserved, thus causing doubtful determinations in such cases. Intergradation of both species could not be observed, but it should be borne in mind that the indistinct apertural characteristics in many individuals hamper a clear decision on this subject. Such an intergradation is thought to be not entirely impossible, as many older species of *Bulimina* show a considerable amount of variation in the shape of their aperture.

*Occurrence*—Few in C 263.

Originally described from the Lower Eocene of France. Specimens resembling *G. stavensis* Bandy from the Claiborne Eocene of Alabama are equally represented in the Algerian material. They cannot be separated specifically here.

Family BULIMINIDAE
Genus **Buliminella** Cushman, 1911
**Buliminella parvula** Brotzen

*Buliminella parvula* Brotzen, 1948, Sver. Geol. Unders., Avh., ser. C, no. 493, årsb. 42, no. 2, p. 57, pl. 10, f. 3, 4.

*Remarks*—In sample Q 3 one specimen was found, which closely resembles the one pictured by Brotzen as Fig. 3 from the Paleocene of Sweden.

Genus **Bulimina** d'Orbigny, 1826
**Bulimina marksi** Drooger, n. sp.
Plate 15, figures 17a-19

*Description*—Test small, 1½ times to twice as long as broad, bluntly triangular in transverse section, sides about parallel, initial end truncate and somewhat rounded; early chambers indistinct, later ones triserial, slightly inflated and overlapping, very slowly increasing in size as added; sutures somewhat depressed and sinuous; wall smooth, distinctly and rather coarsely perforate; aperture slightly elongate, at the inner margin of the last-formed chamber, extending upwards into the apertural face, lying in a wide depression of the latter. Length up to 0.20 mm.

*Remarks*—The most characteristic features of *B. marksi*, which also serve to distinguish it from the other representatives of the genus *Bulimina*, are the truncate initial end and the triangular, prismatic appearance of the test. Possibly *B. rugifera* Glaessner (1937, Probl. Paleont., Moscow Univ., vols. 2-3, p. 372, pl. 2, f. 19) from the Upper Senonian and the Paleocene of the Caucasus and the same species, reported from the Upper Velasco of Mexico [*B. velascoensis* White (non Cushman), 1929, Journ. of Pal., vol. 3, p. 50, pl. 5, f. 13] are related to the Algerian species, which is different by the more truncate lower part of the test and the lack of surface ornamentation. Another possibly allied species is *B. mendezensis* White (1929, Journ. of Pal., vol. 3, p. 49, pl. 5, f. 10) from the Upper Cretaceous Mendez shale of Mexico, which differs from *B. marksi* by the less truncate initial end and the more rounded cross section.

*Occurrence*—Common in C 263.

**Bulimina ovata** Orbigny

*Bulimina ovata* Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p. 185, pl. 11, f. 13, 14; Cushman and Parker, 1937, Contrib. Cushman Lab. Foram. Res., vol. 13, p. 47, pl. 6, f. 4, 5; Glaessner, 1937, Probl. Paleont., Moscow Univ., vols. 2-3, p. 371; Dam, 1944, Meded. Geol. Stichting, ser. C, vol. 5, no. 3, p. 111, pl. 3, f. 10, 11; Marks, 1951, Contrib. Cushman Found. Foram. Res., vol. 2, pt. 2, p. 57.

*Occurrence*—Rare in Q 3.

Originally described from the Miocene of the Vienna Basin. Probably ranging from Upper Cretaceous to Recent.

**Bulimina trigonalis** Dam
Plate 15, figures 20-22

*Bulimina trigonalis* Dam, 1944, Meded. Geol. Stichting, ser. C, vol. 5, no. 3, p. 112, pl. 3, f. 16, 17.

*Remarks*—Especially the smaller Algerian specimens closely resemble the individuals, pictured by ten Dam. In most of the larger ones the later chambers are somewhat more rapidly increasing in size than those of the early stages of individual development. Moreover the final chambers become more strongly twisted than those of the pictured Dutch forms, often tending towards biseriality. Length up to 0.4 mm.

*Occurrence*—Common to abundant in Q 3 and C 263.

Originally described from the littoral-marine Paleocene of the Netherlands.

Genus **Virgulina** Orbigny, 1826
**Virgulina troosteri** Drooger, n. sp.
Plate 15, figures 23a-24

*Description*—Test small, elongate, 2½-4 times as

long as broad, slightly to moderately compressed, sides about parallel to slowly tapering to the initial end; early triserial portion relatively very small, biserial part somewhat twisted, made up of 6-12 slightly inflated chambers; early biserial chambers broader than high, increasing upwards in relative height, resulting in final chambers with greater height than breadth; sutures distinct, slightly curved, making an angle of 50-80 degrees with the longer axis of the test, slightly depressed; wall smooth, finely perforate; aperture a large, wide opening at the inner margin of the final chamber. Length 0.24-0.36 mm., breadth about 0.9 mm.

*Remarks*—In general appearance *V. troosteri* resembles *V. tegulata* Reuss (1845, Verst. böhm. Kreide, pt. 1, p. 40, pl. 13, f. 81), reported from the Turonian of Central Europe and the same species pictured by Cushman (1937, Cushman Lab. Foram. Res., Spec. Publ. 9, p. 4, pl. 1, f. 9-12) from the Upper Cretaceous of North America, mainly differing in the shape of the aperture.

The species has been named in honor of the late S. G. Trooster, Professor of Geology of the State University of Utrecht.

*Occurrence*—Common in C 263 and 699, few in Q 1 and Q 12. Holotype and paratypes from C 263.

