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BIOSTRATIGRAPHIC STUDIES OF THE CRETACEOUS ROCKS  
OF MONAGA WELL NO.1 (NILE DELTA)

by

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ABSTRACT

*Biostratigraphic studies of the Cretaceous Rocks were carried out on the subsurface section (Monaga Well No.1) in the Nile Delta Area. The biostratigraphic zonation is based on the planktonic, benthonic smaller and larger foraminiferal associations. Four planktonic, two benthonic smaller and two benthonic larger foraminiferal biozones could be identified and correlated with similar biozones in Egypt, Libya, Saudi Arabia, Trinidad and Caribbean region.*

INTRODUCTION

Monaga well No.1 is located at; Lat: 30° 48' 48" N Long: 32° 00' 20" E. It was drilled by CONOCO OIL COMPANY in 1978 to a total depth of 11886'. The well penetrated a great thickness of the Cretaceous Sediments (5350'). In Egypt a lot of work is done on the foraminifera and biostratigraphy of the Upper Senonian and lower Tertiary sediments, while less consideration was given to the Cenomanian and Turonian biostratigraphy and microfossils, Omara 1951, 1954, 1956; Said & Kennawy 1957; Ghorab 1961; Ghorab 1961; Ansary, Andrawis and Fahmy 1962, Ansary & Omar, 1962, Abdou &

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Santonian, Matulla Formation (Ghorab 1961) and the Campanian Chalk (Kostandi 1959).

### LITHOSTRATIGRAPHY

In Moanga well No.1 the cretaceous deposits are subdivided into nine main rock units:

- 9 - Chalk : (6150 - 6300'), thickness 150 of Campanian age.
- 8 - Matulla Formation : (6300 - 6550'), thickness 250' of Santonian age.
- 7 - Wata Formation : (6550 - 6700'), thickness 150' of Turonian age.
- 6 - Hala Formation : (6700 - 7900'), thickness 1200' of Cenomanian age.
- 5 - Upper Clastic : (7900 - 8300'), thickness 400' of Late Albian age.
- 4 - Upper Carbonate : (8300 - 8500'), thickness 200' of Late Albian age.
- 3 - Lower Carbonate : (8500 - 10500'), thickness 2000' of Aptian age.
- 2 - Lower Clastic : (10500 - 11350'), thickness 850' of Barremian age.
- 1 - Malha Formation : (11350-11500'), thickness 150' of Hauteravian age.

1- Malha Formation :

Author; Abdallah and Adindani 1965.

Type locality: Wadi Malha and Wadi Umm Galawat (Western side of the Gulf of Suez).

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Lithology :

Sandstone : Colorless, tan, white, medium hard to hard, medium grained.

Shale : Varicolored, soft, to medium hard, fissile, slightly calcareous.

Limestone : Tan, white, tannish brown, argillaceous, oolitic, pisolitic.

Age : Hauterivian.

Faunal Content : Please check the chapter of biostratigraphy.

2 - Lower Clastic Unit :

This unit is proposed here to the clastic section of the Barremian stage, conformably overlain by the lower carbonate unit (Aptain) and conformably underlain by the Malha Formation (Hauteravian).

Lithology :

It is composed of friable to loose sand intercalated with shale and limestone.

Sands : Whitish yellow in color, well sorted, medium to coarse grained.

Shale : Grey to dark grey, medium hard, calcareous, fossiliferous.

Limestone : White to greyish white, tan, medium hard, microcrystalline, chalky.

Age : Barremian.

Faunal Content : Please check the chapter of biostratigraphy.

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3 - Lower carbonate unit :

It is established here to the carbonate sediments belonging to the Aptian stage, unconformably overlain by the late Albian rocks.

The unit is represented by limestone intercalated with shale bands, rich with benthic foraminiferal fossils, especially *Orbitolina and choffatella*.

Limestone : Greyish white, brown white, medium hard, finely crystalline, dolomitic.

