

PLANKTIC FORAMINIFERA
OF THE CRETACEOUS AND PALEOCENE - EOCENE

PART 1: CRETACEOUS

Course given by
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Caracas
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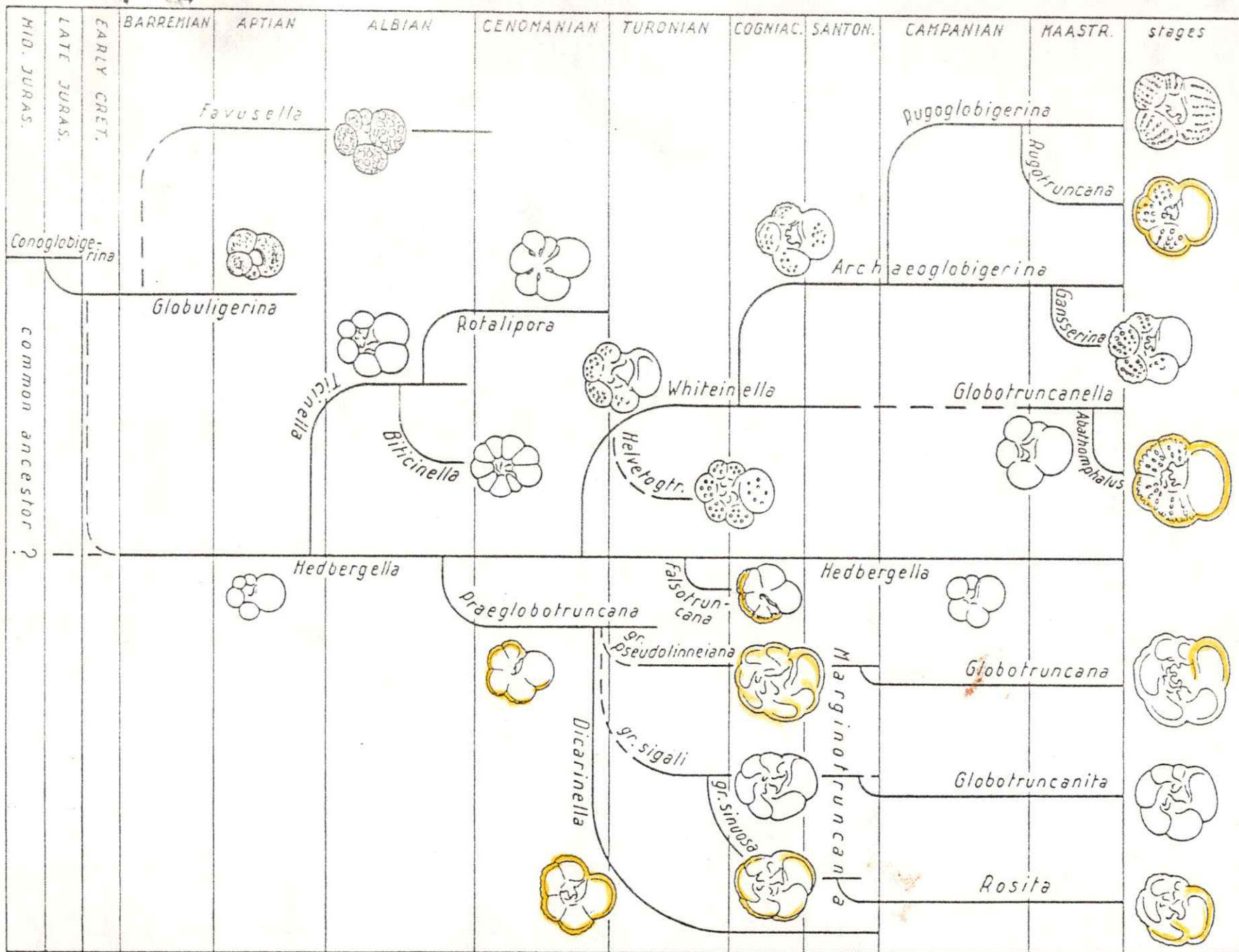
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4: Caron: Cretaceous planktic foraminifera

Table 1. Classification of the Cretaceous Globigerinacea

1. Test bi-, tri-, multiserial:	HETEROHELICIDAE	<i>Heterohelix</i> <i>Pseudotextularia</i> <i>Pseudoguembelina</i> <i>Guembelitra</i> <i>Racemiguembelina</i>
2. Test planispiral	PLANOMALINIDAE	<i>Planomalina</i> <i>Globigerinelloides</i> <i>Hastigerinoides</i> <i>Schackoina</i>
3. Test trochospiral		
"Globigerina-like", primitive forms:	FAVUSELLIDAE	<i>Globuligerina</i> <i>Favusella</i>
primary aperture entirely umbilical and chamber surface roughly reticulated		
primary aperture varies from umbilical to extraumbilical and chamber surface regularly reticulated		
"Hedbergella-lineage", evolved forms:	GLOBOTRUNCANIDAE	
primary aperture umbilical-extraumbilical-nearly peripheral, protected by lip or flap		
without supplementary apertures on umbilical side		
periphery without keel		
pustulose angular periphery		
periphery with 2 keels		
with supplementary apertures on umbilical side		
periphery without keel		
periphery with 1 keel		
primary aperture umbilical-extraumbilical		
protected by portici		
periphery without keel		
periphery with 1 keel		
with pustulose, truncate periphery		
periphery with 2 keels		
umbilical sutures depressed, radial or curved		
periphery with 2 keels, sometimes fused in 1 keel on the last whorl		
umbilical sutures raised, curved		
only with imperforate, angular periphery or passing gradually to 1 keel		
protected by tegilla		
periphery with 2 keels		
umbilical sutures depressed, radial		
primary aperture umbilical		
protected by portici		
periphery with 1 keel		
umbilical sutures raised, radial or curved		
periphery with 2 keels		
umbilical sutures raised, curved		
protected by tegilla		
periphery truncated by 2 keels		
umbilical sutures raised, curved		
periphery with inflated rugose chambers		
umbilical sutures depressed, radial		
with rugose surface		
imperforate peripheral band and weakly developed double keel		
1 keel on the last whorl, 2 keels weakly visible in section on the previous whorl		
with costellae arranged in meridional pattern		
globulose periphery		
imperforate peripheral band and well developed double keel		
		<i>Hedbergella</i> <i>Praeglobotruncana</i> p.p. <i>Falsotruncana</i> <i>Ticinella</i> <i>Biticinella</i> <i>Rotalipora</i> <i>Whiteinella</i> <i>Helvetoglobotruncana</i> <i>Praeglobotruncana</i> p.p. <i>Dicarinella</i> <i>Marginotruncana</i> <i>Globotruncanella</i> <i>Abathomphalus</i> <i>Globotruncanita</i> <i>Rosita</i> <i>Globotruncana</i> <i>Archaeoglobigerina</i> <i>Gansserina</i> <i>Rugoglobigerina</i> <i>Rugotruncana</i>