**Virgulina cruysi** Drooger, n. sp.
Plate 15, figures 25a-26b

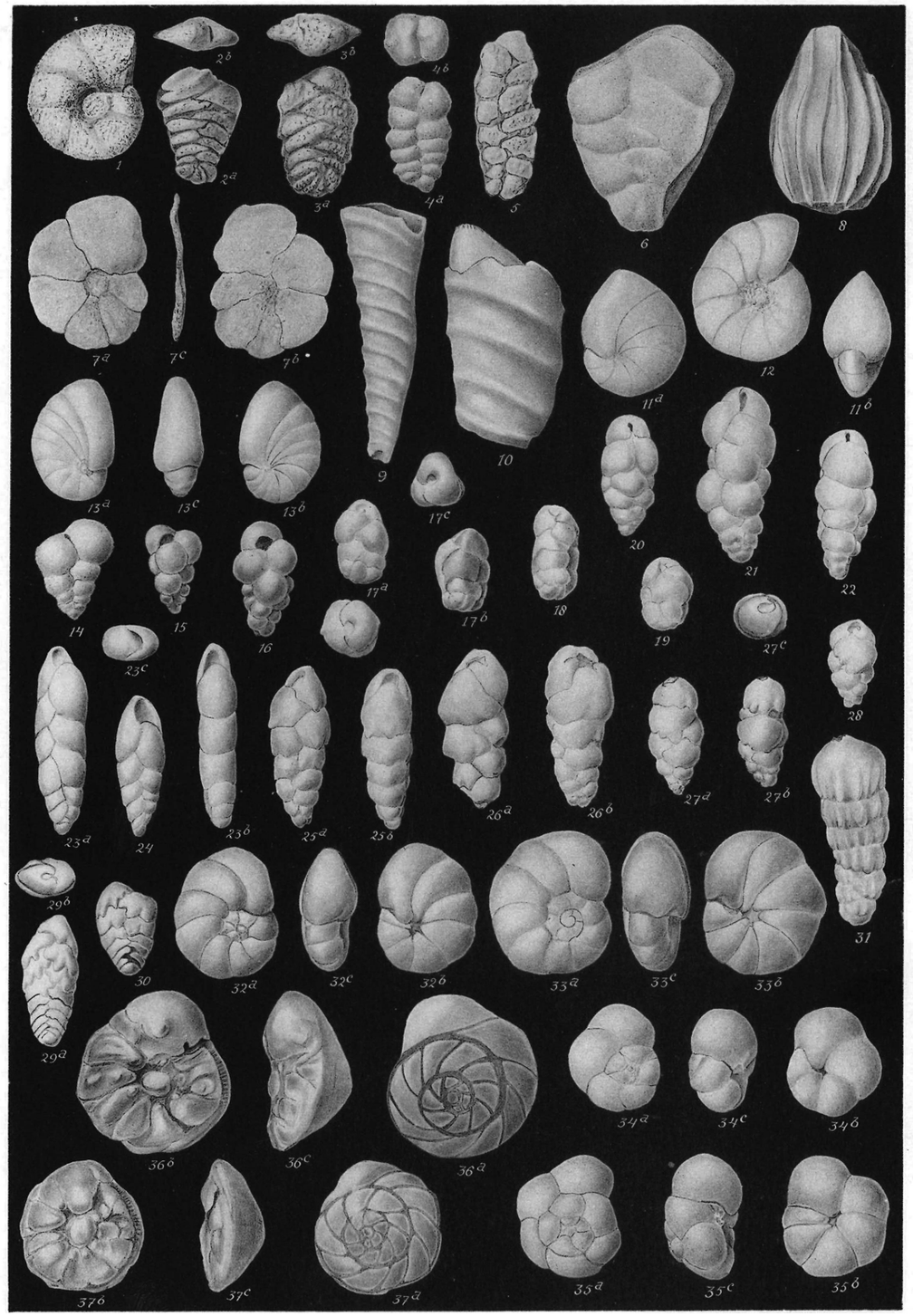
*Description*—Test elongate, 1½-3 times as long as broad, slightly compressed, occasionally from a somewhat oblique direction, more or less tapering, often with about parallel sides in the adult; triserial portion relatively small, biserial part slightly if at all twisted with 6-10 inflated chambers, which are in most larger specimens more or less protruding basally, forming processes, especially near the angles of the test; sutures depressed, at about right angles to the median line of the test; wall smooth, finely perforate; aperture large and wide, often with lateral extensions into the apertural face, at the inner margin of the last-formed chamber. Length up to 0.5 mm.

*Remarks*—The abundant specimens of *V. cruysi* show a wide variation as to the general appearance of the test, the degree of overhanging of the chambers and the shape of the aperture. Those with a distinctly tapering test throughout may be microspheric individuals, whereas others, which are more abundantly present, with about parallel sides and a very small triserial initial part may represent the megalospheric generation. On account of the peculiar apertural features several specimens were tested with hydrochloric acid, after which action only trifling amounts of fer-