Shale : Greenish grey, soft to medium hard, calcareous.

Age : Aptian.

Faunal Content : Please check the next chapter.

4 - Upper carbonate unit :

This unit is recorded in this section to represent the carbonate rocks related to the lower part of the Late Albian stage. Conformably overlain by the upper clastic unit of Late Albian age.

Lithology :

The unit mainly consists of limestone.

Limestone : White, greyish white, tan, medium hard. oolitic, finely crystalline.

Age : Late Albian.

Faunal Content : Please check the next chapter.

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### 5 - Upper clastic unit :

This unit is suggested in this work to characterize the topmost unit of the Early Cretaceous section, unconformably overlain by the Cenomanian rocks. It is composed mainly of sandstone and shale.

Sandstone : Tan, white, dark grey, medium hard to hard, fine to very fine grained.

Shale : Grey, greenish grey, soft, blocky, noncalcareous.

Age : Late Albian

Faunal Content : Please check the next chapter.

### 6 - Halal formation :

Author : Kostandi 1959.

Type locality : Risan-Aneiza, north Sinai.

#### Lithology :

The section is made of an almost solid limestone intercalated with dolomite and shale streaks.

Limestone : White, greyish white, medium hard, hard, chalky.

Dolomite : Tan, hard, microcrystalline, nonporous.

Shale : Grey, soft to medium hard, silty, noncalcareous.

Age : Cenomanian.

Faunal Content : Please check the chapter of biostratigraphy.

### 7 - Wata Formation :

Author : Ghorab (1961)

Type locality : Wadi Wata, west central Sinai.

This Turonian unit is unconformably overlain by the Matulla Formation and unconformably underlain by Halal Formation.

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Lithology :

Limestone : Tan, brown, hard, siliceous, partly dolomitic.

Age : Turonian.

Faunal : Please check the next chapter.

8 - Matulla Formation :

Author : Ghorab (1961)

Type locality ; Wadi Matulla, central Sinai.

This Santonian unit unconformably overlies the Wata Formation and conformably underlies the chalk.

The section is made up of limestone alternating with shale.

Limestone : White medium hard to soft, highly chalky, highly fossiliferous.

Shale : Grey, dark grey, fissile.

Age : Santonian

Faunal Content : Please check the next chapter.

9 - Chalk :

Author : Kostandi (1959)

Type locality : North Egypt, Gulf of Suez region.

Lithology : The rock is made up of dazzling white chalk, rich in foraminifers especially species of the genus *Globotruncana*, it is dated to belong to the campanian age.

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It is unconformably overlain by the Early Eocene sediments and conformably underlain by Matulla Formation.

Age : Campania .

Faunal content : Please check the next chapter.

### BIOSTRATIGRAPHY

Biostratigraphic zonation of the Cretaceous rocks in Monaga- well No. 1 is mainly based on the planktonic benthic foraminiferal species.

Due to the absence of the planktonic foraminifera in the Aptain, Cenomanian and Santonian stages, the benthic foraminifera have been used to define them.

The zonal scheme of Caron (1985) on the cretaceous planktic foraminifera is mainly followed in this work.

The foraminiferal distribution in the section is listed in chart, fig-1.

Nine foraminiferal zones have been recognized in the Cretaceous sediments of the studied well :

- 9 - *Globotruncana ventricosa* zone : (6150 - 6300'), thickness 150' of campanian age.
- 8 - *Arenaceous forams assemblage* zone : ( 6300 - 6550'), thickness 250' of Santonian age.
- 7 - *Helvetoruncana helvetica* zone : (6550 - 6700'), thickness 150' of Turonian age.
- 6 - *Praealveolina cretaces tenuis* zone : (6700 - 7900'), thickness 1200' of Cenomanian age.

