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THE NEW POSTRUGOGLOBIGERINA PRAEDAUBJERGENSIS ZONE AT THE BASE OF THE STRATOTYPE OF THE MARINE PALEOCENE (EL KEF, TUNISIA)

(Figs 5, Pls. 3)

A b s t r a c t: The base of the Danian hypostratotype is determined by the zone of very small eoglobigerines and postrugoglobigerines, defined as the zone with *Postrugoglobigerina praedaubjergensis* n. sp. This zone is underlying the *Parvularugoglobigerina eugubina* Zone including the formely used *Globigerina taurica Globoconusa daubjergensis* Zone in Tunisia. This horizon of very small eoglobigerines and postrugoglobigerines with new species of foraminifers is represented by the associacion of the following species: *Eoglobigerina microcellulosa* MOROZOVA, *Postrugoglobigerina praedaubjergensis* n. sp., *Chiloguembelina minutissima* n. sp., *Guembelitria azzouzi* n. sp. and *Guembelitria besbesi* n. sp. For small rugulose globigerinoid forms 50—70 μm large the new genus *Postrugoglobigerina* n. gen. with the type species *Postrugoglobigerina hariana* nov. gen., nov. sp. is introduced.

Р е з ю м е: Основа датского гипостратотипа определяется зоной очень маленьких эоглобигерин и пострутоглобигерин, определенной как зона с *Postrugoglobigerina praedaubjergensis* n. sp. Эта зона подстиляет зону *Parvularugoglobigerina eugubina*, включая прежнюю зону *Globigerina taurica/Globoconusa daubjergensis* в Тунисе. Этот горизонт очень маленьких зоглобигерин и пострутоглобигерин с новыми видами фораминифер представлен сообществом следующих видов: *Eoglobigerina microcellulosa* MOROZOVA, *Postrugoglobigerina praedaubjergensis* n. sp., *Chiloguembelina minutissima* n. sp., *Guembelitria azzouzi* n. sp. и *Guembelitria besbesi* n. sp. для маленьких ругулозных глобигериноидных форм 50—70 μм больших вводится новый род *Postrugoglobigerina* n. gen. с типовыми видами *Postrugoglobigerina hariana* nov. gen., nov. sp.

Introduction

The hypostratotype or stratotype of the marine Paleocene (S a l a j, 1974a, 1980; S a l a j—P o ż a r y s k a—S z c z e c h u r a, 1976; P o ż a r y s k a, 1976; D o n z e, 1980) in the NW part of Tunisia near El Kef is represented by marls of the El Haria Formation (B u r o l l e t, 1956) and dated by foraminifers (D a l b i e z, 1956, in B u r o l l e t—S a i n f e l d, 1956; S a l a j, 1969, 1970). The marls correspond to the Danian s. 1., Harian (= Montian s. 1.) and Mellegian (= Landenian s. 1., S a l a j, 1980, 1981). The Paleocene (Fig. 1) which was the subject of excursion of the VIth African Micropaleontological Colloquium is studied in detail not only on the basis of foraminifers (S a l a j—P o ż a r y s k a—S z c z e c h u r a, 1976; A u b e r t—B e r g g r e n, 1976), nannoplankton (P e r c h—N i e l s e n, 1979, 1981 a, b; H a q—A u b r y, 1980) but also on the basis of ostracodes (E s k e r, 1968; D o n z e et al. 1982) and microphytoplankton (D o n z e—J a r d i n é—L e g o u x—M a s u r e—M e o n, 1981).

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The oldest Danian zone, originally defined by Dalbiez (in Burollet—Sainfeld, 1956) was the *Coleites reticulosus Zone*. This zone, as indicated by Salaj—Pożaryska—Szczechura (1976) corresponds to the *Subbotina pseudobulloides* Subzone or Zone. In this subzone the author (Salaj, 1978) determined from the rich nannoplankton two spectra of the species *Toweius* petalosus ELLIS, et LEHMANN (NP_2 — *Cruciplacolithus tenuis* Zone, Perch-Nielsen in Salaj, 1980, Perch-Nielsen, 1979. p. 240). Monechi (1979) found *Toweius petalosus* ELLIS et LEHMANN in the NP_1 and NP_2 zones at the profile Gubbio (Italy) as well as Romein (letter from September 1, 1976) in the area of Caravaca (Spain). On the basis of detailed studies of Perch—Nielsen (1981) the established *Toweius petalosus* Subzone in the area of El Kef represents the upper part of Martini's NP_1 Zone (1971) or the middle part of Romein's *Cruciplacolithus primus* Zone (1979).

The lowermost part of the Paleocene sequence, not existing at the Danian stratotype (= Infradanian; Salaj, 1974 or Eodanian Perch-Nielsen, 1981) and the basal Danian in the area of El Kef, equally as in other areas of Tunisia, as far as proved, was represented by the foraminifer *Globigerina taurica — Globoconusa daubjergensis* Zone (Salaj, 1970, 1974a,b; Salaj—Pożarys—ka—Szczechura, 1976 = *Parvularugoglobigerina eugubina* Zone) and corresponds to the essential part of Martini's nannoplankton NP_1 Zone (1971) or Romein's *Biantholithus sparsus* Zone (1979).

The Infradanian or Eodanian represents the passage transitional between the Cretaceous and Paleogene (about 30 cm). To this passage also uncommon attention was paid during the excursion of the VIth Micropaleontological African Colloquium (Salaj, 1974b). It may be distinguished here:

The uppermost layer of the Upper Maastrichtian with impoverished microfauna is practically without globotruncanas. Representatives of the families Heterohelicidae and Hedbergellinidae are predominating here (Bellier et al., 1983, p. 609).

5—8 cm layer of clays with scarce benthic, prevailingly agglutinate foraminifers.

This passage together with the overlying (about 20 cm) marls with *Globigerina taurica* MOROZOVA and *Globoconusa daubjergensis* (BROENNIMANN) was assigned to the *Globigerina taurica — Globoconusa daubjergensis* Zone.

Between both the mentioned members of the zone is a distinct, but only local submarine erosion wash-out, which resulted in missing of about 30 cm clays. This phenomenon apparently could lead to the opinion that the Danian profile is not complete as it was concluded during the excursion of the VIth Micropaleontological African Colloquium, or that there is a stratigraphical hiatus between the Maastrichtian and Danian. Therefore attention was paid to this problem. This also resulted from the proposal to study the suggested Upper Cretaceous and Paleocene hypostratotypes of Tunisia by several working groups, presented by the author during the closing plenary session of the VIth Micropaleontological African Colloquium in Tunisia. This proposal, worked out and presented by Prof. Dr. J. van Hinte, was accepted (Salaj, 1978, p. 119, 135) and the individual working groups were created, with coordination of which the author was commissioned. The essential part of the result from the Paleocene was published in the work by Salaj—Pożaryska—Szczechura (1976). Later, at the second working meeting of the UNESCO Project No 145 (chiefs

TIME IN my	EPOCH / STAGE		PLANKTIC FORAMINIFERAL ZONES	THICKNESS	THICKNESS calculated	ESTIMATED TIME IN my	SEDIMENTATION TIME 10^3 m y	
54.700								
56.050	EOCENE	MELLEGIAN (= LANDENIAN s.l. THANETIAN)	Morozovella velascoensis	37 m	37, 72 m	1. 350	2, 79 cm	2, 7941 cm
58.150			Planorotalia pseudomenardii	58 m	58, 67m	2. 100	2, 79 cm	
59.900			Morozovella pusilla	125 m	125, 00 m	1. 750	7, 14285 cm	
60.150		MONTIAN (= HARIAN)	Morozovella angulata	27 m	26, 76m	0. 250	7, 64 cm	7, 64705 cm
60.320			Turborotalia (Acarinina) praecursoria: praecursoria	13 m	12, 99m	0. 170	7, 64 cm	
60.650			Turborotalia (Acarinina) praecursoria: uncinata	25 m	25, 23m	0. 330	7, 64 cm	
61.500			Globoconusa kozlowskii	65 m	64, 99m	0. 850	7, 64 cm	
62.467	PALEOCENE	DANIAN	Turborotalia (Acarinina) inconstans	10 m	10, 26m	0.997	1, 05 cm	1, 1137 cm
64.267			Planorotalia compressa	20 m	20, 57m	1.800	1, 14 cm	
64.767			Subbotina pseudobulloides	5 m	5, 71 m	0.500	1, 14 cm	
64.947			Parvularugoglobigerina eugubina	2 m	2, 05m	0. 180	1, 14 cm	
64.992			Postrugoglobigerina praedaubjergensis	0,5 m	0, 48m	0.045	1, 07 cm	
65.000			Arenaceous foraminifers	5-10 cm	0, 085m	0.008	1, 07 cm	
	LATE MAASTRICHTIAN without globotruncanas			60 cm	0,592m	0.013	4,55714 cm	

Fig. 1. Estimated time relationship and correlation of Paleocene planktic zones at El Kef sequence.