KEY TO CRETACEOUS PLANKTIC TROCHOSPIRAL GENERA

1. Test calcitic, radial-hyaline, lamellar, perforate

2. Chamber architecture

3. Primary aperture

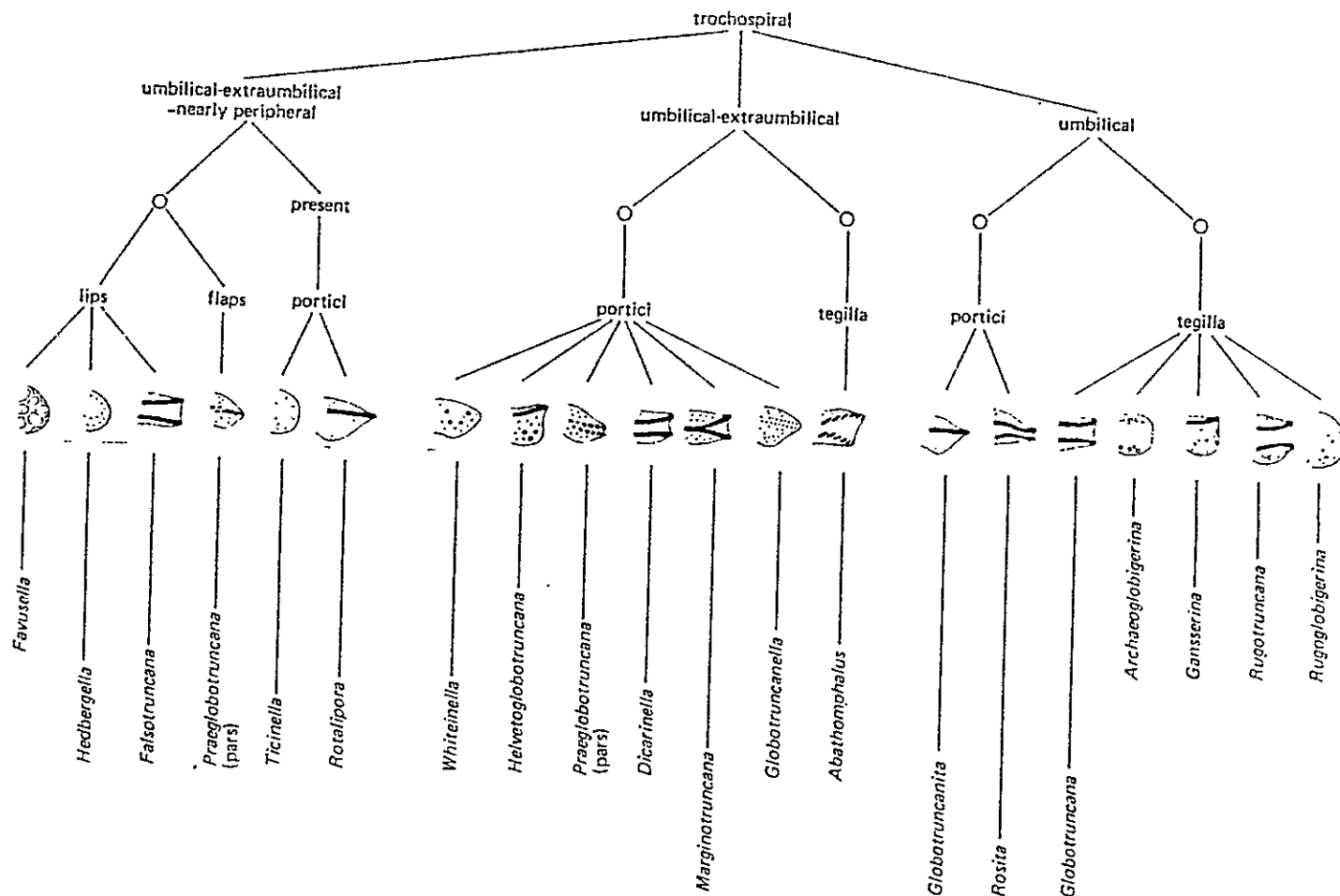
4. Supplementary apertures on umbilical side