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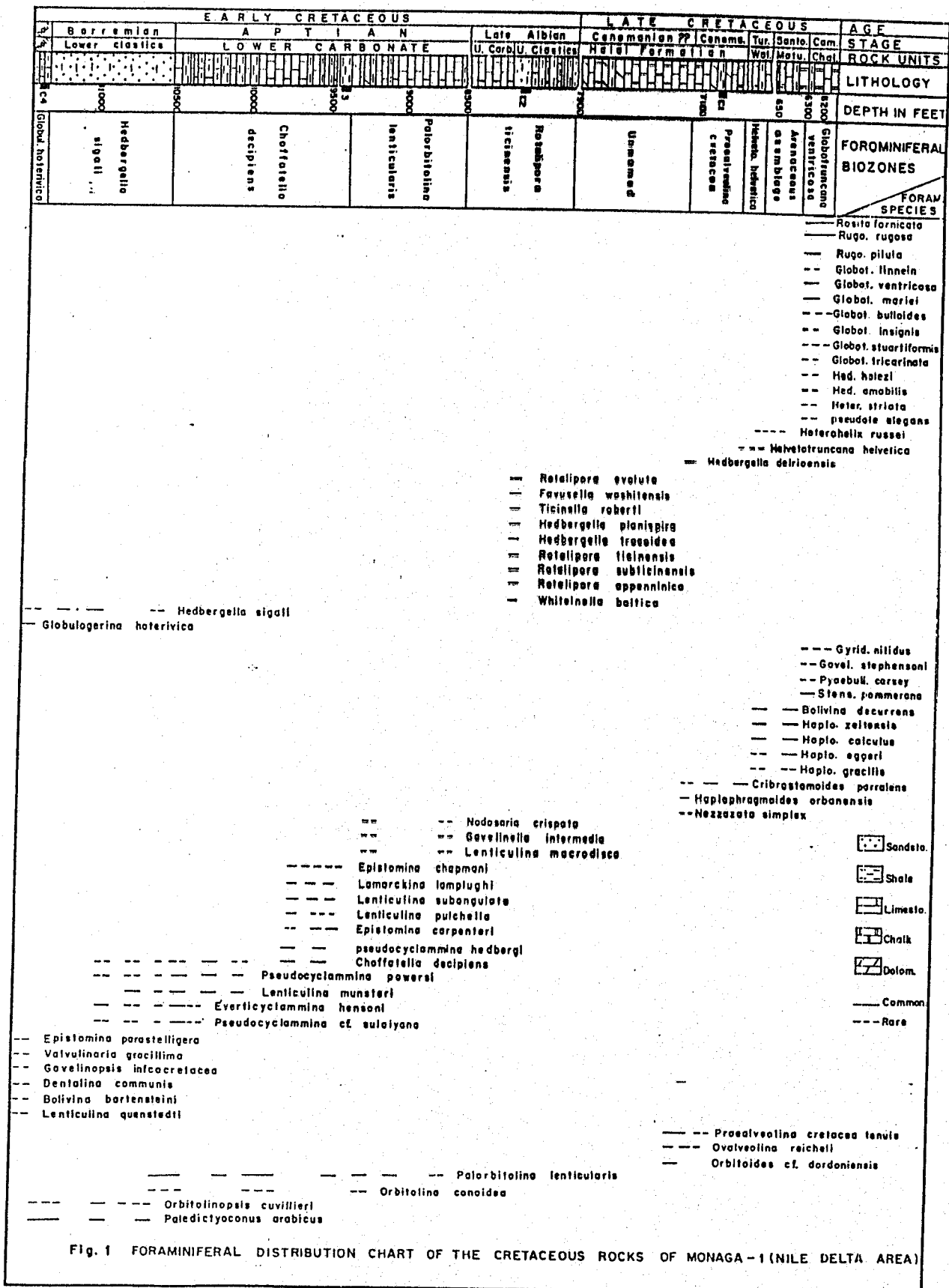


Fig. 1 FORAMINIFERAL DISTRIBUTION CHART OF THE CRETACEOUS ROCKS OF MONAGA-1 (NILE DELTA AREA)



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- 5 - *Rotalipora ticinensis* zone : (7900 - 8500'), thickness 600' of Late Albian age.
- 4 - *Palorbitolina lenticularis* zone : (8500 - 9350'), thickness 850' of Aptian age.
- 3 - *Choffatella decipiens* zone (9350 - 10500'), thickness 1150' of Aptian age.
- 2 - *Hedbergella Sigali* zone : (10500 - 11350'), thickness 850' of Barremian age.
- 1 - *Globulogerina hoterivica* zone : (11350 - 11500'), thickness 150' of Hauterivian age.