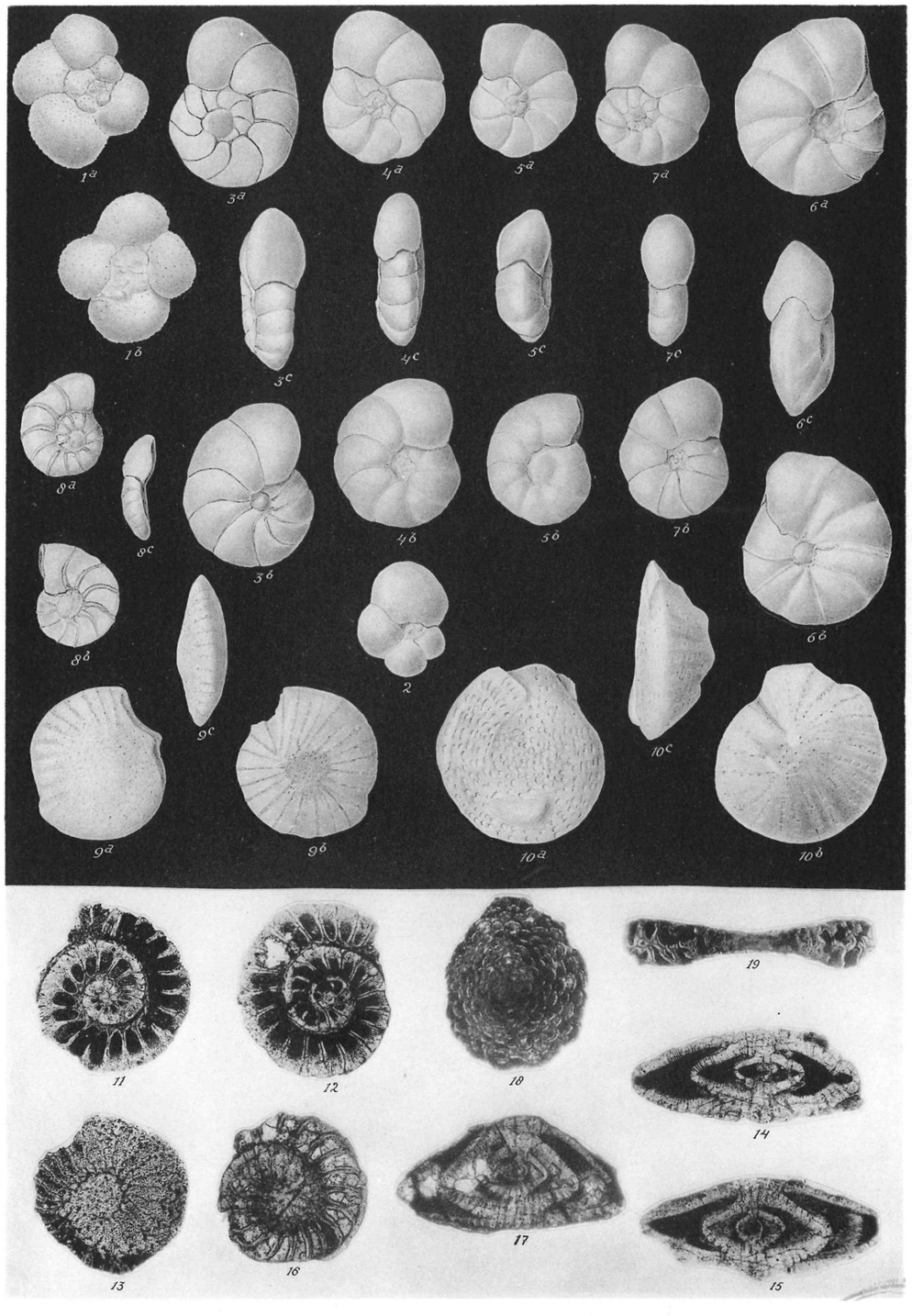
## EXPLANATION OF PLATE 15







Drooger, Algerian Cretaceous—Tertiary Foraminifera



Drooger, Algerian Cretaceous—Tertiary Foraminifera



ruginous material remained undissolved, these probably originating from secondary impregnation, as was observed in many more species of these samples. Because of this negative result the species is thought to belong to the genus *Virgulina*.

*V. cruysi* differs from *V. primitiva* Cushman (1936, Cushman Lab. Foram. Res., Spec. Publ. 6, p. 46, pl. 7, f. 1) and *V. subcretacea* Cushman (ibid., p. 46, pl. 7, f. 2) from the Lower Cretaceous of Texas and *V. miniacea* Cushman and Bermudez (1936, Contrib. Cushman Lab. Foram. Res., vol. 12, p. 30, pl. 5, f. 14) from the Upper Eocene of Cuba, by a relatively long, rather regularly biserial portion of the test and by the peculiar processes of the chambers. The latter characteristic together with the shape of the aperture distinguish *V. cruysi* from *V. sandegreni* Brotzen (1948, Sver. Geol. Unders., Avh., ser. C, no. 493, årsb. 42, no. 2, p. 65, pl. 9, f. 2) from the Lower Paleocene of Sweden.

*Occurrence*—Common in G 64.

**Virgulina cruysi** Drooger
var. **maadidensis** Drooger, n. var.
Plate 15, figures 27a-28

*Description*—Variety differing from the typical by its smaller size, the relatively unimportant biserial stage and the aperture, which in larger specimens is strongly contracted at its base, often being entirely separated from the inner margin of the final chamber. Length up to 0.35 mm.

*Remarks*—The individuals of sample 699 are smaller and usually less developed than those of sample G 64, showing a predominance of the triserial part, which often makes up the entire test. In the largest specimens, which possess a biserial part of 2-4 chambers, the aperture is separated or nearly so from the inner margin of the last-formed chamber. The latter feature allows to distinguish this variety from immature individuals of *V. cruysi*. Among the specimens of the latter in sample G 64 of El Melab no distinct representatives of *V. cruysi* var. *maadidensis* were encountered, whereas on the other hand in sample 699 mainly this variety is present. In another sample from the region of Bordj Rh'dir specimens were found which show a longer biserial portion of the test. Part of them somewhat resemble *Loxostomum cushmani* Wickenden (1932, Trans. Roy. Soc. Canada, ser. 3, vol. 26, sect. 6, p. 91, pl. 1, f. 6) from the American Upper Cretaceous.

*Occurrence*—Few in 699.

Genus **Bolivina** Orbigny, 1839
**Bolivina betieri** Drooger, n. sp.
Plate 15, figures 29a-30

*Description*—Test minute, 1½-2½ times as long as broad, gradually tapering to the rounded initial end, compressed, especially in the early portion of the test; periphery rounded; early chambers narrow, later ones more rapidly increasing in relative height and often also in thickness; sutures oblique, curved and slightly limbate in the early portion, in the upper part of the test crenulate with one or two deep reëntrants on each side of the chambers, the crenulate sutures appearing rather abruptly; wall smooth, finely perforate; aperture elongately oval at the inner margin of the final chamber, extending to the top of the test. Length up to 0.25 mm.

*Remarks*—*B. betieri* differs from most other *Bolivina* species with crenulate sutures by the absence of these crenulations on the early chambers. Some variation exists as to the relative length of the test. Extremely short variants (see Pl. 15, fig. 30) show some resemblance with *B. plicatella* Cushman var. *mera* Cushman and Ponton (1932, Florida Geol. Survey, Bull. 9, p. 82,

## EXPLANATION OF PLATE 16

pl. 12, f. 4) from the Miocene of Florida and with *B. thomsoni* Howe (1939, Louis. Dept. Conserv., Geol. Survey, Bull. 14, p. 69, pl. 9, f. 17) from the Claiborne Eocene of Louisiana. *B. crenulata* Loetterle (non Cushman) (1937, Nebraska Geol. Survey, ser. 2, Bull. 12, p. 38, pl. 6, f. 1) from the Upper Cretaceous Niobrara formation has much higher early chambers than the Algerian species.