5. Protection of primary aperture and umbilicus

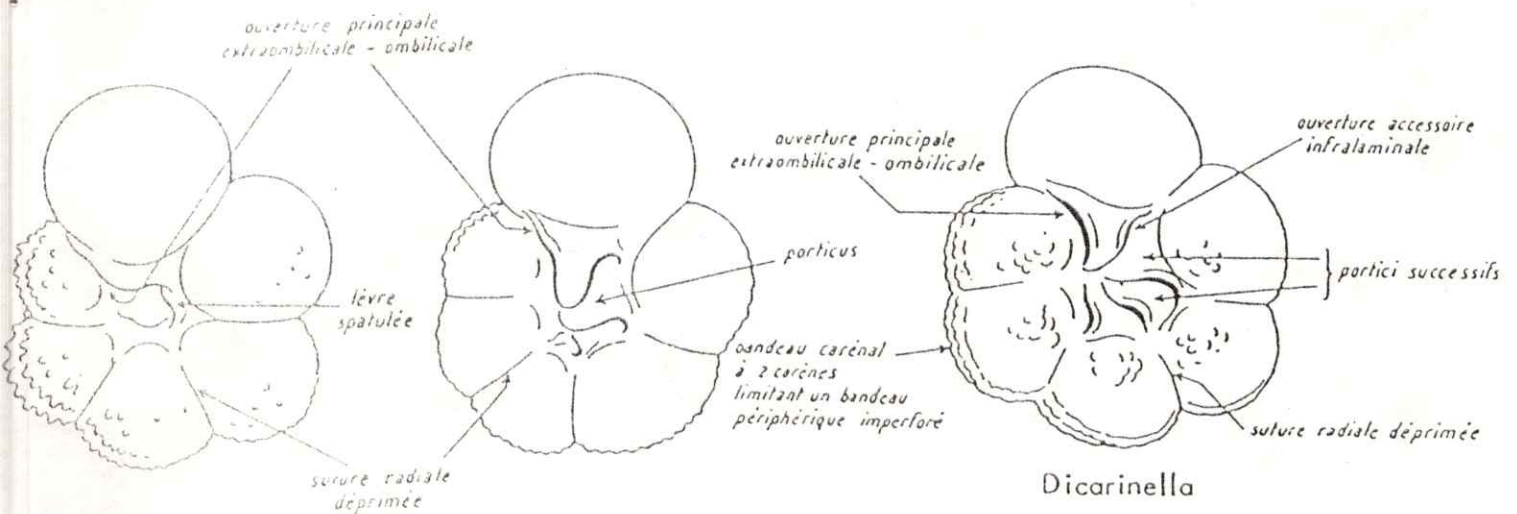
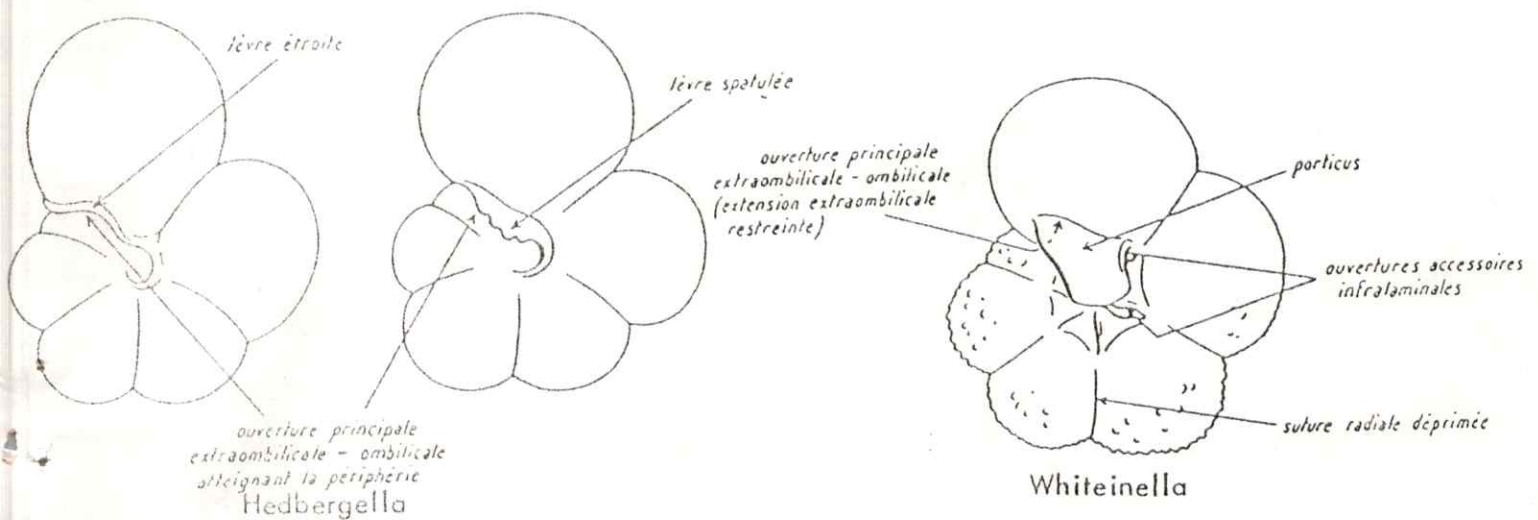
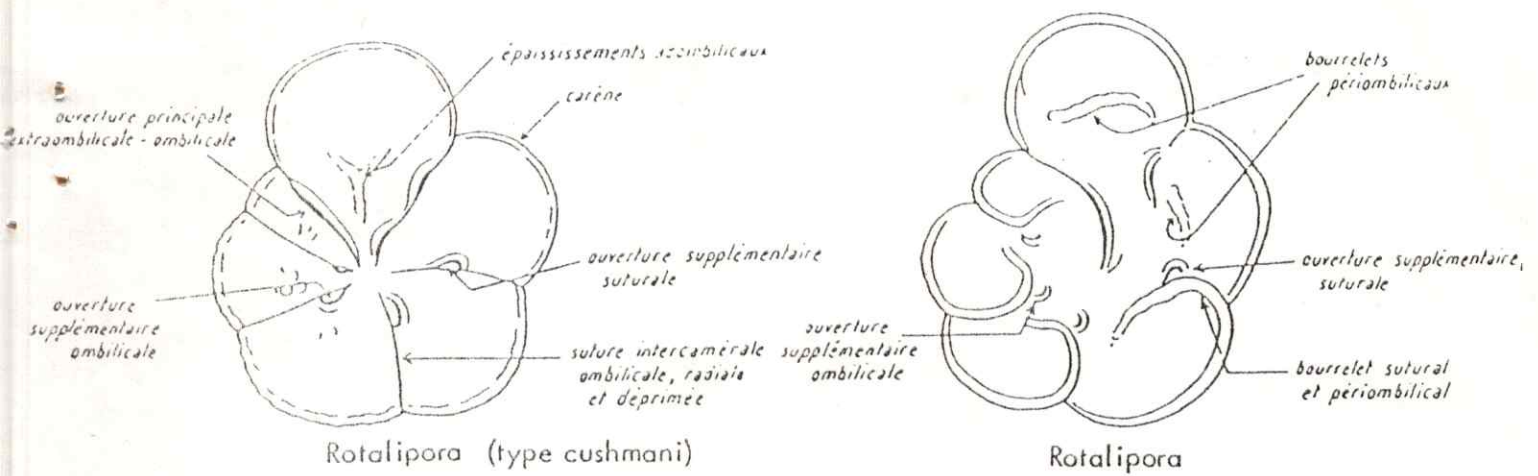
6. Keels (0, 1, 2) or imperforate band