1 - *Globulogerina hoterivica* zone :

It occupies the interval from 11350 to 11500', 150' thickness of the Malha Formation. The zone extends from the first occurrence of *Globulogerina hoterivica* to the first occurrence of *Hedbergella sigali*. This definition coincides with that of Van Hinte 1985. The zone delineates the base of the Cretaceous in the studied well. It is characterized by the associations: *Globulogerina hoterivica* SUBBOTINE, *Epistomina parastelligera* HOFKER *Dentalina communis* D'ORIGNY, *Gavelinopsis infracretacea* HOFKER and *Valvulinaria greillima* TEN DAM.

2 - *Hedbergella sigali* zone :

This zone comprises the interval from 10500-11350', 850' thickness of the Lower Clastic unit. The zone is recognized by the first appearance of the genus *Hedbergella* as very primitive, small sized, and rare form. Moullade (1966) was the first who mentioned this zone to represent Barremian to early

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Aptian stage. The most diagnostic species are: *Hedbergella sigali* MOULLADE, *Orbitolinopsis cuvillieri* MOULLADE, *Orbitolinopsis cuvillieri* MOULLADE, *Lenticulina quenstedti* GUMBEL, *Everticyclammina hensoni* ROEMER and *pseudocyclammina powersi* REDMOND.

3 - *Choffatella decipiens* zone :

This benthic zone covers the interval from 9450 - 10500', thickness 850' of the lower part of the lower carbonate unit. This zone is defined by the first occurrence of *Choffatella decipiens* and comprises the total range of the species.

In Trinidad, Maync (1956) and Bolli(1957) dated the species to belong to the Barremian age.

Barr (1962) reported a widespread occurrence of *Choffatella decipiens* in the Lower Cretaceous. In this study the species is considered to be of Aptian stage, as it is associated with : *Palorbitolina lenticularis* BLUMENBACH, *Epistomina chapmani* TEN DAM, *Epistomina carpenteri* REUSS, *Lamarckina lamplughi* SHERLOCK, *Pseudocyclammina hedbergi* MAYNC, *Lenticulina subangulata* REUSS and *Lenticulina pulchella* REUSS.

4 - *Palorbitolina lenticularis* zone :

The zone comprises the interval from 8500-9350', a thickness of 850' of the upper part of the lower carbonate unit. The biozone is defined to extend from the disappearance of the *Choffatella decipiens* to the first occurrence of the *Albian fossils*. Dating of this zone in the Aptian coincides with the estimation of Saint Marc, 1970. The most characteristic faunal assemblage are:

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*Nodosaria crispata* TER QUEM, *Gavelinella intermedis*  
BERTHELIN and *lenticulina macrodisca* REUSS.

5 - *Rotalipora ticinensis* zone :

The zone covers the interval from 7900 - 8500', a thickness of 600' of the upper clastic unit . The zone is known by the first appearance of *Rotalipora ticinensis* to the first occurrence of *Rotalipora appenninica*. Recognition of this zone in the Late Albian stage is in a good agreement with that of Wonders (1985) and Caron (1985).