Prof. I. de Klasz and Prof. Dr. M. Moullade) in Sfax in the year 1976 it was agreed that the study of hypostratotypes would continue especially focused on the Maastrichtian and Paleocene in the area of El Kef. On the proposal of Prof. Dr. M. Moullade at this profile Prof. Dr. P. Donze was commissioned with further coordination. Together with him I carried out precise location of this profile and showed from where the samples were taken and studied by the author. For the purpose of precise correlation studies from the same places samples were taken in the years 1978—79 (Donze—Ben Salem—Khessibi), in some parts of the profile stile more detailed sampling was carried out from the *Globotruncana calcarata, Globotruncana stephensoni* zones (Late Campanian). *Archaeoglobitruncana kefiana*, which together with *Pseudokossmaticeras brandti* (REDTENBACHER) represents the base of the Tethyan stratotype of the Maastrichtian now. Besides that, especially for the passage between the Cretaceous and Paleocene a complementary parallel profile was collected (sampl. LM1—31, MLC 1—18). These samples were distributed by the Service Geologique de Tunisia and Prof. Donze to the individual interested specialists, securing mutual control and precise mutual parallelization of the results achieved in the study of the individual fossil groups. The results of the complementary studies also confirm justification of the opinion of Dalbiez

(1955), Burollet (1956), Salaj (1970; 1974a,b; 1980) of full bedding and stratigraphical completeness of this Campanian—Paleocene profile as well as purposefulness of establishing of hypostratotypes or Tethyan stratotypes of the Campanian—Maastrichtian and Paleocene just in the area of El Kef (NW Tunisia).

Stratigraphy of Maastrichtian — Danian stratotype boundary beds

a) Uppermost Maastrichtian (samples K 15, 48, 49/1—29, LMC 9) still generally assigned to the *Abathomphalus mayaroensis* Zone (Salaj, 1980; Fig. 37, p. 112 bis) corresponds to the passage with a so far undefined zone according to latest knowledge (Bellier—Caron—Donze—Maamouri—Salaj, 1983). Globotruncanas, besides scarce occurrences of the species *Globotruncanita stuarti* (DE LAPPARENT), are not found any more. *Racemiguembelina varians varians* (RZEHAK), *Racemiguembelina varians fructicosa* (EGGER) are still found, further species of the genera *Heterohelix* EHRENBERG, 1843, *Hedbergella* BROENNIMANN et BROWN, 1958 and *Rugoglobigerina* BROENNIMANN, 1952 are abundant, many of which are represented by new species and the study of which has not been finished yet. It is not excluded that many individuals considered as representatives of the genus *Hedbergella* or *Rugoglobigerina* may be species, from which representatives of the genus *Postrugoglobigerina* n. gen., representing the oldest Danian "globigerinas", developed. There is a similar situation as pointed out by Sigal (1979) at the profile Leg 47B.

It is not excluded that the absence of globotruncanas in the Uppermost Maastrichtian layers in the area of El Kef — Les Salines may be explained not only as a consequence of beginning distinct cooling, also by unfavourable ecological conditions, mainly resulting from distinct shallowing and partial isolation of the Kef Basin from the open sea, into which Upper Maastrichtian globotruncanas were redeposited (Salaj—Bajaník—Menčík—Stránik, 1973, p. 224). This may be concluded from the fact that in many places the Uppermost Maastrichtian layers contain abundant globotruncanas in NW as well as eastern Tunisia. Distinct oceanic species as *Abathomphalus mayaroensis* (BOLLI) and *Kassabian falsocalcarata* (KERDANY et ABDELSALAM) are also present. The last mentioned species was established as the index species of the zone of equal name defined in Tunisia in the last time (Salaj—Maamouri, 1982; Solakius, 1983; Salaj—Solakius, 1984). It is necessary to remark that in the area of El Kef when compared with eastern Tunisia the species *Kassabiana falsocalcarata* (KERDANY et ABDELSALAM) is found very scarcely, rather sporadically, in the Uppermost Maastrichtian (Salaj, 1980), what is equally valid also for extension of the species *Abathomphalus mayaroensis* (BOLLI).

On the contrary, from other Tethyan regions cases are known when *Abathomphalus mayaroensis* (BOLLI) is found throughout the Maastrichtian. This fact is also known in the West Carpathians. So, for instance, in the area of Hradisko near Žilina globotruncanas equally as *Abathomphalus mayaroensis* (BOLLI) although dying out suddenly, become extinct at the immediate contact with the Danian zone of smaller "globigerinas" only (Salaj—Gašpariková—Kysela, 1983).

b) Zone of untypical agglutinated foraminifers.

The passage (5—8 cm) of claystones (LMC 8, LMC 7, LMC 6, K - 27) contains benthic, prevailingly agglutinated foraminifers (S a l a j, 1980, p. 137). Planktic foraminifers equally as calcareous nannoplankton are missing (P e r c h - N i e l s e n, 1981, p. 29). Its missing was obviously caused by extraordinarily intense dissolution, as a consequence of which neither nannoplankton, nor planktic foraminifers have preserved. Sporadically relatively trick - walled calcareous benthic foraminifers, damaged by dissolution, are found (representatives of the genus *Gavelinella*). A similar situation is also known from the Maastrichtian—Danian boundary beds from the South Atlantic (P r e m o l i S i l v a—B o e r s m a, 1977). On the contrary however, D o n z e—J a r d i n e—L e g o u x—M a s u r e—M e o n (1981) describe a rich marine microphytoplankton (Dinoflagellata and Acritarcha) from this passage and define the *Isabelidinium cretaceum* Zone. When compared with the Maastrichtian, this passage is obviously missing at the Danian stratotype and at various Danian localities of Denmark and it is little probable that the *Isabelidinium cretaceum* Zone would be equivalent to the Uppermost Maastrichtian layers represented by the dinoflagellate *Chiropteridium inornatum — Palynodinium grallator* Zone (H a n s e n, 1979; B i r k e l u n d—H a k a n s s o n, 1982). This passage as well as the Infradanian was assigned by the author (S a l a j, 1974b) to the *Globigerina taurica — Globoconusa daubjergensis* Zone. D o n z e et al. (1981) assign it still to the Uppermost Maastrichtian. P e r c h - N i e l s e n (1981, p. 29) consider this passage as transitional between the Maastrichtian and Danian (P e r c h - N i e l s e n, 1981; Fig. 2, p. 28). This passage obviously corresponds to the time section, in which at the Cretaceous—Paleogene boundary not only distinct paleogeographical, ecological, but also climatic changes were taking place in all - world scale, as mentioned by D o n z e et al. (1981), as a consequence of distinct cooling. Besides that, the admitted cosmic catastrophe (higher contents of iridium in sediments, A l v a r e z et al. 1979) and cosmic radiation connected with it also largely contributed to extinction of many groups of organisms (C i t a—P r e m o l i S i l v a, 1974, pp. 200—209).

It is still necessary to remark that this passage with agglutinated foraminifers is also known in the West Carpathians (S a l a j—G a š p a r i k o v á—K y s e l a, 1983). It is found in the underlier of the distinct condensed *Parvularugoglobigerina eugubina* Zone, described as the *Globigerina taurica — Globoconusa daubjergensis* Zone.

c) *Postrugoglobigerina praedaubjergensis* Zone.

Definition: Its lower boundary is determined by appearance of the species *Postrugoglobigerina praedaubjergensis* n. sp. whereas the hte upper boundary is determined by appearance of the species *Parvularugoglobigerina eugibina* (LUTERBACHER et PREMOLI SILVA). We define it as the basal zone of the marine Paleocene stratotype (Fig. 1) and also assign it to the Danian s.l., also in spite of that this zone deos not occur at the Danian stratotype. This zone corresponds to S i g a l's (1979, p. 296) zone of very small globigerinas occurring in the underlier of the *Parvularugoglobigerina eugubina* Zone.

This zone is about 50 cm thick (LM 11, LM 12). The assemblage of very small planktic foraminifers, about 40—70 μm, differs distictly from the association of planktic foraminifers of the *Parvularugoglobigerina eugubina* Zone.