7. Heavy ornamentation (reticulate, rugose or costellate)

8. Umbilical sutures
depressed
raised



Distinctive features of some Cretaceous planktic foraminiferal genera

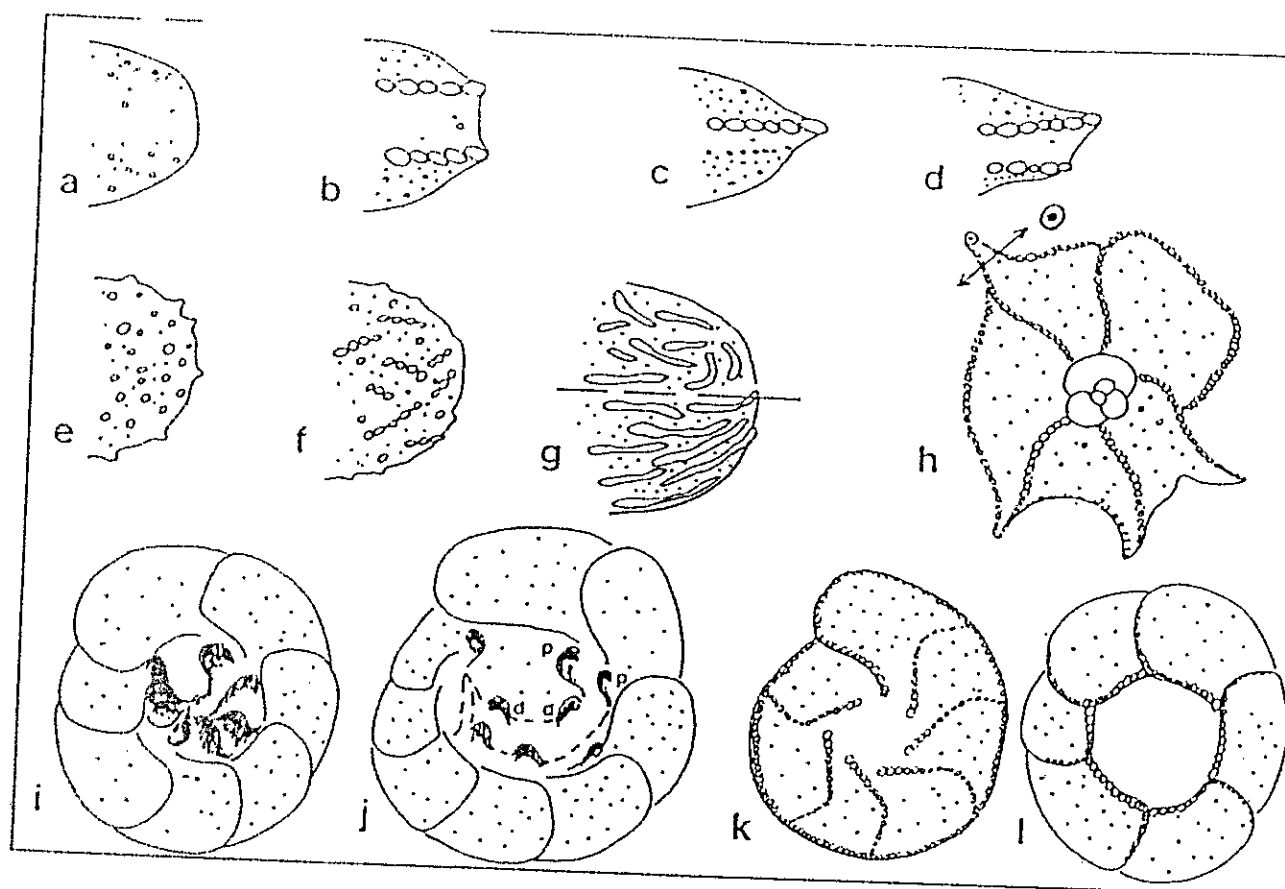


Forme primitive *Præglotunculus* Forme évoluée



genera		HEDB.	WHIT.	ARCH.	RUGG. PLUM.	G'LLA	ABAT.	GANS.	DICA.	MARG.	GLOBOTRUNCANA			ROS.	G'ITA.
characters											arca- mar. gr.	linn gr.	aeg.		
Trochospire	always high														
	high to low	●	●		●	●			●	●	●	●		●	●
	always low			●			●	●					●		
Primary aperture	umbilical			●	●	●		●			●	●	●	●	●
	extra umbilical-umb.	●	●			●	●		●	●					○
Umbilicus	always small ($\approx 1/4d$)	●		●		●	●								
	others		●		●			●	●	●	○		●		
	always large ($\approx 1/3-1/2d$)										●	●		●	●
Umbilical system	lips	●													
	portici		●			●	●	●	●	●				●	●
	tegilla			●	●		○	○			●	●	●		
Lateral view	2 keels (or 2-1)			○			●	●	●	●	●	●	●	●	
	1 keel (= lined by some pustules)					●		●		●	●				●
	imperforate per. band and rounded		○	●	○	●									
	rounded	●	●	●	●	●									
Chambers surface	costellae in a merid. patt.				●	○	●								
	others	●	●	●		●	○	●	●	●	●	●	●	●	●
Sutures umbilical side	always depressed	●	●	●	●	●	●	●	●				●		
	others									●	●	●		●	●
Sutures spiral side	always depressed	●	●	●	●	●									
	others					○	●	●	●	●	●	●	●	●	●
Adumbilical ridges	always absent	●	●	●	●	●	●	●							
	others								●	●	●	●	●	●	●
Periphery	subcircular							●		●	●	●		●	●
	lobate	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	polygonal										●				●
	strongly lobate				○						●			●	●
	tubulospines				○										●
Test always undulated														●	

○ sometimes ● yes



Text-fig. 2 — Illustration of morphological characters defined in chapter IV :

a : imperforate peripheral band — b : keel band : two keels lining an imperforate peripheral band — c : keel band with a less developed umbilical keel, reduced to a row of sparse pustules — d : keel band tilted towards the umbilical side — e : scattered pustules — f : rugosities — g : costellae; above : not arranged in a meridional pattern; below : arranged in a meridional pattern — h : tubulospines, section showing hollow spine-like extension of the penultimate chamber — i : portici partly merging in the umbilicus — j : tegilla merging in the umbilical area, leaving proximal accessory apertures (p) = "infralaminar accessory apertures" *auct.*, and distal accessory apertures (d) = "intralaminar accessory apertures" *auct.* — k : adumbilical ridges bordering the umbilical part of chambers, here not in continuity due to their oblique arrangement — l : tangential adumbilical ridges, here in continuity and forming a "peri-umbilical ridge" *auct.* pattern.

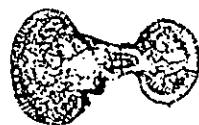
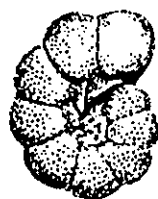
IV. DESCRIPTIVE TERMINOLOGY, GLOSSARY

For the greater number of the terms used we refer to the figures given in the first part of the "Atlas of Mid Cretaceous Planktonic Foraminifera (Boreal Sea and Tethys)", Robaszynski, Caron and E.W.C.P.F. (1979). However, some modifications and additions had to be made :

- Pustule : small isometric imperforate surface elevation.
- Rugosity : several coagulated pustules.
- Costellae : thick, elongated rugosities.
- Imperforate peripheral band : generally equatorial band of the chamber surface without pores; may be bordered by keels.
- Keel : imperforate ridge in an equatorial position.
- Row of pustules : pustules lining the peripheral keel on the umbilical side.
- Keel-band : keels and imperforate peripheral band.

- Primary aperture : main opening of each chamber.
- Accessory aperture : opening the communication between the primary aperture and the exterior through a system of plates; when these are portici, accessory apertures are directed towards the earlier part of the whorl and are generally trumpet-shaped; when they are tegilla, proximal accessory apertures ("infralaminar" apertures *auct.*) open near the primary aperture and the suture, and distal accessory apertures ("intralaminar" apertures *auct.*) are formed by non-coalescing parts of successive tegilla.
- Porticus (plur. : portici) : thin imperforate extension bordering the primary aperture, generally trumpet-shaped, partly merging in the umbilicus by their distal edges.
- Tegillum (plur. : tegilla) : thin, broad, generally scarcely and finely perforate extension covering the primary aperture; successive tegilla coalesce but leave distal accessory apertures between each other.
- Tubulospine : hollow spine-shaped extension of a chamber.
- Adumbilical ridge : imperforate ridge on the umbilical part of a chamber; successive adumbilical ridges are generally not in continuity (and thus do not constitute a "peri-umbilical ridge" *auct.*); they are tangential or oblique (= secant) to the umbilicus if this latter is considered as being a circle.

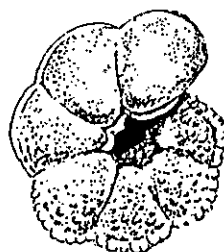
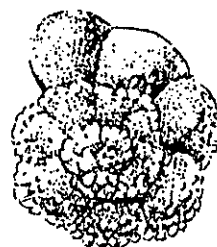
Planomalina breggiensis
x 100



Planomalina buxtorfi
x 90



Praeglobotruncana stephani
x 115



Rugoglobigerina rugosa
x 110



Trinitella scotti
x 160



TICINELLA - ROTALIPORA

Ticinella roberti
x 115

Rotalipora subticinensis
x 160

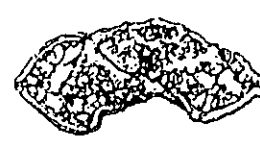
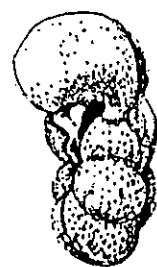
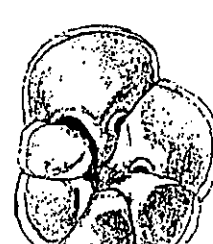
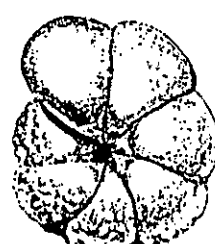
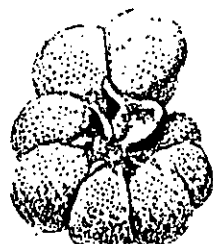
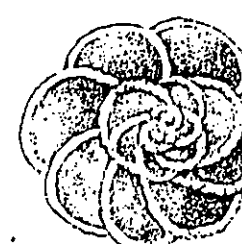
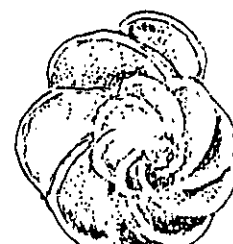
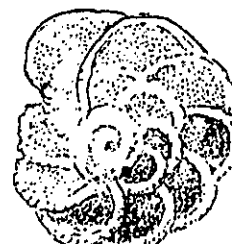
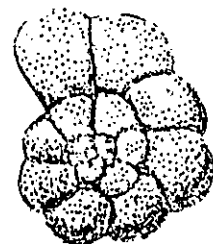
Rotalipora ticinensis
x 135