*Rotalipora ticinensis* zone is erected here for the first time in Egypt. The zonal species is associated with; *Rotalipora evoluta* SIGAL, *Favusella washitensis* CARSEY, *Ticinella roberti* GANDOLFI, *Hedbergella planispira* GANDOLFI, *Rotalipora subticiensis* GANDOLFI *Rotalipora appenninica* RENZ and *whiteienlla baltica* DOUGLAS & RANKIN. It is of interest to denote that a close similarity of this faunal assemblage exists with that of Marsa El Hilal area of northern Cyrenaica (Libya), where abundant Albian planktonic foraminifera were recorded (Barr and Hammuda 1971).

6 - *Praealveolina cretaces tenuis* zone :

The zone occupied the interval from 6700-7900', thickness 1200' of Halal Formation. The Cenomanian age is assigned to those sediments according to the presence of the larger foraminifera *Praealveolina cretacea* together with the benthic smaller forams: *Nezazzata simplex* OMARA *Haplophragmoides orbanesis*. ANSARY & TEWFIK *Cribrostomoides parallens* ANSARY & TEWFIK and *Haplophragmoides gracilis* SAID & KENAWY.

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It is noticed that this shallow marine facies of the cenomanian deposits could be compared with that reported by Gohrbandt (1966) on the cenomanian foraminifera of the northern Libya because of similarity in both assemblages.

7 - *Helvetoglobotruncana helvetica* zone :

It comprises the interval from 6550 - 6700', thickness 150' of Wata Formation. The biozone represents the total range of *Helvetoglobotruncana helvetica*, and is of Middle Turonian age. Definition and age of the zone is correlatable with that proposed by Van Hinte 1976, Sigal 1977, Wonders 1980 and Caron 1985, Barr (1972), assigned this zone to the Turonian rocks of northern Libya.

8 - Arenaceous foraminiferal assemblage zone :

It covers the interval from 6300 - 6550', thickness 250' of Matulla Formation. The santonian rocks in Monaga well No. 1 are only recognized by the presence of the following arenaceous foraminifera : *Haplophragmoides zeitensis* ANSARY & TEWFIK, *Haplophragmoides calculus* CUSHMAN & WATERS *Haplophragmoides eggeri* CUSHMAN together with *Orbitoides dordoniensis* HOFKER.

9 - *Globotruncana ventricosa* zone :

The zone attains a thickness of 150' of chalk occupying the interval from 6150' to 6300'.

The zone is defined by Caron (1985) to occupy the interval between the first occurrence of *Globotruncana ventricosa* to the first appearance of *Globotruncana calcarata*, however the upper limit of the zone is not defined owing to the absence of the later

species and the gap in sedimentation.

This zone is very rich in planktonic and benthics such as : *Rosita formicosa* PLUMMER *Rugoglobigerina rugosa* PLUMMER *Globotruncana linneinna* D'ORBIGNY *Globotruncana mariei* BANNER & BLOW, *Globotruncana insignis* GANDOLFI, *Globotruncanita stuartiformis* DALGIEZ *Globotruncana tricarinata* QUEREAU, *Hedbergella holezi* HAGN & ZEIL *Heterohelix striata* EHRENBERG *pseudotextularia elegans* RZEHAJ, *Gyridinoides nitidus* REUSS, *praebullimina carseyae* PLUMMER, *Stensioina pommerana* BROTZEN and *Bolivina decurrens* EHRENBERG.