The species has been named in honour of G. Bétier, Inspecteur Général des Mines, Directeur du Service de la Carte Géologique de l'Algérie.

*Occurrence*—Common to abundant in C 263.

Genus **Loxostomum** Ehrenberg, 1854

**Loxostomum plaitum** (Carsey)

*Bolivina plaita* CARSEY, 1926, Univ. Texas Bull. 2612, p. 26, pl. 4, f. 2.

*Loxostoma plaita* (Carsey) CUSHMAN, 1937, Cushman Lab. Foram. Res., Spec. Publ. 9, p. 169, pl. 20, f. 1-4.

*Occurrence*—A single distinct specimen in C 263.

Originally described from the Lower Navarro of Texas. Widely distributed in the Upper Taylor and Navarro of the United States.

Genus **Siphogenerinoides** Cushman, 1927

**Siphogenerinoides parvus** Cushman

Plate 15, figure 31

*Siphogenerinoides parva* CUSHMAN, 1929, Contrib. Cushman Lab. Foram. Res., vol. 5, p. 58, pl. 9, f. 11-13; STONE, 1946, Journ. of Pal., vol. 20, p. 471, pl. 71, f. 11, 12.

*Remarks*—As far as could be ascertained the aperture in our specimens is arcuate, usually with a slight neck and a thickened rim. In the larger individuals the bi- (tri-) serial portion of the test is relatively small, even smaller than in the pictured American specimens. A drawing is given of one of the small specimens from our material (Pl. 15, fig. 31).

*Occurrence*—Few in Q 3.

Originally described from the Upper Cretaceous Colon shale of Venezuela.

Family ROTALIIDAE

Genus **Valvulineria** Cushman, 1926

**Valvulineria koenigswaldi** Drooger, n. sp.

Plate 15, figures 32a-33c

*Description*—Test small, trochoid, compressed, about equally biconvex; periphery rounded, slightly lobulate in the later portion; chambers distinct, somewhat inflated, especially in the adult, rapidly increasing in size as added, about two whorls visible dorsally, 7-9 chambers in the final convolution; sutures ventrally depressed and evenly curved, radiating from the small umbilical depression, dorsally depressed and curved, the spiral sutures being most strongly depressed; wall smooth and finely perforate; aperture somewhat variable and often indistinct, usually consisting of a narrow slit along the inner margin of the final chamber from the periphery to about half way towards the ventral umbilicus, with a curved narrow opening from about the middle of the basal slit, extending obliquely upwards into the apertural face and pointing to the ventral umbilicus. Larger diameter up to 0.85 mm., thickness up to 0.35 mm.

*Remarks*—In many specimens only the oblique opening of the aperture is distinct, whereas in others this part could not be traced. Sometimes it is less well-developed and evidently it is replaced then by a shallow closed furrow in the apertural face. Similar apertures occur in some described species of the genus *Valvulineria,* for which reason our species is placed here although distinct umbilical plates of the chambers are hardly developed, if not entirely lacking. The peculiar apertural characteristics of this species make its generic placement uncertain. In some respects the specimens resemble compressed *Gyroidina* species, whereas on the other hand the extension of the aperture towards the periphery seems to place this form in the vicinity of the *Anomalinidae*. A similar species in general appearance is *Gyroidina childsi* Martin (1943, Publ. Stanford Univ., Calif., Univ. Ser., Geol. Sci., vol. 3, no. 3, p. 112, pl. 6, f. 6) from the Eocene and Paleocene Lodo formation of California, which is different from *V. koenigswaldi* in its slightly higher number of less elongate chambers, whereas the aperture is evidently a simple basal slit in this American species.

The species has been named in honour of G. H. R. von Koenigswald, Professor of Paleontology of the State University of Utrecht.

*Occurrence*—Common in 699 and G 64, few in Q 1 and C 263, rare in R 109. Holotype and paratype from G 64.

**Valvulineria palmi** Drooger, n. sp.

Plate 15, figures 34a-35c

*Description*—Test small, trochoid, about equally biconvex; periphery broadly rounded and lobulate; chambers inflated, rather rapidly increasing in size as added, each with a slight extension over the small depressed ventral umbilicus, dorsally two whorls visible, about 5 chambers in the final coil; sutures depressed, curved; wall finely granular and coarsely perforate; aperture ventral, at the base of the last-formed chamber as a low arched slit from near the periphery to close to the umbilicus. Diameter up to 0.20 mm., thickness up to 0.13 mm.

*Remarks*—Except for its much smaller size *V. palmi* differs from *V. chirana* Cushman and Stone (1947, Cushman Lab. Foram. Res., Spec. Publ. 20, p. 22, pl. 3, f. 3) from the Upper Eocene of Peru, by its generally more curved sutures, whereas *Gyroidina byramensis* Cushman and Todd (1946, Contrib. Cushman Lab. Foram. Res., vol. 22, p. 98, pl. 16, f. 19-21) from the Oligocene Byram marl of Mississippi is somewhat more elongate and evidently possesses a flattened dorsal side.



*Occurrence*—Few in Q 12. In C 263 some rare specimens were encountered, which are close to *V. palmi,* only being relatively somewhat thicker with a wider aperture.

Genus **Rotalia** Lamarck, 1804

**Rotalia sigali** Drooger, n. sp.

Plate 15, figures 36a-37c

*Description*—Test small, trochoid, unequally biconvex to plano-convex, dorsal side most strongly elevated, forming a low, somewhat rounded cone, ventral side occasionally slightly convex, usually about flat; periphery subacute, formed by the thick peripheral part of the spiral wall, in some specimens with a beginning development of peripheral spines; ventral umbilicus filled with a large plug, somewhat variable in size, generally separated from the inner ends of the chambers, especially the later ones, by a deeply depressed furrow; chambers rather distinct, about three whorls visible dorsally, 8-11 chambers in the final convolution; dorsal sutures strongly oblique and somewhat curved, limbate, slightly raised in the early part of the test to slightly depressed in the adult; ventral sutures depressed, becoming deeper and wider towards the umbo, where they open into the umbilical furrow, radial to slightly tangential to the umbo, slightly curved, more strongly so near the periphery, where they often show a more or less developed bifurcation; wall smooth, perforate; aperture ventral at the base of the last-formed chamber, running from near the periphery to close to the umbo, in well-preserved specimens covered by a narrow, plate-like structure. Diameter up to 0.45 mm., thickness up to 0.18 mm.