Rotalipora apenninica
x 125

Rotalipora greenhornensis
x 75

Rotalipora reicheli
x 90

Rotalipora cushmani
x 90

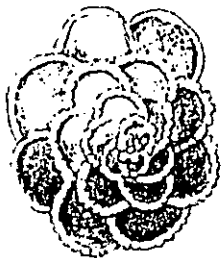


SINGLE KEELED GLOBOTRUNCANA SPECIES

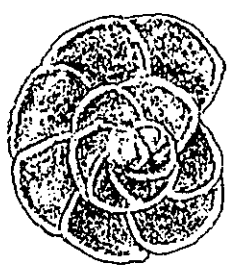
Globotruncana sigali
x 110



Globotruncana falsostuarti
x 80



Globotruncana stuarti
x 65



Globotruncana elevata
x 65



Globotruncana calcarata
x 85



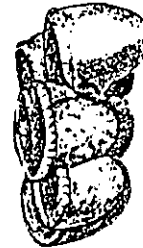
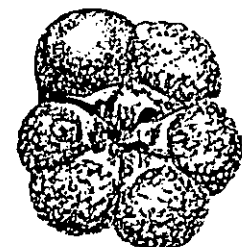
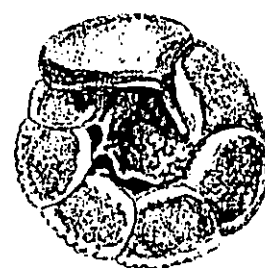
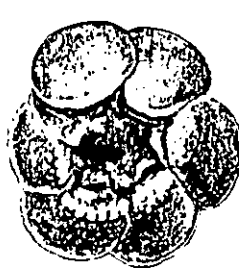
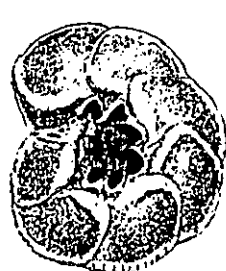
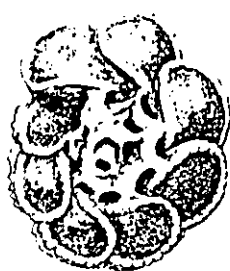
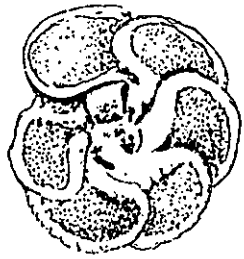
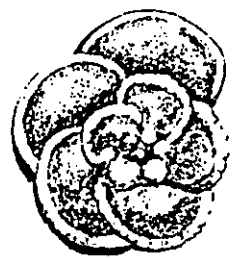
Globotruncana conica
x 95



Globotruncana helvetica
x 90



Globotruncana gansseri
x 120



DOUBLE KEELED GLOBOTRUNCANA SPECIES

Globotruncana bulloides
x 105

Globotruncana angusticarinata
x 100

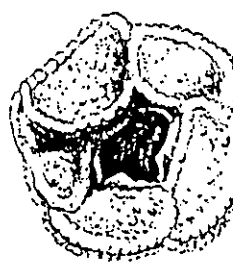
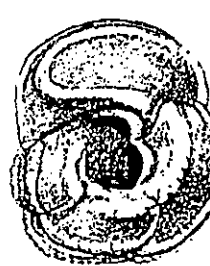
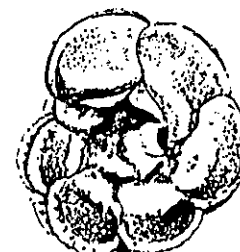
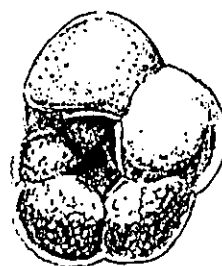
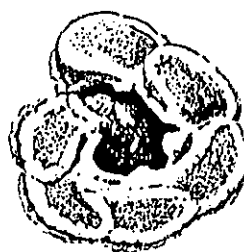
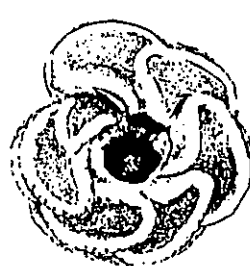
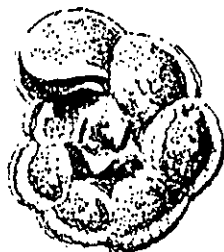
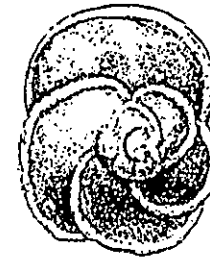
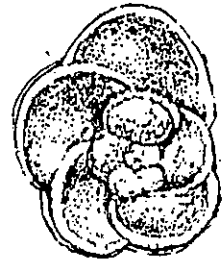
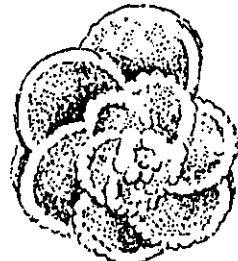
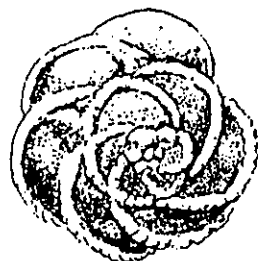
Globotruncana lapparenti
x 120

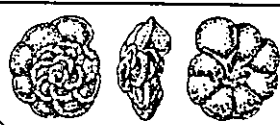
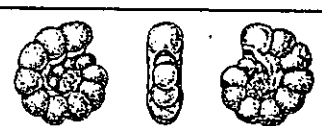
Globotruncana concavata
x 95

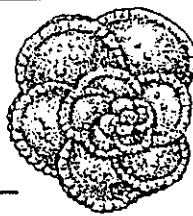
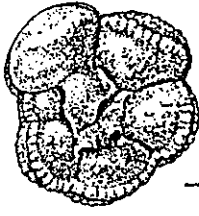
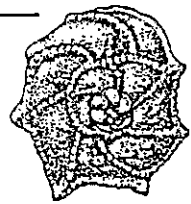
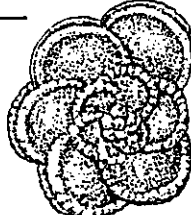
Globotruncana ventricosa
x 95

Globotruncana formicata
x 120

Globotruncana contusa
x 70



STAGE	M. Y.	ZONE	"H." hoterivica	H. sigali	G. blowi	S. cabri	G. des algeriana	H. gorbachikae	T. bejaouensis	T. primula	B. breggiensis	R. subticinensis	T. ticinensis	R. appenninica	ZONAL MARKER SPECIES
ALBIAN	108	<i>Rotalipora appenninica</i>													
		<i>Rotalipora ticinensis</i>													
		<i>Rotalipora subticinensis</i>													
		<i>Biticinella breggiensis</i>													
		<i>Ticinella primula</i>													
		<i>Ticinella bejaouensis</i>													
APTIAN	100	<i>Hedbergella gorbachikae</i>													
		<i>Globigerinelloides algeriana</i>													
		<i>Schakoina cabri</i>													
		<i>Globigerinelloides blowi</i>													
		<i>Hedbergella sigali</i>													
HAUTE-RIVIAN	121	"Hedbergella" hoterivica													