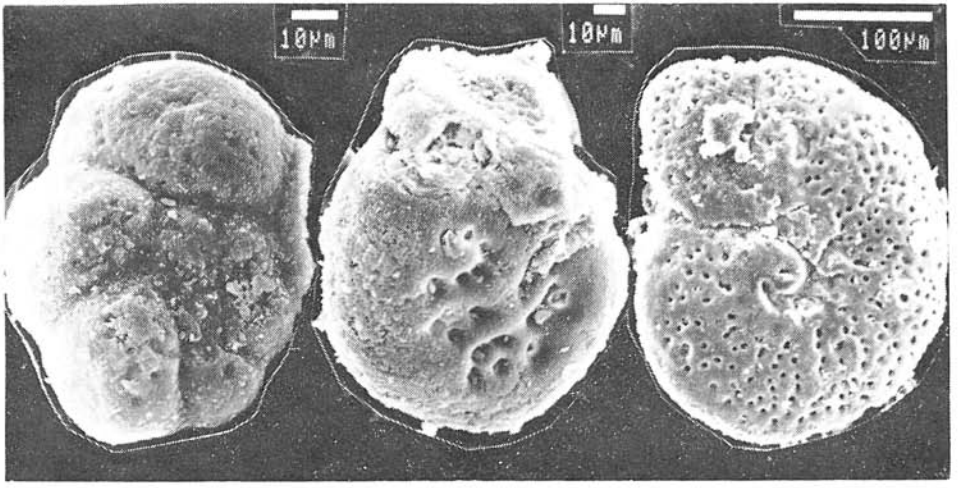


Fig. 2. *Gavelinella* sp.$_1$ × 1000. Sample LM-12 (a).
Gavelinella sp.$_2$ × 700. Sample LM-12 (b). *Gavelinella* aff. *danica* BROTZEN × 300. Sample LM-12 (c).

In the described zone the following species are found: *Eoglobigerina microcellulosa* MOROZOVA, *Postrugoglobigerina hariana* nov. gen., n. sp., *Postrugoglobigerina praedaubjergensis* n. sp., *Guembelina minutissima* n. sp., *Guembelina azzouzi* n. sp., *Guembelitria irregularis* MOROZOVA, *Chiloguembelina* cf. *taurica* MOROZOVA and *Guembelitria besbesi* n. sp. Calcareous benthic foraminifers, which are scarce, are represented by the species (Fig. 2): *Gavelinella* aff. *danica* BROTZEN, *Gavelinella* sp.$_1$ and *Gavelinella* sp.$_2$. Calcareous benthic foraminifers are relatively moore abundant in the *Parvularugoglobigerina eugubina* Zone (Fig. 3).

Recently Herm—Hillebrandt—Perch-Nielsen (1981) described in the Northern Limestone Alps (Lattengebirge) in the overlier of the Upper Maastrichtian *Abathomphalus mayaroensis* Zone the newly defined *Globigerina fringa* Zone, which they also related to the profile El Kef, sample LM 12. We paid more attention to the occurrence of the species "*Globigerina*" *fringa* SUBBOTINA in sample LM 12. When also some specimens of eoglobigerinas are similar to the species "*Globigerina*" *fringa* SUBBOTINA, however, these are by more than one half smaller and have a smooth test wall, with very minute pores, on the contrary to "*Globigerina*" *fringa* SUBBOTINA (Herm—Hillebrandt—Perch-Nielsen, 1981; Pl. 1, Figs. 1—4) (cf. also Bang, 1980, p. 140). This species belonging to the genus *Subbotina*, BROTZEN et POŹARYSKA, 1961, however, is found higher up at the profile El Kef (LM 13, LM 14), in the *Parvularugoglobigerina eugubina* Zone, from where it is also mentioned by the above quoted authors. In sample LM 12, which is available to the author, neither *Subbotina fringa* (SUBBOTINA), nor *Parvularugoglobigerina eugubina* (LUTERBACHER et PREMOLI SILVA) have been found. For this reason the author considers introduction of the new name of the *Postrugoglobigerina praedaubjergensis* Zone as substantiated.

Ammodiscus latus (GRZYBOWSKI)
Ammodiscus siliceus (TERQUEM)
Glomospira gordialis (JONES et PARKER)
Glomospira charoides (JONES et PARKER)
Trochamminoides globigeriniformis (PARKER et JONES)
Trochamminoides irregularis WHITE
Dendrophrya robusta GRZYBOWSKI
Nodellum cf. *velascoense* (CUSHMAN)
Spiroplectammina spectabilis (GRZYBOWSKI)
Dorothia longa (MOROZOVA)
Lenticulina (Lenticulina) aff. *alabamensis* (CUSHMAN)
Lenticulina (Lenticulina) degolyeri (PLUMMER)
Semivulvalina dentata (ALTH)
Pullenia quinqueloba (REUSS)
Loxostomoides applinae (PLUMMER)
Tappanina selmaensis (CUSHMAN)
Sporobulimina eocaena BYKOVA
Bulimina quadrata PLUMMER
Bulimina trinidadensis CUSHMAN et JARVIS
Bulimina velascoensis WHITE
Eponides plummerae CUSHMAN
Eponides subcandidulus (GRZYBOWSKI)
Osangularia plummerae BROTZEN
Cibicidoides susanaensis (BROWNING, in MALLORY, 1959)
Cibicides commatus MOROZOVA
Cibicides succedens BROTZEN
Anomalinoides acuta (PLUMMER)
Anomalinoides affinis (HANTKEN)
Gavelinella danica BROTZEN
Gavelinella umbilicatula MJATLIUK

Fig. 3. Benthic species distribution in the *Parvularugoglobigerina eugubina* Zone of the El Kef section.

As to relation of this zone to the nannoplankton in the sense of knowledge of Perch-Nielsen (1981), it corresponds to the *Biscutum? romeini* Subzone (= lower part of Romein's, 1979; *Biscutum sparsus* Zone) defined by her. In addition, from the *Postrugoglobigerina praedaubjergensis* Zone from equal sample (LM 12) a rich microphytoplankton of the *Membranilarnarcia tenella* Zone of equivalent age is described (Donze—Jardine—Legoux—Musure—Meon, 1981).

Although in Denmark the oldest Danian *"Globigerina" eugubina* Zone is present at the Danian stratotype according to Bang (1979; 1980) and mainly in Jylland, it may be inferred on the basis of comparison with Tunisia that in Denmark as well as at the profile Gubbio in Italy (Luterbacher—Premoli Silva, 1964; Cita—Premoli Silva, 1974) the bed sequence between the Maastrichtian and Danian is not complete and the newly established *Postrugoglobigerina praedaubjergensis* n. sp. Zone is not present at these profiles. Atlhough it appeared that the dinoflagellate *Membranilarnarcia tenella* Zone (Donze et al., 1981) described from the horizon, corresponding to the *Postrugoglobigerina praedaubjergensis* Zone, on the basis of the common occurrence

of the species *Membranilarnarcia tenella* equivalent to the *Carpatella cornuta* Zone, described from the lowermost Danian layers (Hansen, 1979) of the "*Globigerina*" *eugubina* Zone, it is evident that the lowermost part of the *Carpatella cornuta* Zone is missing here and appearance of the species *Membranilarnarcia tenella* in Denmark is not corresponding to appearance of this species as foraminifers of the *Postrugoglobigerina praedaubjergensis* Zone are missing here. This statement is in agreement with knowledge of Hansen (1979) and Birkelund—Hakansson (1982), who indicate a short break in sedimentation close below the Fish Clay at the locality Stevns Klint or at other localities where sedimentation may be gradual or extremely condensed and so even in the area of Jylland where are the most complete profiles a short break in sedimentation cannot be excluded according to Birkelund—Hakansson (1982, p. 382). Their statement results from the knowledge that some taxa, as e.g. *Chrizopteridium inoratum,* which is already known before the boundary events, appears only from the Fish Clay base in Jylland, together with the species *Membranilarnarcia tenella* and *Carpatella cornuta* appearing for the first time.

d) *Parvularugoglobigerina eugubina* Zone.

This zone was described in Tunisia by Salaj (1970) as the *Globigerina taurica* Zone, later by Salaj (1974a,b) and Salaj—Pożaryska—Szczechura (1976) as the *Globigerina taurica — Globoconusa daubjergensis* Zone. For the reason that *Eoglobigerina* cf. *eubulloides* Morozova, ?*Eoglobigerina hemisphaerica* Morozova, *Eoglobigerina pentagona* Morozova, *Eoglobigerina tetragona* Morozova and *Eoglobigerina taurica* Morozova are found not from the base of this zone but higher up (Bang, 1980), it is evident that Morozova's (1960) *Eoglobigerina taurica* Zone is synchronous with the "*Globigerina*" *eugubina* Zone established by Luterbacher—Premoli Silva (1964) partly only. For this reason the author uses the name of the *Parvularugoglobigerina eugubina* Zone as it was already carried out in the area of El Kef by Perch-Nielsen (1980), Herm—Hillebrandt——Perch-Nielsen (1981) and Donze et al. (1982). Justification of its application is also confirmed by the results of Bang (1979; 1980), who carried out correlation studies of the "*Globigerina*" *eugubina* zone from the type profile (sample Ceselli) with the localities at Jylland.