*Remarks*—No clear thin sections of this small species could be made.

*R. sigali* shows morphologically some resemblance with *R. orientalis* Cushman and Bermudez (1947, Contrib. Cushman Lab. Foram. Res., vol. 23, p. 26, pl. 7, f. 2) from the Upper Eocene of Cuba and *R. cushmani* Applin and Jordan (1945, Journ. of Pal., vol. 19, p. 143) from the Upper Eocene of Florida. Since little is remarked about the variation of these species, it is impossible to obtain a clear comparison of the Algerian with the American forms. Some extreme variants of *R. sigali* approach the types of each of these species, but both from the figures and from the descriptions it is evident that many differences exist with the group of individuals from the Hodna Mountains. For this reason the latter is described as a new species. Bifurcating sutures and peripheral spines are shown in much higher development than in *R. sigali* in *R. lithothamnica* Uhlig (1886, Jahrb. Geol. Reichsanst., Wien, vol. 36, p. 195, pl. 5, f. 9-11) from the Lower Tertiary of the Carpathians.

*Occurrence*—Common in C 265, few in C 267. Holotype and paratype from C 265.

Genus **Laffitteina** Marie, 1945

**Laffitteina bibensis** Marie

Plate 16, figures 9a-c; 11-15

*Laffitteina bibensis* MARIE, 1945, Bull. Soc. Géol. France, ser. 5, vol. 15, p. 431, f. 1-3, 14-16, pl. 1, f. 1-6.

*Remarks*—The specimens of the Hodna material agree fairly well with those described by Marie. A few additional, partly differing, observations could be made on the inner structure.

In thin sections a canal system in the walls is apparent, which is best visible in the septae. This intraseptal system consists of fissure-like spaces in the septae, which send branches, either bifurcating or not, to the surface of the test, where they correspond with the openings along the sutures. In the central part of the test many of these canals, leading to the surface, are seen to pierce the involute later walls without interruption. A second, much less distinct canal system occurs on the dorsal side of the spiral walls of the earlier convolutions, where these are covered by the later whorls. This system, which is formed on the older spiral wall by an irregular covering with shell material from the chambers of the overlying whorls, consists of a number of thin, sometimes flattened, irregular and anastomosing, spirally arranged canals. In some of the sections the latter are distinctly seen to correspond with the intraseptal canals of the previous and overlying whorls. The spiral system is probably only developed on the dorsal part of the coils and it is absent in the final whorl.

When regarding the exterior, *Laffitteina* seems to be close to the genus *Faujasina* Orbigny, 1839, as was suggested by Marie. According to d'Orbigny (1846, Foram. Foss. Bass. Tert. Vienne, p. 194, pl. 21, f. 29-31) the type species of the latter genus, *Faujasina carinata,* had been derived from the Upper Cretaceous of Maastricht, Holland. Cushman remarked, however, (1939, U. S. Geol. Survey, Prof. Paper 191, p. 67) that this statement is probably erroneous, as *Faujasina carinata* occurs in the Pliocene of St. Erth in southern England, but has never again been found at Maastricht. An examination of material from St. Erth evidenced that the specimens from this English locality, which are completely identical with those pictured by d'Orbigny, belong to a thin-walled species, obviously closely related to recent species of *Elphidium.* When assuming very close relations between *Laffitteina bibensis* and *Faujasina carinata* we would have to conclude a wide, incomprehensible time-stratigraphic gap between the occurrences of both genera. Therefore it looks unlikely that *Faujasina* is connected directly with *Laffitteina,* their resemblance obviously being only superficial. It is worth mentioning moreover, that, according to Hofker (1928, Contrib. Cushman Lab. Foram. Res., vol. 4, p. 80), the species from St. Erth shows an

umbilical canal system on either side of the test, in addition to that in the septae (as is the case in *Elphidium*), which is principally different from the systems observed in the Algerian *Laffitteinae*.

On the other hand connections of *Laffitteina* with some species of *Rotalia* s. l. are thought to be much closer, for which reason the genus is considered to belong to the *Rotaliidae,* rather than to the *Nonionidae.* Clear comparisons, however, are difficult, because of lack of sufficient data on the interior characters of the *Rotalia* species. Other difficulties are caused by the confusion in literature about the generic placement of many of these species. Some of the species described as *Rotalia* (*R. schroeteriana* Parker and Jones, *R. elphidioides* Caudri, *R. catelliformis* Thalmann, *R. papillosa* var. *tuberculata* Schubert, *R. viennoti* Greig a. o.) either possess bifurcating intraseptal canals or distinct openings in the sutural lines or both. However, the larger part of these species are much younger than the *Laffitteina* species. The latter differ from them by the absence of a distinct umbilical filling with plug or pillars, the involute character of the spiral walls at the dorsal side and probably also by the possession of a spiral canal system on the dorsal side of the earlier whorls, instead of a ventral umbilical system, as was described for some *Rotalia* species (f. i. *R. schroeterina*) by Hofker (1927, Foraminifera of the Siboga Expedition). Possibly *Laffitteina* is most closely related to *Sulcoperculina* Thalmann, 1938, though it lacks the distinct peripheral groove of the latter.

*Occurrence*—Common in C 265.

Originally described from the Montian of northern France. In Algeria the species possibly ranges downwards into the Upper Cretaceous.

**Laffitteina conica** Drooger, n. sp.
Plate 16, figures 10a-c; 16, 17

*Description*—Test trochoid, planoconvex, dorsally flat, ventrally conical, on the dorsal side strongly evolute, on the ventral side involute or nearly so; periphery subacute to narrowly rounded; chambers not inflated, numerous, about 17 in the final coil in specimens of about 0.7 mm. diameter, about 24 in those of a diameter of 1.1 mm.; chamber walls involute on both sides; sutures straight to moderately curved, more or less limbate, with openings, either in or along the sutures, only occasionally with a row on each side of the sutural lines; in the central part of the test, especially on the dorsal side, the openings are irregularly placed; wall thick, finely perforate; aperture not visible from the outside, probably a slit at the base of the final chamber's apertural face. Maximum observed diameter 1.2 mm.