EXPLANATION OF PLATE 1

Figures 1-15, X 64; figures 16-19, X 100; figures 20-22, X 150

- 1, *Ovalveolina reicheli* DE CASTRO, horizontal section of microspheric form; *praealveolina cretacea* zone Cenomanian.
- 2-5 *Praealveolina cretacea tenuis* REICHEL, (3,4) horizontal section of megalspheric form; (5), horizontal section of microspheric form; *praealveolina cretacea* zone, Cenomanian.
- 6-8 *Paleodictyoconus arabicus* HENON: (6) horizontal section, X (7) vertical section; (8) Oblique section; *Hedbergella Sigali* zone, Barremian.
- 9-10 *Palorbitolina lenticularis* BLUMENBACH: (9) vertical section; (10) horizontal section; *Palorbitolina lenticularis* zone, Aptian.
- 11-12 *Orbitolina conoidea* GRAS; (11) vertical section; (12) horizontal section *Palorbitolina lenticularis* zone, Aptian.
13. *Orbitolinopsis cuvillieri* MOULLADE, horizontal section, X *Hedbergella sigali* zone, Barremain.
14. *Orbitoides cf dordoniensis* HOFKER+ horizontal section, *praealveolina cretacea* zone, Cenomanian.
- 15-18 *Pseudocyclammina powersi* REDMOND: 15,17 horizontal section of microspheric form; 16, 18 horizontal section of megalo-spheric form; *choffatella decipiens* zone, Aptian.