It is necessary to remark that Bang (1980) holds the opinion that *Globigerina imbrica* LUTERBACHER et PREMOLI SILVA, *Globigerina* sabina LUTERBACHER et PREMOLI SILVA, *Globigerina sabina* LUTERBACHER et PREMOLI SILVA and *Globigerina eugubina* LUTERBACHER et PREMOLI SILVA are not belonging to the genus *Parvularugoglobigerina* HOFKER, 1978, the type species of which is *Globigerina eugubina* LUTERBACHER et PREMOLI SILVA, but to the new genus, which she provisionally calls genus *L.* When also Hofker (1978) includes in this genus species with a pustulose surface, the author holds the opinion that on the basis of the type species of the genus it is better to carry out emendation and to assign the flat rounded, above mentioned species to the genus *Parvularugoglobigerina.* These have a specific slot-like aperture, elongated parallel with the test. Their tests are also very fine with pustules. It is, however, necessary to exclude from this genus globose forms with rugulose surface with fine pores as well as with a semiarcuate intraumbi-

lically - umbilically situated aperture. The author introduces for these species, which are also abundant at the profile El Kef, the new genus *Postrugoglobigerina* nov. gen. with the type species *Postrugoglobigerina hariana* n. sp. At the profile El Kef, in agreement with Donze et al. (1981) and Perch-Nielsen (1981) we assing samples LM 13, LM 14 and LM 15 to the *Parvularugoglobigerina eugubina* Zone which thickness is 2 m (Fig. 1). From this zone a considerable number of samples was taken already previously, in the years 1967—1975, by the author (Salaj, 1980; p. 184. Fig. 62) The nannoplankton, described from this zone by Perch-Nielsen (1981), corresponds to the *Biscutum? parvulum* Subzone, i.e. to the upper part of Romein's (1979) *Biscutum sparsus* Zone. The *Biscutum? parvulum* Subzone reaches the lowermost part of the *Subbotina pseudobulloides* Zone. It is still necessary to remark that in the *Parvularugoglobigerina eugubina* Zone at the profile El Kef the species *Toweius petalosus* ELLIS et LOHMANN, proved by Monechi (1979) at the type locality of the respective zone, has not been found, what compared with the results of Perch-Nielsen (1981a,b) would confirm the opinion of the author that at the type profile Gubbio the lowermost part of the Danian, represented by the described *Postrugoglobigerina praedaubjergensis* Zone, is not proved or present.

The rich microphytoplankton described by Donze et al. (1981) from the *Parvularugoglobigerina eugubina* Zone corresponds in its futt extent to the dinoflagellate *Alisocysta circumtabulata — Cassidium fragile* Zone.

e) Remarks to other Paleocene zones.

The other Danian *Subbotina pseudobulloides*, *Planorotalia compressa* and *Turborotalia (Acarinina) inconstans* zones (Fig. 2) are described in detail in the work by Salaj—Pożaryska—Szczechura (1976), to which we also refer. For completing of the problem it is, however, necessary to remark that alternation of marly limestones and marls, ranged by Donze et al. (1982; Fig. 2, p. 277) to the *Planorotalia compressa* Zone, already belongs to the *Turborotalia (Acarinina) inconstans* Zone (samples 6/1967, 33, 37, 38, K-28, 34/68, 35/68, 34 (= KPN 34), 35 (= KPN 35), K-47a, 39, 40, 41), where typical representatives of the species *Turborotalia (Acarinina) inconstans* (SUBBOTINA) (Salaj, 1980; Pl. 19, Figs. 2—3) are found, coming from samples KPN 34 and KPN 35, taken together with Perch-Nielsen in the year 1974 during the excursion of the VIth Micropaleontological African Colloqium. In these samples a rich nannoplankton is found, determined by Perch-Nielsen (letter from April 5, 1974), of the *Chiasmolithus danicus* Zone. On the contrary, the sequence between samples 157—160 assigned to the *Globigerina trinidadensis* Zone with the *trinidadensis* and *inconstans* subzones by Donze et al. (1982; Fig. 2, p. 277), corresponds to the *Globoconusa kozlowskii* Zone (Salaj, 1974a; Salaj, 1980; p. 184, Fig. 62), in which, of course, the species *Globigerina trinidadensis* (BOLLI), *Turborotalia (Acarinina) inconstans trinidadensis* (BOLLI) sensu SALAJ and *Turborotalia (Acarinina) inconstans inconstans* (SUBBOTINA) are abundant (Salaj, 1974a,b, 1980; Salaj—Pożaryska—Szczechura, 1976), but together with *Globoconusa kozlowskii* (Brotzen et Pożaryska) and *Subbotina spiralis* (BOLLI). From samples KPN 38—39 (=47a—h), taken together with Perch-Nielsen during the Colloqium in Tunis in the year 1974 just from this passage, is already nannoplankton of the *Elipsolithus macellus* Zone (letter of Perch-Nielsen from May 7, 1974), excluding, as

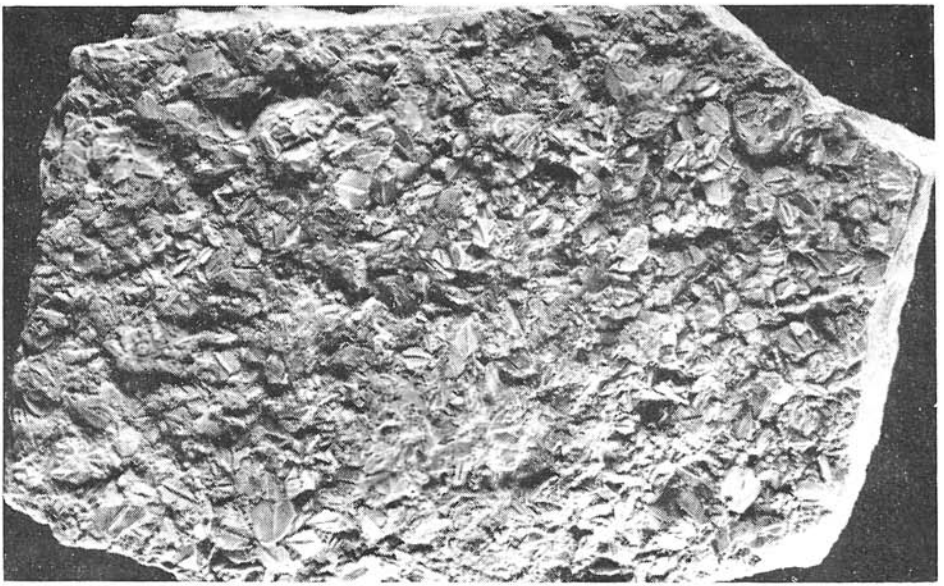


Fig. 4. Level with *Frondicularia* ex gr. *phosphatica* (RUSSO) × 1.5; photo made by Mss. J e n d e k o v á.

naturally, that this part of the sequence would belong to the Danian. So the *Globoconusa kozlowskii* Zone is not belonging to the Danian, but to the newly proposed Harian stage (= Montian s.l.), defined at the profile El Kef by S a l a j (1980; p. 146, 1981) (Fig. 1).

When in the Danian and Harian planktic foraminifers are predominating in associations, so in the Upper Paleocene benthic foraminifers begin to be prevalent (S a l a j, 1974b). In the area of El Kef was distinct shallowing from the base of the *Planorotalia pseudomenardii* Zone when 15 cm thick organogenic limestones deposited (level K-52) and explosive development of benthic foraminifer set in (Fig. 4).

Magnetic stratigraphy

The paleomagnetic studies in the boundary beds of the El Kef sequence in relation to the marly facies was not possible to realised (N a i r n, personal information). The magnetostratigraphic correlation was possible by comparsion to the Gubbio G — Polarity chron (Uppermost Maastrichtian—Lowermost Danian). Its marin anomalies are 30 and 29 (A l v a r e z et al., 1977, p. 385).