STAGE	M. Y.	ZONE	<i>D. concavata</i>	<i>D. asymetrica</i>	<i>G. elevata</i>	<i>G. ventricosa</i>	<i>G. calcarata</i>	<i>G. havanensis</i>	<i>G. aegyptiaca</i>	<i>R. gansseri</i>	<i>A. mayaroensis</i>	ZONAL MARKER SPECIES			
MAASTRICHTIAN	65	<i>Abathomphalus mayaroensis</i>													
		<i>Rugotruncana gansseri</i>													
		<i>Globotruncana aegyptiaca</i>													
		<i>Globotruncanella havanensis</i>													
CAMPANIAN	70	<i>Globotruncanella calcarata</i>													
		<i>Globotruncana ventricosa</i>													
		<i>Globotruncanella elevata</i>													
SANTONIAN	78	<i>Dicarinella asymetrica</i>													

[illegible]

Stage	Planktic Foraminiferal Zones	
		<i>Globuligerina hoterivica</i> <i>Hedbergella sigali</i> <i>Globigerinelloides blowi</i> <i>Hedbergella bizonae</i> <i>Hedbergella planispira</i> <i>Schackoina cabri</i> <i>Hedbergella maslakovae</i> <i>Globigerinelloides terreolensis</i> <i>Hedbergella delrioensis</i> <i>Globigerinelloides algeriana</i> <i>Hedbergella trochidea</i> <i>Planomalina chenourensis</i> <i>Hedbergella gorbachikae</i> <i>Ticinella bejaouensis</i> <i>Ticinella roberti</i> <i>Ticinella primula</i> <i>Globigerinelloides bentonensis</i> <i>Favusella washitensis</i> <i>Ticinella praetienensis</i> <i>Blitkinella breggiensis</i> <i>Ticinella raynaudi</i> <i>Rotalipora subticinensis</i> <i>Rotalipora ticinensis</i> <i>Ticinella madecassiana</i> <i>Planomalina buxtorfi</i> <i>Praeglobotruncana delrioensis</i> <i>Heterohelix moremani</i> <i>Globigerinelloides ultramira</i> <i>Rotalipora appenninica</i> <i>Praeglobotruncana stephani</i> <i>Gumbelitra cenomana</i> <i>Rotalipora gandolfii</i> <i>Rotalipora brotzeni</i> <i>Schackoina cenomana</i> <i>Rotalipora montsalvensis</i> <i>Schackoina multispinata</i> <i>Praeglobotruncana gibba</i> <i>Rotalipora reicheli</i> <i>Rotalipora greenhornensis</i> <i>Rotalipora cushmani</i> <i>Whiteinella ballica</i> <i>Whiteinella parvubis</i> <i>Helvetoglobotr. praehelvetica</i> <i>Dicarinella algeriana</i> <i>Whiteinella canaliculata</i> <i>Dicarinella hagni</i> <i>Dicarinella imbricata</i> <i>Whiteinella inornata</i> <i>Heterohelix reussi</i> <i>Helvetoglobotr. helvetica</i> <i>Marginostruncana renzi</i> <i>Marginostruncana sigali</i> <i>Marginostruncana schneegansi</i> <i>Marginostruncana marianosi</i>
Maastrichtian	<i>A. mayaroensis</i>	
	<i>G. gansseri</i>	
	<i>G. aegyptiaca</i>	
	<i>G. havanensis</i>	
Campanian	<i>G. calcarata</i>	
	<i>G. ventricosa</i>	
	<i>G. elevata</i>	
Santonian	<i>D. asymmetrica</i>	
Coniacian	<i>D. concavata</i>	
	<i>D. primitiva</i>	
Turonian	<i>M. sigali</i>	
	<i>H. helvetica</i>	
	<i>W. archaocretacea</i>	
Cenomanian	<i>R. cushmani</i>	
	<i>R. reicheli</i>	
	<i>R. brotzeni</i>	
Albian	<i>R. appenninica</i>	
	<i>R. ticinensis</i>	
	<i>R. subticinensis</i>	
	<i>B. breggiensis</i>	
	<i>T. primula</i>	
Aptian	<i>T. bejaouensis</i>	
	<i>H. gorbachikae</i>	
	<i>G. algeriana</i>	
	<i>S. cabri</i>	
	<i>G. blowi</i>	
Barremian	<i>H. sigali</i>	
Hauterivian	<i>G. hoterivica</i>	