As far as could be ascertained the canal systems are the same as in *L. bibensis;* only the ascending branches of the intraseptal fissures usually do not bifurcate before reaching the surface of the test.

*Remarks*—Occasionally the dorsal side of the test is very slightly convex; the ventral cone varies in relative height from one quarter to over half the diameter of the test. As in *L. bibensis* the cavities in the interior of the specimens are filled with reddish brown coloured material, but to a considerably lesser degree, which made it more difficult to establish the characters of the canal systems than in *L. bibensis.*

*L. conica* differs from *L. bibensis* by the smaller size of adult specimens, the planoconvex test, which is much more trochoid, and the rarely bifurcating of the branches of the intraseptal fissures. It occurs in the same section, only at a higher level. It is very likely that it descended directly from the earlier species. As in none of both occurrences specimens were found, which are morphologically distinctly intermediate between both groups of individuals, the younger group is treated as a separate species. Certain variants of *L. monodi* Marie resemble *L. conica,* but in the latter no traces of irregular coiling were found.

*Occurrence*—Common in C 267.

Family GLOBIGERINIDAE
Genus **Globigerina** Orbigny, 1826
**Globigerina** sp. cf. **G. belli** White
Plate 16, figures 1a, b

*Globigerina belli* White, 1928, Journ. of Pal., vol. 2, p. 197, pl. 28, f. 5.

*Remarks*—Our few specimens, which show only a superficial resemblance with White's species, to which they are tentatively referred to, are too scarce and too ill-preserved for a safe determination.

*Occurrence*—Rare in G 64.

Reported from the Uppermost Mendez and the Lower Velasco of Mexico.

**Globigerina voluta** White
Plate 16, figure 2

*Globigerina voluta* White, 1928, Journ. of Pal., vol. 2, p. 197, pl. 28, f. 5; Drooger, 1951, Proc. Kon. Ak. Wetensch., Amsterdam, ser. B, vol. 54, no. 1, p. 69, f. 8.

*Globigerina* cf. *cretacea* Schwager (non d'Orbigny), 1883, Palaeontogr., vol. 30, pt. 1, Pal. Theil., p. 119, pl. 29, f. 13.

*Remarks*—In the stratigraphically lower samples from the Hodna Mountains most specimens, considered to belong to *G. voluta,* are identical with the one pictured by White but some smaller individuals are closer to *G. aspera* (Ehrenberg). Possibly *G. voluta* may be considered to be identical with *G. aspera,* as for instance described and pictured by Brotzen (1936, Sver. Geol. Unders., Avh., ser. C, no. 396, årsb. 30, p. 170, pl. 13, f. 2), but the typical forms in our material are completely smooth, whereas in the Algerian specimens the chambers are more rapidly increasing in size than in typical *G. aspera.* At higher levels (G 64, Q 3) the few observed individuals show intermediate features between *G. voluta, G. cretacea* Orbigny, and *G. pseudo-bulloides* Plummer.

*Occurrence*—Few in Q 12 and C 263, rare in Q 3, C 265 and G 64.

This species has mainly been reported from Upper Senonian strata, but, according to White, its range in Mexico extends into the basal Velasco. A nearly identical form has been pictured by Schwager from the Paleocene of Egypt.

**Globigerina pseudo-bulloides** Plummer

*Globigerina pseudo-bulloides* Plummer, 1926, Univ. Texas Bull. 2644, p. 133, pl. 8, f. 9; Glaessner, 1937, Probl. Paleont., Moscow Univ., vols. 2-3, p. 382, pl. 4, f. 31; Cushman and Todd, 1942, Contrib. Cushman Lab. Foram. Res., vol. 18, p. 43, pl. 8, f. 3, 4.

*Remarks*—The scarcely observed Algerian specimens usually show only four chambers in the final whorl, thus closely resembling those pictured by Cushman and Todd from the Naheola formation of Alabama.

*Occurrence*—Rare in 699.

This species is known from several widely distributed localities of Lowermost Tertiary age.

**Globigerina** sp. cf. **G. velascoensis** Cushman

*Globigerina velascoensis* Cushman, 1925, Contrib. Cushman Lab. Foram. Res., vol. 1, p. 19, pl. 3, f. 6; Cushman, 1926, Bull. Am. Ass. Petr. Geol., vol. 10, no. 6, p. 605, pl. 20, f. 21; White, 1928, Journ. of Pal., vol. 2, p. 196, pl. 28, f. 2.

*Remarks*—Our rare specimens most closely resemble those pictured by White. Partly they are thicker than the one pictured together with Cushman's original description.

*Occurrence*—Rare in G 64.

*G. velascoensis* is reported as a typical species for the Mexican Velasco formation.

Family GLOBOROTALIIDAE
Genus **Globorotalia** Cushman, 1927
**Globorotalia wilcoxensis** Cushman and Ponton
var. **acuta** Toulmin

*Globorotalia wilcoxensis* Cushman and Ponton var. *acuta* Toulmin, 1941, Journ. of Pal., vol. 15, p. 608, pl. 82, p. 6-8; Cushman and Renz, 1942, Contrib. Cushman Lab. Foram. Res., vol. 18, p. 12, pl. 3, f. 2.

*Occurrence*—In G 64 a single distinct specimen with four chambers in the final whorl is recorded to belong to this variety.

*G. wilcoxensis* var. *acuta* has originally been described from the Wilcox Lower Eocene of Alabama. As several closely allied forms range from the top of the Senonian upwards, no stratigraphical conclusions can be drawn from our single specimen, because of lack of sufficient material.