PLATE I

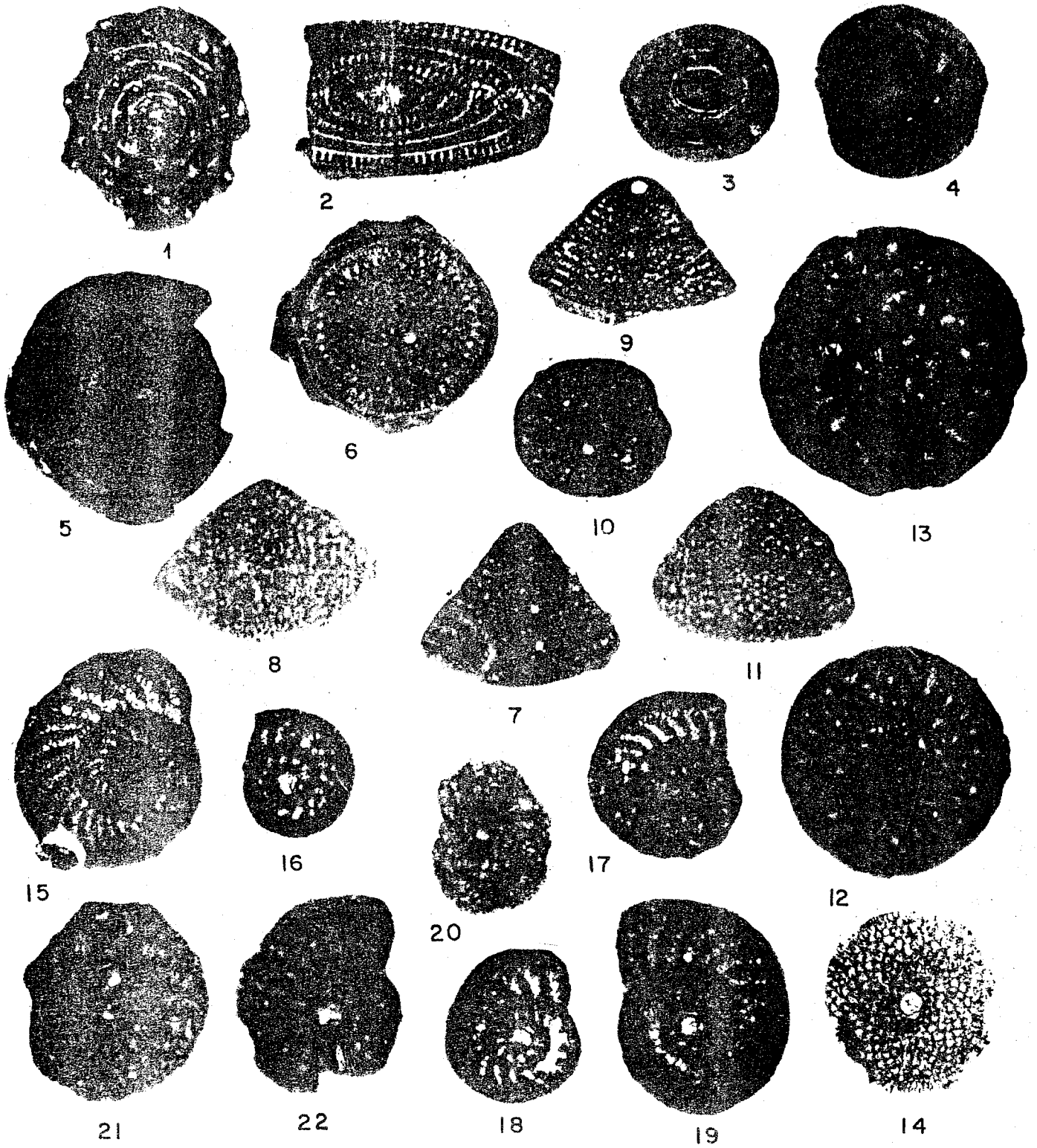
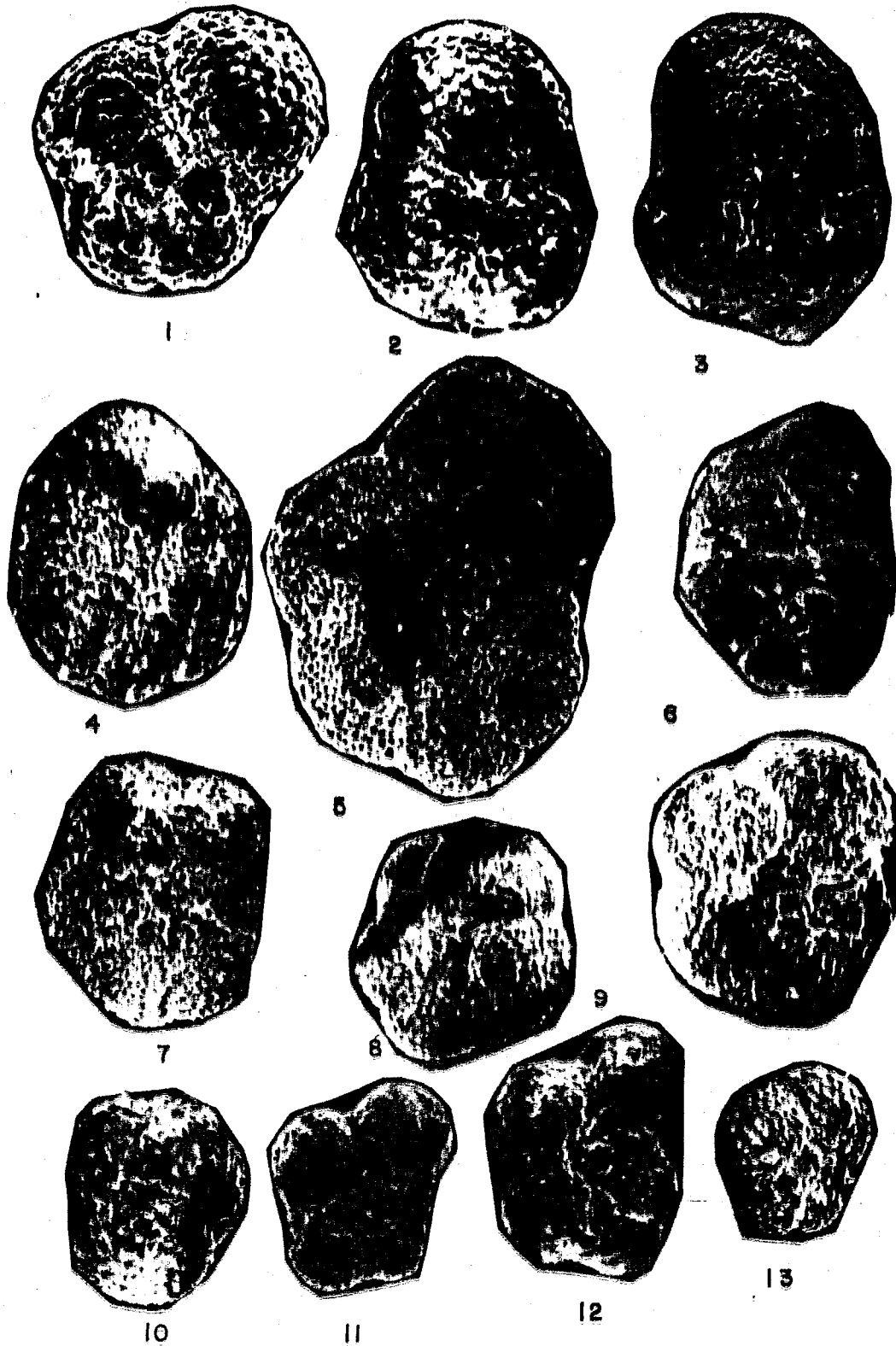