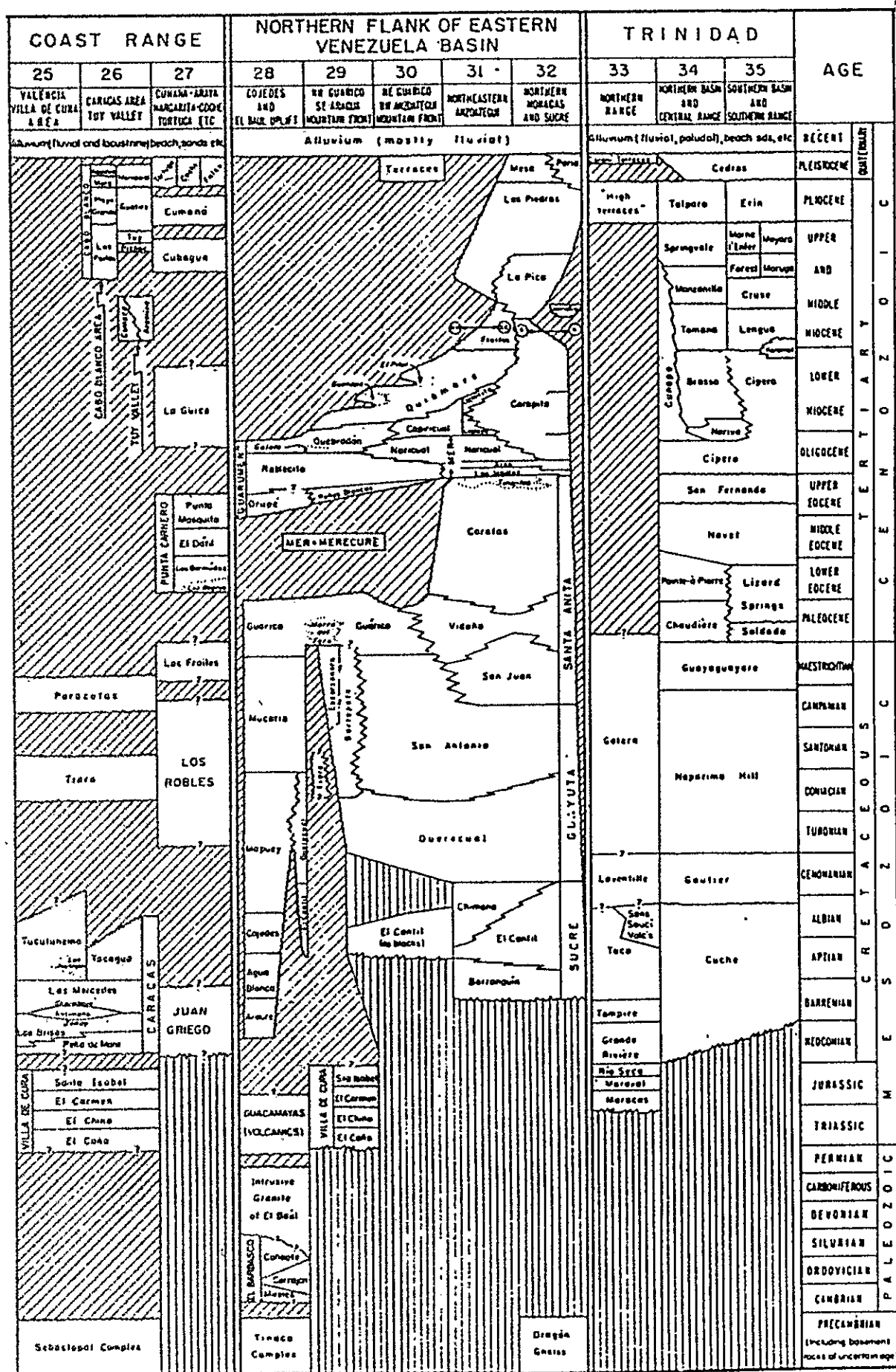
Stage	Planktic Foraminiferal Zones	
	<i>Whiteinella inornata</i>	
	<i>Margino truncana sinuosa</i>	
	<i>Hedbergella flandriani</i>	
	<i>Dicarinella canaliculata</i>	
	<i>Margino truncana sigali</i>	
	<i>Hedbergella delrioensis</i>	
	<i>Whiteinella baltica</i>	
	<i>Margino truncana renzi</i>	
	<i>Dicarinella primitiva</i>	
	<i>Dicarinella imbricata</i>	
	<i>Whiteinella archaeocretacea</i>	
	<i>Whiteinella parvula</i>	
	<i>Falsotruncana maslakovae</i>	
	<i>Hedbergella simplex</i>	
	<i>Hedbergella planispira</i>	
	<i>Dicarinella hagni</i>	
	<i>Margino truncana marianosi</i>	
	<i>Helvetoglobobulites helvetica</i>	
	<i>Dicarinella algeriana</i>	
	<i>Praeglobobulites gibba</i>	
	<i>Heterohelix moremani</i>	
	<i>Helvetoglobobulites praehelvetica</i>	
	<i>Praeglobobulites stephani</i>	
	<i>Gumbellitina cenomana</i>	
	<i>Rotalipora cushmani</i>	
	<i>Rotalipora greenhornensis</i>	
	<i>Schackoina cenomana</i>	
	<i>Rotalipora brotzeni</i>	
	<i>Rotalipora appenninica</i>	
	<i>Praeglobobulites delioensis</i>	
	<i>Rotalipora montalvensis</i>	
	<i>Rotalipora reicheli</i>	
	<i>Favosites washtensis</i>	
	<i>Rotalipora gandolfii</i>	
	<i>Ticinella madecassiana</i>	
	<i>Planomalina buxtorfi</i>	
	<i>Globigerinelloides bentonensis</i>	
	<i>Rotalipora ticinensis</i>	
	<i>Ticinella roberti</i>	
	<i>Biticinella breggiensis</i>	
	<i>Ticinella raynaudi</i>	
	<i>Ticinella primula</i>	
	<i>Rotalipora subticinensis</i>	
	<i>Ticinella praeticinensis</i>	
	<i>Hedbergella gorbachikae</i>	
	<i>Ticinella bejaouensis</i>	
	<i>Hedbergella trocoides</i>	
	<i>Planomalina cheniouensis</i>	
	<i>Globigerinelloides ferreolensis</i>	
	<i>Hedbergella maslakovae</i>	
	<i>Hedbergella bizoneae</i>	
	<i>Globigerinelloides algeriana</i>	
	<i>Globigerinelloides blowi</i>	
	<i>Schackoina cabri</i>	
	<i>Hedbergella sigali</i>	
	<i>Globuligerina hoterivica</i>	
Maastrichtian	<i>A. mayaroensis</i>	
	<i>G. gansseri</i>	
	<i>G. aegyptiaca</i>	
	<i>G. havanensis</i>	
Campanian	<i>G. calcarata</i>	
	<i>G. ventricosa</i>	
	<i>G. elevata</i>	
Santonian	<i>D. asymetrica</i>	
Coniacian	<i>D. concavata</i>	
	<i>D. primitiva</i>	
Turonian	<i>M. sigali</i>	
	<i>H. helvetica</i>	
	<i>W. archaeocretacea</i>	
Cenomanian	<i>R. cushmani</i>	
	<i>R. reicheli</i>	
	<i>R. brotzeni</i>	
Albian	<i>R. appenninica</i>	
	<i>R. ticinensis</i>	
	<i>R. subticinensis</i>	
	<i>B. breggiensis</i>	
	<i>T. primula</i>	
	<i>T. bejaouensis</i>	
Aptian	<i>H. gorbachikae</i>	
	<i>G. algeriana</i>	
	<i>S. cabri</i>	
	<i>G. blowi</i>	
Barremian	<i>H. sigali</i>	
Hauteriviage.	<i>G. hoterivica</i>	

STAGE m. y.	CARON this chapter	WONDERS 1980	VAN HINTE 1976	SIGAL 1976	POSTUMA 1971	PESSAGNO 1967	BOLLI 1966
65	mayaroensis	mayaroensis	mayaroensis	mayaroensis	mayaroensis	mayaroensis	mayaroensis
MAASTRICHTIAN	gansseri	contusa	contusa	gansseri	gansseri	contusa	gansseri
		gansseri	stuarti				
			gansseri				
	aegyptiaca	"tricarinata"	scutilla	stuarti + falsostuarti	stuartiformis	subcircumnodifer	lapp. tricar.
	havanensis						
70	calcarata	calcarata	calcarata	calcarata	calcarata	calcarata	calcarata
CAMPANIAN	ventricosa	ventricosa	subspinosa	elevata + stuartiformis	elevata	elevata	stuarti s. l.
	elevata	elevata	stuartiformis			A. blowi	
78	asymetrica	carinata	elevata	concevata + carinata	carinata	fornicata	fornicata
SANTONIAN		concevata	+ concevata		concevata	concevata	concevata
82	concevata	primitiva	concevata + sigali	concevata	schneegansi		schneegansi
CONIACIAN	primitiva		sigali + renzi	sigali + schneegansi			
	M. sigali						
TURONIAN	helvetica	helvetica	helvetica	helvetica	helvetica	helv. archaeocretacea sigali	helvetica
	archaeocretacea	archaeocretacea	lehmanni	cushmani			gigantea
92	cushmani	cushmani	cushmani	cushmani	cushmani	cushmani + greenhornensis	cushmani
CENOMANIAN	reicheli	globotruncanoides	reicheli + gandolfii	globotruncanoides + brotzeni	greenhornensis	evoluta	reicheli
	brotzeni	appenninica s. l.	gandolfii + greenhornensis		appenninica		brotzeni
100		appenninica + buxtorfi	appenninica + buxtorfi	appenninica + buxtorfi	buxtorfi		
ALBIAN	appenninica	ticinensis + buxtorfi	ticinensis + buxtorfi	breggiensis	breggiensis		appenninica
	ticinensis	prae-buxtorfi					ticinensis
	subticinensis	subticinensis		primula + bejaouensis	subticinensis		
	breggiensis		breggiensis	bejaouensis	roberti		roberti
	primula			ferreolensis + bejaouensis			
108	bejaouensis		ferreolensis	bejaouensis			
APTIAN	gorbachikae		ferreolensis	trochoidea			
	algeriana		algeriana	algeriana			
	cabri		cabri	ferreolensis cabri			
	blowi		G. blowi	blowi/ maridalensis			
				gottisi/ duboisii			
115	H. sigali		sigali	similis			
BARREMIAN				sigali			
121	hoterivica		hoterivica	gr. haterivica			
HAUTERIVIAN	minute planktic foraminifera						