Paleobathymetric (paleoenvironments) conditions

The paleoecological conditions in the area of El Kef to the end of the Maastrichtian, corresponding to the uppermost part of the *Abathomphalus may-*

aroensis Zone or *Kassabiana falsocalcarata* Zone (= sous zone non nommée, Bellier—Caron—Donze—Herm—Maamouri—Salaj, 1983; ecozone 3, Donze et al., 1982), were not most suitable for development of planktic foraminifers. These were mainly influenced by paleogeographical changes on the one hand and paleoclimatic changes on the other hand.

a) Paleogeographical changes

These resulted most probably also from distinct shallowing of the sea of the Tunisian trough, what may be put into relation with general regression of the Maastrichtian in the Boreal region on the one hand and Saharan platform on the other hand. This regression also distinctly influenced the depth regime in the Tethyan realm, mainly in its southern part. Its manifestation from the line Thala — Bizerta to the east in Tunisia are frequent stratigraphic hiatuses (Cuvillier—Dalbiez—Glinzboeckel et al., 1955; Salaj—Bajaník—Menčík—Stránik, 1973). Distinct shallowing was taking place here, but sedimentation continued still under pelagic condition, however, on raised bottom. In the area of El Kef there was besides aleuritic quartz grains also the supply of redeposited Upper Maastrichtian microfauna (Salaj—Bajaník—Menčík—Stránik, 1973, p. 224). The shallower-water character would also be testified by the presence of sporadical specimens of Upper Maastrichtian orbitoid foraminifers (*Omphalocyclus macroporus* LAMARCK; Salaj, 1980, p. 115). The above mentioned facts would confirm that the shallow-water sedimentation platform zone of central Tunisia where in the Campanian—Maastrichtian limestones of the Abiod Formation with orbitoid foraminifers deposited was not very far from the Tunisian trough and this further upwelling or also local emersion, mainly in the Upper Maastrichtian, distinctly influenced the regressive character of the sea in the area of El Kef and caused redeposition of planktic Upper Maastrichtian microfauna from the markedly elevated part of the basin by depth current (Thurow—Kuhnt—Wiedmann, 1982, p. 167).

b) Climatic changes

In the area of El Kef (Tunisia), the distinct change of fauna at the Maastrichtian—Danian boundary was obviously influenced by the change of marine physical - chemical conditions as well as by the higher contents of some elements (Fe, Ti, Mn, Ba, Sr, Mg) in marine water, generally known from Denmark and other localities of the world. In Denmark (Buchardt—Jørgensen 1979) distinct changes in the stable isotope composition of the calcium carbonate phase were proved.

On the basis of the results of oxygen isotope data (Birkelund—Hakansson, 1982) in Denmark the temperature level may have fluctuated by as much as 12 °C (between 8 °C below average Late Maastrichtian temperature to 4 °C above). In the Atlantic Ocean, on the basis of oxygen and carbon isotope measurements carried out by Boersma—Shackleton (1979), the drop in temperature to the end of the Maastrichtian and in the Lower Danian *Parvularugoglobigerina eugubina* Zone was very distinct. The lowermost values between 9 °C to 12 °C or up to 14 °C. Regarding to the geographical situation of

Tunisia we may suppose these values as being very probable also for the boundary beds of the studied area. This would also be confirmed by the occurrence of an impoverished microfauna to the end of the Maastrichtian and agglutinated microfauna as wel as very small, 50—70 μm, pelagic foraminifers of the I. Danian zone. We suppose, however, that sedimentation was taking place under conditions of normal salinity and not under completely anoxic conditions.

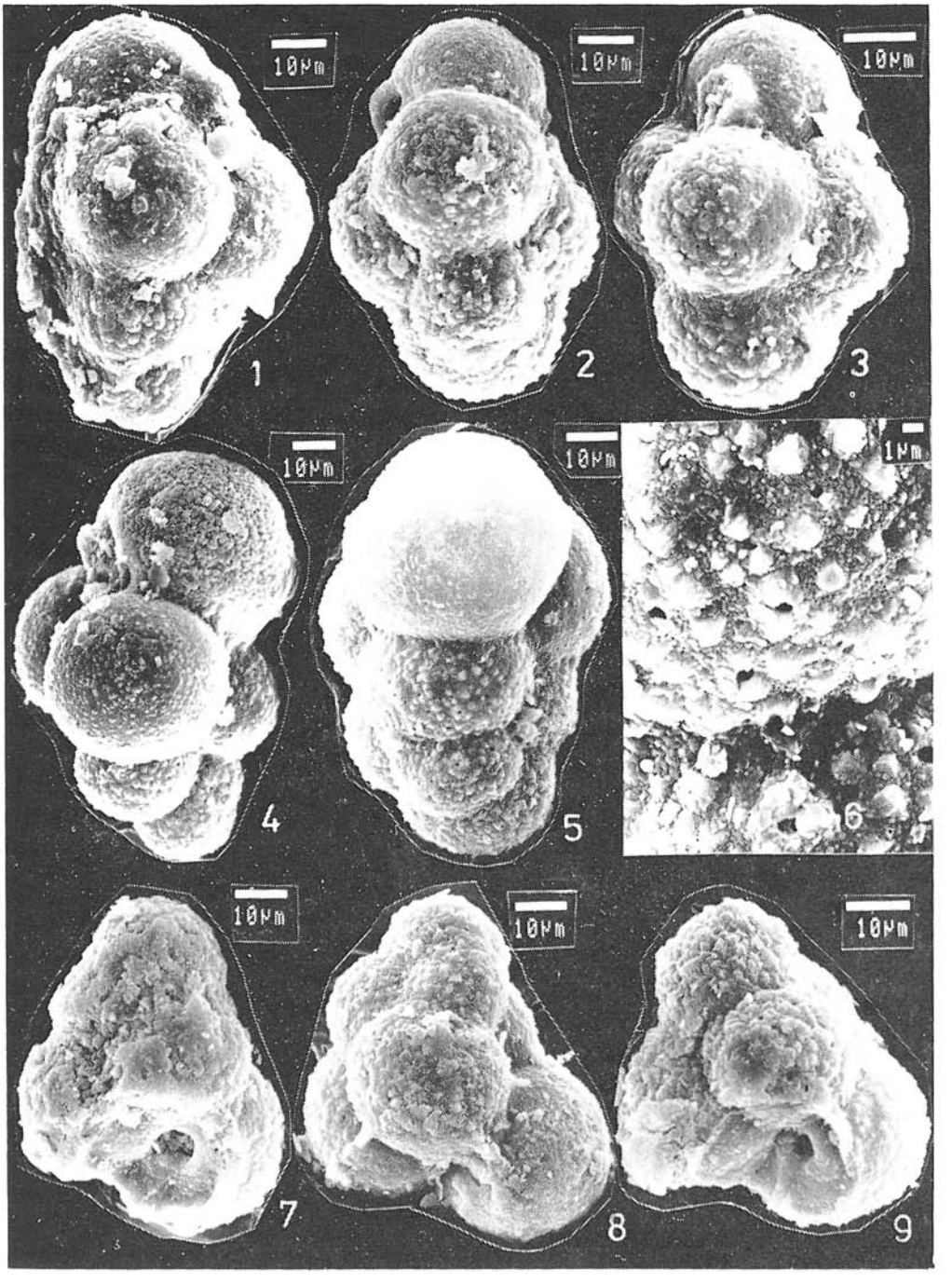
Oxic conditions, as were in this area, have been determined on the basis of ostracodes (genus *Crythe* sp. F) by Donze et al. (1982). In the Uppermost Maastrichtian the zone of minimum oxygen (Z.O.M.) is very strong. A reduction of oxygenation is very strong, but still not very sudden at bottom level (O_2 < < 3—4 ml/l). The presence of abundant microphytoplankton (Donze et al., 1982) and nannoplankton of the *Micula prinsii* Zone (Perch-Nielsen, 1981; p. 28, Fig. 2) still testifies to the existence of photosynthesis. Most distinct reduction of oxygenation as a consequence of cooling and obviously extinction of nannoplankton is at the Maastrichtian—Danian boudary in the zone of agglutinated foraminifers, which represent the uppermost part of ecozone 3 (Donze et al., 1982; O_2 < 2 ml/l), where planktic foraminifers and nannoplankton are not present at all (Perch-Nielsen, 1981). The presence of a rich microphytoplankton (Donze et al., 1981), however, which was not hampered by cooling, obviously excludes the existence of a zone with total absence of photosynthesis under conditions of sedimentation of the outer shelf to upper epibathyal zone (Donze et al., 1982).