Family ANOMALINIDAE

Numerous representatives of this family were observed in the samples of the Algerian Cretaceous-Tertiary transitional strata of the northern border of the Hodna Basin. The individuals in each of the samples show a rather wide variation and the ranges of variation of the specimens of the different samples overlap in most cases. Thus it proved to be impossible to draw sharp boundaries between species, although on the other hand minor changes, occurring in the group from the base of the ideal section upwards, might be too important for stratigraphy to be neglected and to treat the entire group as a single species without subdivision. For the specific determination a choice had to be made out of numerous described and closely resembling species, which are often much less apart from one another than the individuals of one of our samples, which doubtlessly belong together. Of each of the forms, dealt with separately, only a single, more or less typical, specimen has been pictured, as it was impossible to show the existing variation by means of sufficient numbers of figures.

Genus **Cibicides** Montfort, 1808
**Cibicides praecursorius** (Schwager)
Plate 16, figures 3a-c

*Discorbina praecursoria* Schwager, 1883, Palaeontogr., vol. 30, pt. 1, pal. pt., p. 125, pl. 27, f. 12, 13, pl. 29, f. 16.

*Cibicides praecursorius* (Schwager) Glaessner, 1937, Prob. Paleont., Moscow Univ., vols. 2-3, p. 386, pl. 5, f. 40.

*Remarks*—Especially the smaller specimens from the stratigraphically lower samples may be assigned to this species, but usually the following two varieties are equally well represented or even more abundant, as well as many intermediates. In the individuals of the species and of its two varieties, the dorsal side is usually somewhat less flattened than in those pictured from Egypt, thus tending towards *Anomalina midwayensis* (Plummer) and its variety (see below). Part of the specimens also somewhat resemble *C. mortoni* (Reuss) (1862, Sitzungsber. K. Ak. Wiss., Wien, Math. Naturw., vol. 44, pt. 1, p. 337, pl. 8, f. 1) from the Senonian of New Jersey, U. S. (compare Pl. 16, fig. 3).

Though several occurrences of *C. praecursorius* are given in literature, it may be doubted whether all these belong to Schwager's species. Our specimens are closest to those pictured by Schwager and Glaessner.

*Occurrence*—*C. praecursorius* itself is relatively most common in Q 12 and C 263. In C 265, and especially in C 267, the variety *umbonifera* is predominant, whereas the variety *scrobiculata* occurs in all these

samples, but in the higher ones the features are mixed with those of var. *umbonifera*.

Originally described from the Paleocene of Egypt. Recorded from the Paleocene of the Caucasus, as well as from some Early Tertiary deposits in America, in which there may partly be incorrect interpretations of this species.

**Cibicides praecursorius** (Schwager)
var. **scrobiculata** (Schwager)
Plate 16, figures 4a-c

*Anomalina scrobiculata* SCHWAGER, 1883, Palaeontogr., vol. 30, pt. 1, pal. pt., p. 129, pl. 29, f. 18.

*Remarks*—All intermediate forms between typical specimens of *C. praecursorius* and this variety are present. Also intergradation occurs with *Anomalina midwayensis* (Plummer) and its variety, both described below. Morphologically *C. praecursorius* var. *scrobiculata* rather belongs to *Anomalina* than to *Cibicides*, but it has been placed in the latter genus here for its distinct connections with *C. praecursorius*. The place of the aperture is not clear from Schwager's description and figures, but it is unlikely that the form, referred to as *Valvulineria scrobiculata* (Schwager) by Cushman and Ponton from the Wilcox Eocene of Alabama (1932, Contrib. Cushman Lab. Foram. Res., vol. 8, p. 70, pl. 9, f. 5) is identical with the Egyptian species.

*Occurrence*—See *C. praecursorius*.

Originally described from the Paleocene of El-Guss-Abu-Said, Egypt.

**Cibicides praecursorius** (Schwager)
var. **umbonifera** (Schwager)
Plate 16, figures 5a-c

*Discorbina umbonifera* SCHWAGER, 1883, Palaeontogr., vol. 30, pt. 1, pal. pt., p. 126, pl. 27, f. 14.

*Remarks*—Several specimens with the characteristics of this variety were recognized among our material. Partly they differ from the one, pictured by Schwager, by a stronger excess of shell material in the ventral umbilicus, while others again have hardly depressed sutures in the larger part of the test.

*Occurrence*—See *C. praecursorius*.

As both previously mentioned forms this variety has originally been described from the Paleocene beds of El-Guss-Abu-Said, Egypt.

Genus **Anomalina** Orbigny, 1826
**Anomalina midwayensis** (Plummer)
Plate 16, figures 6a-c

*Truncatulina midwayensis* PLUMMER, 1926, Univ. Texas Bull. 2644, p. 141, pl. 9, f. 7, pl. 15, f. 3.

*Anomalina midwayensis* (Plummer) CUSHMAN, 1940, Contrib. Cushman Lab. Foram. Res., vol. 16, p. 73, pl. 12, f. 18.

*Anomalinoides midwayensis* (Plummer) BROTZEN, 1948, Sver. Geol. Unders., Avh. ser. C, no. 493, årsb. 42, no. 2, p. 88, pl. 14, f. 3.

*Remarks*—The specimens, regarded to belong to *A. midwayensis*, show close affinities to the *C. praecursorius* group, described above. Although highly variable, as for instance by the nearly planoconvex appearance of the test in many cases or the slight development of umbilical knobs and the generally less raised sutures in others, the majority of our specimens are so close to the earlier pictured representatives of *A. midwayensis* (Plummer) to justify the determination.

*Occurrence*—Common in Q 3.

Originally described from the Midway formation of Texas. Reported by Brotzen from the Paleocene of Sweden.

**Anomalina midwayensis** (Plummer)
var. **trochoidea** (Plummer)
Plate 16, figures 7a-c

*Truncatulina midwayensis* Plummer var. *trochoidea* PLUMMER, 1926, Univ. Texas Bull. 2644, p. 142, pl. g, f. 8.

*Remarks*—A number of specimens from sample G 64 are close to this Midway form, but usually they have the raised character of the sutures confined to the early portion of the test, whereas the later chambers are somewhat more inflated than in the typical, corresponding with a more lobulate periphery. The evolute portion of the test is differently developed in the specimens of this sample, on the average being half way in this feature between typical forms of *A. midwayensis* (Plummer) and this variety. On the other hand intermediates are present in G 64 between this variety and the new *A. newmanae* var. *ksobensis* (see below), of which some representatives were found in this sample, too. The diversity of forms in the sample from El Melab may partly be due to the fact that G 64 is a composite sample from slightly above, slightly below and in the *Cardita beaumonti* layer.