Plate 2



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- 19 *Pseudocyclamina* cf. *sulaiyana* REDMOND : horizontal section of megalospheric form; *Choffatella decipiens* zone, Aptian.
- 20 *Everticyclamina henson*; REDMOND; horizontal section of microspheric form; *Choffatella decipiens* zone, Aptian.
- 21-22 *Choffatella decipiens* SCHLUMBERGER; (21) horizontal section of microspheric form. (22) horizontal section of megalospheric form; *Choffatella decipiens* zone, Aptian.

EXPLANATION OF PLATE 2

- Figs (1, 11, 13) *Favusella washitensis* CARSEY; *Rotalipora ticinensis* Zone; Late Albian-Figs 1, 11 (X 350), Fig 13 (X 200).
- Figs (2, 3) *Globulogerina hoterivica* SUBBOTINA; *Globulogerina hoterivica* Zone; Late Hauteravian; X 200.
- Fig. (4) *Rotalipora ticinensis* GANDOIFI; *Rotalipora ticinensis* Zone; Late Albian; (X 350).
- Fig. (5) *Rotalipora evoluta* SIGAL; *Rotalipora ticinensis* Zone.
- Fig. (6) *Rotalipora appennenice* RENZ; *Rotalipora ticinensis* Zone; Late Albian, (X 350).
- Fig. (7) *Ticinella roberti* GANDOLFI; *Rotalipora ticinensis* Zone; Late Albian, (X 200).
- Fig. (8) *Hedbergella trocoidea* GANDOLFI; *Rotalipora ticinensis* Zone; Late Albian; (X 200).
- Fig. (9) *Whiteinella baltica* DOUGLAS RANKIN; *Rotalipora ticinensis* Zone; Late Albian; (X 350).
- Fig. (10) *Hedbergella sigali* MOULLADE; *Hedbergella sigali* Zone; Barremian; (X 350).
- Fig. (11) *Hedbergella delrioensis* CARSEY *Rotalipora ticinensis* Zone, Late Albian, (X 200).



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### CONCLUSION

It was noticed that the Cretaceous sediments in the studied section could be compared with those in the northern Sinai especially the Late Cretaceous, therefore the previously used rock units are considered here. The Early Cretaceous rocks in the Nile Delta area are subdivided in this work for the first time except for the Malha Formation where the Hauterivian facies coincides with that of Wadi Malha, Western side of the Gulf of Suez region. (Abdallah 1965).

The Early Cretaceous sediments are predominated with benthic smaller and larger foraminiferal species.

The Hauterivian stage in the present section is determined on the presence of *Globulogerina hoterivica* zone.

The *orbitolines* together with *Choffatella* are of great help in delineation of the Aptain stage.

Deep marine facies of the Albian rocks, in Egypt is reported here for the first time, according to the presence of the marine foraminifera *Rotalipora ticinensis*.

The Cenomanian and Santonian rocks were deposited under a shallow marine conditions as indicated by the common appearance of arenaceous foraminifera and Praealveolines.

The studied area is characterized by many unconformities indicated by the missing of sediments, Early Albian, lower part of Cenomanian, the most great part of Turonian, Coniacian and Maestrichtian stages.

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