Unfavourable ecological conditions could be survived only by some representatives of the globose genera *Hedbergella* and *Rugoglobigerina* from planktic foraminifers, which reduced the size of their test to 50 μm under stress conditions (cf. also Bang, 1979). So at the Maastrichtian—Danian boundary new species originated, belonging to *Parvularugoglobigerina* HOFKER, 1978 *Eoglobigerina* MOROZOVA, 1959 and *Postrugoglobigerina* nov. gen. In the *Parvularugoglobigerina eugubina* Zone the dimensions of tests enlarged to 100—200 μm and considerable differentiation of species and genera set in quickly under already more or less normal ecological conditions of the upper epibathyal, when also still partly at lowered temperature.

Therefore it is necessary to consider if the uncommonly small representatives of newly described species in the newly established *Postrugoglobigerina praedaubjergensis* Zone have their normal dimensions or could stunded (nanno-) forms. We remark that we have not found larger individuals of the described species, even in the *Parvularugoglobigerina eugubina* Zone. If there are uncommonly small species, but with normal dimensions, so then the bathymetric conditions, salinity and level of oxygenation connected with them would be suitable for their development in the area of El Kef.

Plate 1

Figs. 1, 2, 3. *Guembelitria azzouzi* n. sp. × 1300, × 1300, × 1700, sample LM-12, loc.: El Haria near El Kef. Base of Danian, *Postrugoglobigerina praedaubjergensis* Zone;
Figs. 4, 5. *Guembelitria azzouzi* n. sp. × 1000, × 1200, sample LM-12;
Fig. 6. *Guembelitria azzouzi* n. sp. × 5000, detail of structure, sample LM-12;
Figs. 7, 8, 9. *Guembeltria besbesi* n. sp. × 1200, × 12 000, × 1500, Fig. 9. Type species, sample LM-12.
All microphotos made by Dr. Caňo, Scanning michoscope stereoscan JSM-840, GÚDŠ.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It will be necessary, however, to pay further attention to this problem in future. The representatives of foraminifers of this zone should also be found at further localities. Regarding to the rich development of nannoplankton (Perch-Nielsen, 1981a, b) as well as microphytoplankton (Donze et al., 1982) in this zone, it is evident that in this very short section of time development of the representatives of the first planktic Paleogene foraminifers set in.

After warming and re-appearance of rich nannoplankton phytosynthesis and oxygenation increase again. In the *„Globigerina" eugubina* Zone with an already considerable development of planktic foraminifers, nannoplankton and microphytoplankton, according to Donze et al., 1982, p. 300), the nutrition level is still relatively weak although oxygenation shoud approach 3 ml l on an average. Therefore un the underlying newly defined *Postrugoglobigerina praedaubjergensis* Zone this oxygenation should be still by somewhat lower. It is, however, necessary to remark that in connection with new development of planktic foraminifers after its crisis in all - world scale at the Cretaceous—Paleogene boundary we see that the representatives of the individual species in the *Parvularugoglobigerina eugubina* Zone, in their content and amount, are already well developed everywhere, also at other localities, not only of Tunisia, but also in other regions of the Tethys.

As to the consideration, how long distinct cooling at the Maastrichtian—Danian boundary could have lasted, we shall set out from the data on the absolute age of the Maastrichtian and Danian. This is about 7 mil. y. for the Maastrichtian according to Odin—Kennedy (1982). Thickness of the Maastrichtian at El Kef, taken from the base of the *Archaeoglobitruncana kefiana* Zone with *Pseudokossmaticeras brandti* (Redtenbacher) is 319 m (Salaj—Maamouri, 1982). The rate of sedimentation for 10^6 y is 45.57 m. So the uppermost about 60 cm of the Maastrichtian, where are only representatives of *Hedbergella, Rugoglobigerina* and *Heterohelix*, but already without globotruncanas, deposited in about 13.000 years. As to the rate values for sedimentation in the Danian, Harian and Mellegian of the area of El Kef (Fig. 1), so these are different.

For Paleocene chronostratigraphic scale and correlation with planktic foraminiferal zonation (Salaj—Pożaryska—Szczechura, 1976, modified) (Fig. 1) we taken (with modification) in consideration the works of Berggren (1972), Cavelier—Pomerol (1983) and Harland et al. (1985, p. 36, Chart 2.13). In the absolute age of the Danian in the sense of Berggren (1972) is 3.5 mil. y [without the *Globoconusa kozlowskii* and *T. (Acarinina) uncinata* zones = *G. uncinata* and *G. spiralis* Zone in Berggren 1972, which in the conception of the author already belongs to the Harian or Montian; Salaj 1980],so its thickness in the area of El Kef is about 37.60 m and the rate of sedimentation for 1.07 cm = 10^3 y.

It results from this datum for the 5—10 cm thick zone of agglutinated foraminifers that is deposited in 8.000 years and the 50 cm thick *Postrugoglobigerina praedaubjergensis* Zone is deposited 45.000 years.

Remark to proof-sheet: Regarding to the new results of the absolute age on the Cretaceous—Paleogene boundary, which are mentioned on the basis of the study of the irridium horizon to 66.700 my (lecture of Prof. Dr. A. Preisinger in Bratislava, September 12th 1985) the Danian age instead of the 3.5 my would be 5.2 my. In this sense the new values for the rate of sedimentation (= 0.734 cm for 10^3y), as well as age of the individual Danian foraminifer zones result as follows:

	thickness calculated	estimated time in my
6. *T.(A.) inconstans* I. Z.	10.136 m	1.380
5. *P. compressa* I. Z.	20.200 m	2.750
4. *S. pseudobulloides* I. Z.	5.141 m	0.700
3. *P. eugubina* I. Z.	2.012 m	0.280
2. *Pr. praedaubjergensis* I. Z.	0.550 m	0.075
1. *Arenaceous foraminifers* Z.	0.110 m	0.015

From these data the most probable result would follow that the biological crisis at the Maastrichtian—Danian boundary lasted about 66.000 or 103.000 years. The essential part of this time (about 50.000 or 90.000 years) would correspond to sedimentation of the low carbonate cycle, which is the only one represented by marlstone throughout the Danian (= High - carbonate part of cycle).

The low carbonate cycle would correspond to sedimentation of the epibathyal probably under higher activity of Antarctic Bottom Water. Distinct shallowing of the lysocline of the carbonate compensation depth (CCD) was taking place (influenced by the Saharian Platform and the oxydation of rapidly accumulated organic matter comming from this Platform), resulting in great dissolution of nannofosils and foraminifers, mainly in the zone of agglutinated foraminifers, which besides sporadical benthic foraminifers damaged by dissolution, have not preserved in this horizon. These comparing observations are in agreement with the results of studies carried out in the Tertiary carbonate - - dissolution cycles by Dean—Gardner—Čepek (1981).

In agreement with Birkelund—Hakansson (1982) the author also hold the opinion the at the Cretaceous—Paleogene boundary in stress situation caused by several factors was a gradual transition of a very reduced number of representatives of genera; such ones, which were capable of adaption to the called fourth changes. Therefore, to admit only one (let us say cosmic) catastrophic event, which could have caused this change in development of organic groups, is improbable and difficult to prove.

Paleontological description:

Heterohelicidae CUSHMAN, 1927
Guembelitriinae MONTANARO, GALLITELLI, 1957
Guembelitria CUSHMAN, 1933

Guembelitria azzouzi n. sp.
Pl. 1, Figs. 1—5, Pl. 2, Fig. 1

Type species: Figured in Pl. 2, Fig. 1 and deposited in the collections of the Dionýz Štúr Institute of Geology in Bratislava, No T-14.

Denomination: To the honour of Dr.. A. Azzouz, previous Director of the Service Géologique de Tunisie, now retired.

Type level: Basal part of the Danian hypostratotype (Sample LM 12) in the El Kef area, Tunisia.

Type locality: El Haria near El Kef, excursion locality of the VIth African Micropaleontological Colloquy.

Material: 10 specimens comming from sample LM 12.

Diagnosis: Calcareous test, with very fine pores and pustules, biserial with two - three whorls. The pustules on the last chamber are missing. Chambers inflated, globular, sutures distinct, depressed, aperture narrow, elongated, an interiomarginal arch at the base of the last-formed chamber and the aperture is provided with a narrow lip.

Dimensions: height 85 μm, width 50 μm.

Stratigraphic range: This species has been proved in the newly defined *Postrugoglobigerina postdaubjergensis* n. sp. Zone so far.

Guembelitria besbesi n. sp.
Pl. 1, Figs. 7—9

Type species: Figured in Pl. 1, Fig. 9 and deposited in the collections of the Dionýz Štúr Institute of Geology in Bratislava, No T-15.