Except for the smaller size of the second form, there are no clear differences between *A. midwayensis* var. *trochoidea* and *Truncatulina welleri* Plummer (1926, Univ. Texas Bull. 2644, p. 143, pl. 9, f. 6) from the Texas Upper Midway, as far as can be concluded from the pictures given by Plummer.

*Occurrence*—Rather common in G 64.

Originally described from the basal Midway of Texas.

**Anomalina newmanae** (Plummer)
var. **ksobensis** Drooger, n. var.
Plate 16, figures 8a-c

*Description*—Variety differing from the typical in having the sutures limbate and raised, especially on the convex side. Diameter up to 0.35 mm.

*Remarks*—*A. newmanae* var. *ksobensis* is the least variable and morphologically most distinct form of all *Anomalinidae*, encountered in the samples from the Northern Hodna Mountains. Most of its specimens from stratigraphically higher samples can easily be distinguished; only in G 64 individuals occur with characteristics intermediate between those of this new variety and the other mentioned forms, especially *A. midwayensis* var. *trochoidea*. *A. newmanae* var. *ksobensis* is placed in the genus *Anomalina* for these evident relations with the other representatives of the family *Anomalinidae*, found in the stratigraphically lower samples. The Algerian specimens were combined as a new variety to *A. newmanae* (Plummer) (*Discorbis newmanae* Plummer, 1926, Univ. Texas Bull. 2644, p. 138, pl. 9, f. 4) for the striking resemblance between both forms, though the kind of relations between them is unknown.

*Occurrence*—Common in 699, rare in Q 1 and G 64. Holotype from 699.

*A. newmanae* has been described from the basal Midway of Texas.

Family ORBITOIDIDAE
Genus **Omphalocyclus** Bronn, 1852
**Omphalocyclus macropora** (Lamarck)
Plate 16, figures 18, 19

*Orbulites macropora* LAMARCK, 1816, Hist. nat. Animaux sans vertèbres, tome 2, p. 197.

*Omphalocyclus macropora* (Lamarck) DOUVILLÉ, 1920, Bull. Soc. Géol. France, sér. 4, tome 20, p. 230, pl. 8, f. 5-9, text figs. 35-37; HOFKER, 1949, Verh. Kon. Belg. Inst. Natuurw., no. 12, p. 60, f. 23; VISSER, 1950, Leidse Geol. Meded., vol. 16, p. 294, pl. 9, f. 2, pl. 11, f. 7, 8.

*Sporadotrema minutum* HOFKER, 1926, Natuurh. Maandblad, p. 62, f. 1-20.

*Remarks*—A number of specimens from C 265 with a maximum observed diameter of 2.6 mm. appear to be identical with this well-known species, reported from several European Upper Cretaceous deposits.

*Occurrence*—Few in C 265.

Visser lists occurrences from Holland, Italy, Switzerland and Greece, all of which are of Upper Cretaceous, mainly Maestrichtian, age. At Maastricht the species is found in the uppermost part of the Maestrichtian (Md). Thus it may be considered possible that it ranged elsewhere, i. e. in North Africa, still higher into the stratigraphical column, as other distinct Maestrichtian markers (except possibly *Siphogenerinoides parva* Cushman) are lacking in the investigated Algerian assemblages. Also Rey (1948, in Flandrin, p. 155) mentions the occurrence of *O. macropora* from the Danian of Algeria.

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## RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the Foraminifera that have come to hand.

ANDRUSOV, D. Skameneliny Karpatskych Druhohôr. I. Rastliny a Prvoky. (Les Fossiles du Mésozóique des Karpates. I. Plantes et Protozoaires).—Práce Státneho Geologického Ustavu, No. 25, 1950, pp. 1-164 (pp. 122-164 in French), pls. 1-27, text figs. 1, 2.—Specimens are recorded and illustrated in section from material of Lias to Senonian age.

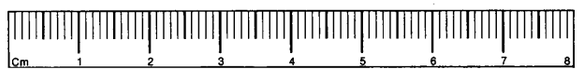
ASANO, KIYOSHI. Illustrated Catalogue of Japanese Tertiary Smaller Foraminifera (compiled and edited by Leo. W. Stach).—Tokyo, Japan, Part 15: Lagenidae, Dec. 18, 1951, pp. 1-39, text figs. 1-165.—Concluding the series, 114 species and varieties, none new, are described and illustrated, and one is given a new name.

BERMUDEZ, PEDRO J. **Heminwayina**, un genero nuevo de los Foraminiferos rotaliformes, y sus especies.—Mem. Soc. Ciencias Nat. La Salle, vol. 11, No. 30, Sept.-Dec. 1951, pp. 325-329, text figs. 1-9.—**Heminwayina** (genotype **Discorbis multisectus** Galloway and Heminway) and two other species, one new.

COLOM, GUILLERMO. Micropaleontologia aplicada. Estudio del sondeo profundo de Oliana (provincia de Lérida).—Bol. Instit. Geol. Min. España, vol. 63, 1951, pp. 1-52, pls. 1-8, text figs. 1-6, 3 distribution tables.—An Eocene fauna from a deep well is studied and mostly illustrated, and the ranges of species graphically shown.

CUSHMAN, JOSEPH A. Paleocene Foraminifera of the Gulf Coastal Region of the United States and adjacent areas.—U. S. Geol. Survey Prof. Paper 232, 1951 (Jan. 29, 1952), 75 pp., 24 pls.—About 280 species and varieties are recorded and illustrated. One new name is assigned. Geographic distribution charts are included.

DAVIS, A. G. **Howchinia bradyana** (Howchin) and its distribution in the Lower Carboniferous of England.—Proc. Geologists' Assoc., vol. 62, pt. 4, 1951, pp. 248-253, pls. 10, 11.—A re-description and re-figuring with additional information on localities.

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Volume III, Part 2
June, 1952

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WASHINGTON, D. C., U. S. A.
1952