Denomination: To the honour of Dr. A. Besbes, previous Director of the Service Géologique de Tunisie, now working at the Office National de Mines à Tunis.

Type level: Basal part of the Paleocene stratotype (Sample LM 12) in the El Kef area.

Type locality: El Haria near El Kef, excursion locality of the VIth Africa Micropaleontological Colloquy.

Material: 8 specimens comming from sample LM 12.

Diagnosis: Calcareus, fine-porous test with small pustules, biserial, with 2 ½ whorls. Test spiral low with a wide, relatively flat base. Chambers inflated, globular; sutures distinct, depressed. Aperture small, circular, without lip at base of last formed chamber.

Dimensions: Height 55—70 μm, width 50—60 μm in the basal part of test.

Stratigraphic range: So far proved in the newly defined *Postrugoglobigerina praedaubjergensis* n. sp. Zone.

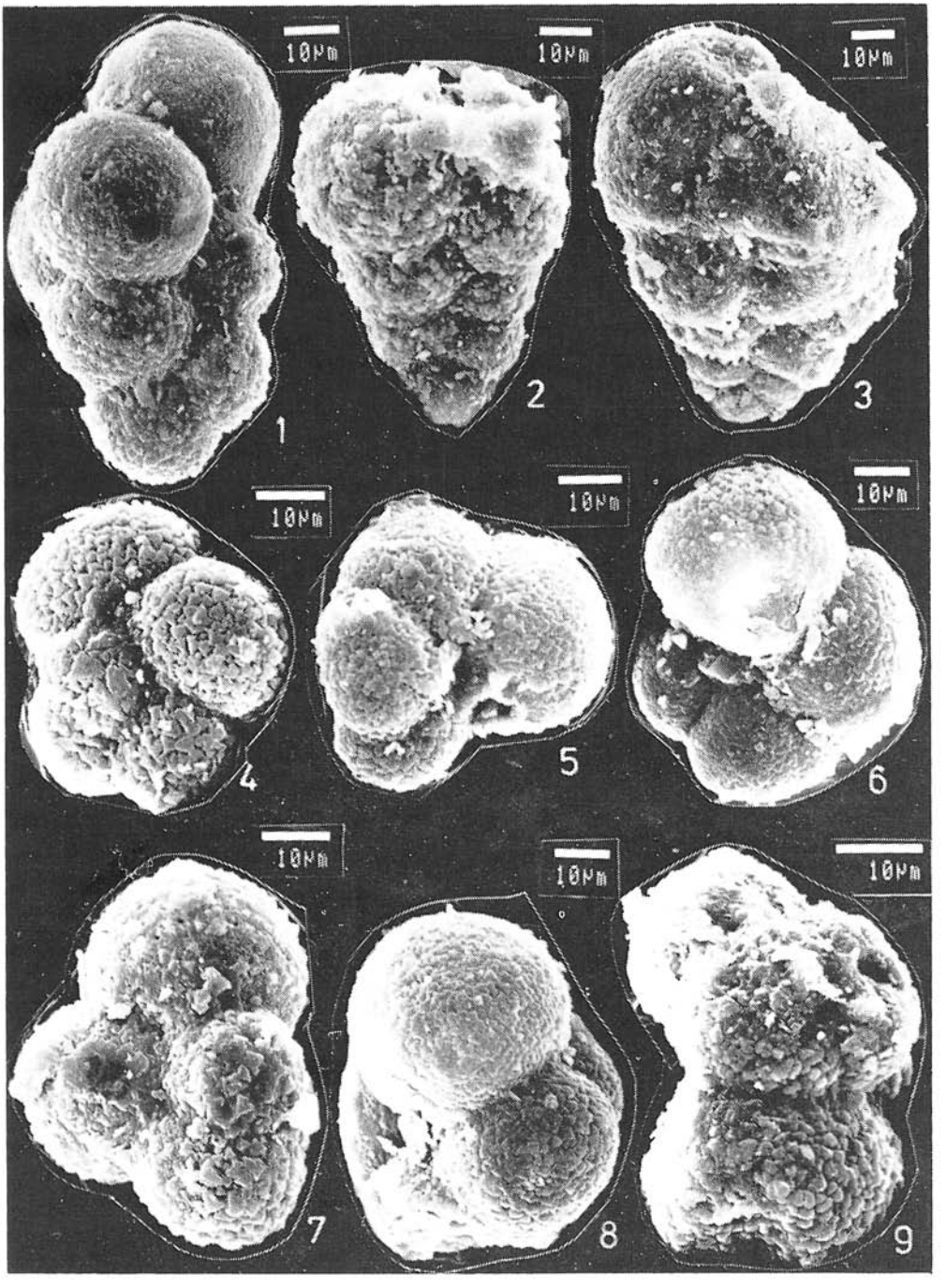
Heterohelicinae CUSHMAN, 1927
Chiloguembelina LOEBLICH et TAPPAN, 1956
Chiloguembelina minutissima n. sp.
Pl. 2, Figs. 2—3

Type species: Figured in Pl. 2, Fig. 3 and deposited in the collections of the Dionýz Štúr Institute of Geology in Bratislava, No T 16.

Denomination: From latin word minutissimus = small.

Plate 2

Fig. 1. *Guembelitria azzouzi* n. sp. × 1300. Type species, sample LM-12, loc.I El Haria near El Kef. Base of Danian, *Postrugoglobigerina praedaubjergensis* Zone;
Figs. 2, 3. *Chiloguembelina minutissima* n. sp. × 1200, × 1000, Fig. 3. = Type species, sample LM-12;
Figs. 4, 5, 6. *Eoglobigerina maamouri* n. sp. × 1600, × 1500, × 1300;
Figs. 7, 8, 9. *Eoglobigerina maamouri* n. sp. × 1300, × 1600, × 2000, sample LM-12.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Type level: Basal part of the Danian hypostratotype (Sample LM 12) in the El Kef area.

Type locality: El Haria near El Kef, excursion locality of the VIth African Micropaleontological Colloquy.

Material: 5 specimens comming from sample LM 12.

Diagnosis: Test calcareous, fine perforate, two possibilitesfine rugulose or provided with fine pustules, flaring; inflated chambers arranged biserially in three-four paurs, with a tendency to become somwhat twisted; sutures distinct, depressed. Aperture broad, bordered by flap, which is much destroyed on the studied specimens.

Dimensions: Height 70—90 μm, width 55—75 μm.

Stratigraphic range: *Chiloguembelina minutissima* n. sp. has been proved from the newly established *Postrugoglobigerina praedaubjergensis* n. sp. Zone so far only.

Globigerinidae CARPENTER, PARKER et JONES, 1862
Globigerinidae CARPENTER, PARKER et JONES, 1862
Eoglobigerina MOROZOVA, 1959
Eoglobigerina maamouri n. sp.
Pl. 2, Figs. 4—9

Type species: Figured in Pl. 2, Fig. 3 and deposited in the collections of the Dionýz Štúr Institute of Geology in Bratislava, No T-17.

Denomination: To the honour of Mme Dr. A.-L. Maamouri, geologe in the Service Géologique de Tunisie.

Type level: Basal part of the Danian hypostratotype (Sample LM 12) in the El Kef area.

Type locality: El Haria near El Kef, excursion locality of the VIth African Micropaleontological Colloquy.

Material: 5 specimens comming from sample LM 12.

Diagnosis: Fine perforate, smooth test, formed by two whorls, in each whorl 4 spaerical, inflated chambers. Suture radially depressed. Umbilicus small, depressed. Aperture extraumbilical, without lip.

Dimensions: Diameter 45—60 μm, height 20—25 μm.

Stratigraphic range: *Eoglobigerina maamouri* n. sp. is abundant and so far found in the *Postrugoglobigerina praedaubjergensis* n. sp. Zone only.

Genus *Postrugoglobigerina* nov. gen.

Type species: *Postrugoglobigerina hariana* nov. gen., n. sp., figured in Pl. 3, Figs. 1—2.

Derivatio nominis: The composed name is derived from the latin word post = after; and from the generic name of the Rugoglobigerina.

Diagnosis: Test free, trochospiral, umbilicate, chambers rounded to sphaerical, sutural, radial to slightly curved, on both sides depressed throughout; wall calcareous, fine and irregularly perforate, often also pustules perforate. Surface of test rought, with abundant, irregularly dispersed pustules. In the parts of test with dense pustules the surface of test is typically rugose.

The pustules are of irregular dimensions and are often missing on the last chamber.

Aperture interiomarginal - umbilical, mostly narrow slot-like, at the base of the last chamber, not protected by lip.

Stratigraphic range: Uppermost Maastrichtian (where are no more globotruncanas) and Lowermost Danian.

Phylogenetic relations: This genus developed from *Rugoglobigerina* BROENNIMANN under ecologically unfavourable conditions at the Cretaceous—Paleogene boundary. From *Postrugoglobigerina* nov. gen. we derive *Parvularugoglobigerina* HOFKER, 1978 (= genus L. BANG);

b) *Eoglobigerina* MOROZOVA, 1959 (in which the pustules got last), from which *Subbotina* BROTZEN et POŽARYSKA, 1961 developed and;

c) *Globoconusa* KHALILOV, 1953.

Postrugoglobigerina hariana n. sp.
Pl. 3, Figs. 1—3, Fig. 5

Type species: Figured in Pl. 3, Figs. 1—2 and deposited in the collectoins of the Dionýz Štúr Institute of Geology in Bratislava, No T - 18.

Denomination: After the name of the locality El Haria.

Type level: Basal part of the Tunisian Paleocene stratotype (Sample LM 12).

Type locality: El Haria near El Kef, excursion locality of the VIth African Micropaleontological Colloquy.

Material: 10 specimens comming from sample LM 12.

Diagnosis: Low - spirally coiled test with two whorls with five chambers in each. Chambers sphaerical and intergrown in the first whorl. Sutures weakly curved and depressed on both sides. Umbilicus small and depressed. Surface of test fine porous and pustulosous, pores irregularly scattered similarly as the pustules, which are often pierced by pores. The last chamber is smooth in the majority of cases. Aperture interiomarginal umbilical, narrow, slot like at the base last chamber, not protected by flap.

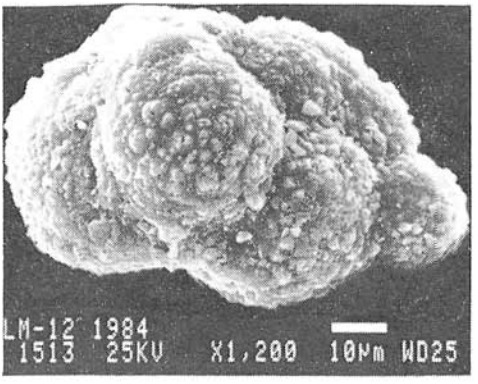

Fig. 5. *Postrugoglobigerina hariana* n. sp.

Dimensions: Diameter 50—85 µm, height 25—50 µm.

Stratigraphic range: So far found in the Lowermost Danian *Postrugoglobigerina praedaubjergensis* Zone.

Postrugoglobigerina praedaubjergensis n. sp.
Pl. 3, Figs. 6—9

Type species: Figured in Pl. 3, Fig. 7 and deposited in the collections of the Dionýz Štúr Institute of Geology in Bratislava, No T - 19.

Denomination: The composed name is derived from the latin word prae- before; and from the name of species daubjergensis.

Type level: Basal part of the Tunisian Paleocene stratotype (Sample LM 12).

Type locality: El Haria near El Kef.

Material: About 15 specimens comming from sample LM 12.

Diagnosis: High-spirally coiled test two whorls with four sphaerical chambers in each. Outline of test lobate. Sutures radial and depressed. Umbilicus small, depressed. Surface of test with irregularly dispersed fine pores and pustules. Aperture slot-like interiomarginal.

Dimensions: Diameter 55—80 μm, height 30—45 μm.

Phylogenetic relations: *Postrugoglobigerina praedaubjergensis* n. sp. may be considered as an ancestral form, from which *Globoconusa daubjergensis* developed. Aperture umbilical small at the base of the last chamber, not protected by flap.

Stratigraphic range: This new species has been proved from the newly established *Postrugoglobigerina praedaubjergensis* n. sp. Zone so far only.

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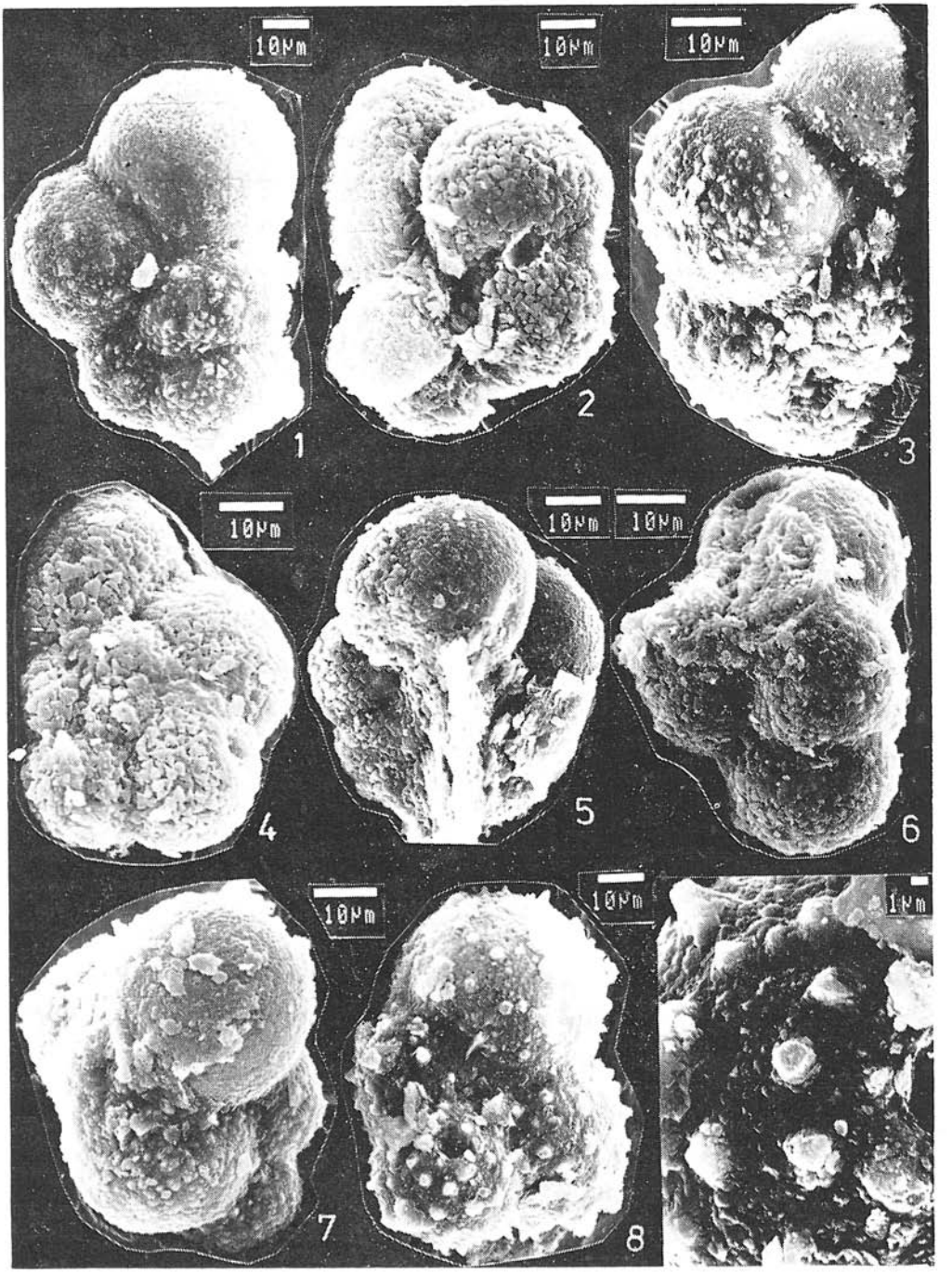
Plate 3

Figs. 1, 2. *Postrugoglobigerina hariana* nov. gen., n. sp. × 1100, × 1300. Type species of genus, sample LM-12, loc.: El Haria near El Kef. Base of the stratotype of the Paleocene, *Postrugoglobigerina praedaubjergensis* Zone;
Fig. 3. *Postrugoglobigerina hariana* n. sp. × 1300, sample LM-12;
Figs. 4, 5. *Eoglobigerina microcellulosa* MOROZOVA × 1600, × 1500, sample LM-12;
Fig. 6. *Postrugoglobigerina paedaubjergensis* n. sp. × 1600, sample LM-12;
Figs. 7, 8. *Postrugoglobigerina praedaubjergensis* n. sp. × 1500, × 1100, Fig. 7. = Type species, sample LM-12,
Fig. 9. *Postrugoglobigerina praedaubjergensis* n. sp. × 5000, detail of structure, sample LM-12.


10µm
1
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2
10µm
3
10µm
4
10µm
10µm
5
6
10µm
7
10µm
8
1µm

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