STAGE m. y.	PACIFIC REALM					ATLANTIC REALM			TETHYAN (s.s.) REALM		
	Japan area	W. Pacific	E. Pacific			Gulf	Caribbean	E. Atlantic	W. Tethys Alpine area	Central Tethys	E. Tethys
65		<i>mayaroensis</i>				<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>
MAASTRICHTIAN		<i>gansseri</i>				<i>gansseri</i>	<i>contusa</i>	<i>caliciformis</i> + <i>citae</i>	<i>gansseri</i>	<i>gansseri</i>	<i>stuarti</i>
		<i>subcircumnodifer</i>	<i>rugosa</i>	<i>havanensis</i>	<i>contusa</i>	<i>subcircumnodifer</i>	<i>lap. tricarinata</i>		<i>subcircumnodifer</i>	<i>stuarti</i> + <i>falsostuarti</i>	
		<i>calcarata</i>	<i>marisi</i>	<i>churchi</i>	<i>calcarata</i>	<i>calcarata</i>			<i>calcarata</i>	<i>calcarata</i>	
70		<i>stuartiformis</i> + <i>elevata</i>	<i>rosetta</i>			<i>elevata</i>			<i>ventricosa</i>	<i>elevata</i> + <i>stuartiformis</i>	<i>morozovae</i>
CAMPANIAN	<i>japonica</i> <i>robusta</i>		<i>stuartiformis</i> + <i>elevata</i>			<i>blowi</i>	<i>elevata</i>	<i>stuartiformis</i>	<i>elevata</i>		<i>elevata</i>
78		<i>carinata</i>	<i>coronata</i> + <i>linneiana</i>			<i>fornicata</i>	<i>conc. carinata</i>	<i>conc. carinata</i>	<i>carinata</i>	<i>concovata</i> <i>carinata</i>	<i>fornicata</i>
SANTONIAN	<i>hantzavae</i>	<i>concovata</i>				<i>concovata</i>	<i>concovata</i>	<i>concovata</i>	<i>carinata</i>		<i>concovata</i>
82		<i>primitiva</i>	<i>cachensis</i>				<i>concovata</i> <i>concovata</i>	<i>primitiva</i>	<i>concovata</i>	<i>concovata</i>	<i>primitiva</i>
CONIACIAN	<i>japonica</i>	<i>renzi</i>					<i>schneegansi</i>	<i>schneegansi</i>	<i>schneegansi</i>		<i>angusticarinata</i>
86		<i>helvetica</i>	<i>helvetica</i>			<i>archaeocretacea</i> <i>sigali</i>		<i>sigali</i>	<i>schneegansi</i>	<i>sigali</i>	<i>lapparenti</i>
TURONIAN	<i>rugosa</i>							<i>helvetica</i>	<i>helvetica</i>	<i>helvetica</i>	<i>helvetica</i>
92			<i>cushmani</i>					"grandes globigerines"	<i>archaeocretacea</i>	<i>aumalensis</i> / <i>paradubia</i>	
CENOMANIAN			<i>stephani</i>					<i>cushmani</i> + <i>greenhornensis</i>	<i>cushmani</i>	<i>cushmani</i>	<i>cushmani</i>
		<i>greenhornensis</i> <i>gandolfii</i> <i>brotzeni</i>	<i>greenhornensis</i>					<i>appenninica</i>	<i>reicheli</i>		<i>deekei</i>
			<i>appenninica</i>					<i>globotruncanoides</i> + <i>brotzeni</i>	<i>montsalvensis</i>	<i>globotruncanoides</i> + <i>brotzeni</i>	
100		<i>evoluta</i> + <i>appenninica</i>				<i>evoluta</i>	<i>washitensis</i>		<i>brotzeni</i>		<i>appenninica</i>
ALBIAN		<i>appenninica</i> + <i>buxtorfi</i>	<i>buxtorfi</i>			<i>ticinensis</i>	<i>ticinensis</i>	<i>appenninica</i> + <i>buxtorfi</i>	<i>appenninica</i> <i>buxtorfi</i>	<i>appenninica</i> + <i>buxtorfi</i>	<i>ticinensis</i>
	<i>breggiensis</i>	<i>breggiensis</i>	<i>ticinensis</i>			<i>breggiensis</i>		<i>ticinensis</i>	<i>ticinensis</i>		<i>infracretacea</i>
			<i>breggiensis</i>			<i>primula</i>	<i>rohri</i>	<i>subticinensis</i>	<i>breggiensis</i>		
		<i>roberti</i>	<i>roberti</i>			<i>bejaouensis</i>		<i>breggiensis</i>	<i>praeticinensis</i>	<i>breggiensis</i>	
108		<i>primula</i>						<i>primula</i>	<i>rischi</i>	<i>rischi</i> + <i>primula</i>	<i>planispira</i>
APTIAN		<i>gorbachikae</i> <i>chenioureensis</i> <i>algerianus</i> <i>ferreolensis</i> <i>aptica</i> <i>gottisi</i> <i>sigali</i>	<i>pacifica</i>			<i>trocoidea</i>	<i>barri</i>	<i>bejaouensis</i>	<i>bejaouensis</i>	<i>bejaouensis</i>	<i>roberti</i> + <i>cheniouri</i> <i>chenioureensis</i>
			<i>ferreolensis</i>			<i>algerianus</i>		<i>chenioureensis</i>	<i>trocoidea</i>	<i>trocoidea</i>	<i>trocoidea</i>
						<i>ferreolensis</i>			<i>algeriana</i>	<i>algeriana</i>	<i>algeriana</i>
			<i>blowi</i>			<i>cabri</i>	<i>protuberans</i>	<i>ferreolensis</i>	<i>ferreolensis</i>	<i>ferreolensis</i>	<i>protuberans</i>
			<i>sigali</i>			<i>cabri</i>		<i>cabri</i>	<i>cabri</i>	<i>cabri</i>	<i>cabri</i>
						<i>maridalensis</i> <i>gottisi</i>		<i>blowi</i> + <i>gottisi</i>	<i>blowi</i>	<i>maridal. + blowi</i> <i>gottisi</i> + <i>dubois</i>	<i>blowi</i> + <i>subcretacea</i> <i>aptica</i>
115								<i>aplica</i> + <i>similis</i> <i>tuschepsensis</i>	<i>sigali</i>	<i>similis</i>	<i>tuschepsensis</i>
BARREMIAN								<i>sigali</i>			
121										<i>sigali</i>	<i>sigali</i>
HAUTERIVIAN										<i>hauterivica</i>	

STAGE m. y.	BOREAL 40°N	TEMPERATE 20-25°N	TROPICAL 20-25°S	TEMPERATE 40°S	AUSTRAL
MAASTRICHTIAN	<i>contusa</i> + <i>arca</i>	<i>mayaroensis</i> <i>contusa</i> <i>gansseri</i> <i>arca</i>	<i>mayaroensis</i> <i>gansseri</i> <i>aegyptiaca</i> <i>havanensis</i>	<i>mayaroensis</i> <i>gansseri</i> / <i>contusa</i> <i>tricarinata</i> / <i>havanensis</i>	<i>arca</i> <i>havanensis</i>
CAMPANIAN	<i>RUGOGLOBIGERINA</i>	<i>ventricosa</i>	<i>calcarata</i> <i>ventricosa</i>	<i>calcarata</i> <i>elevata</i>	<i>HEDBERGELLA</i> <i>HETEROHHELIX</i>
SANTONIAN	<i>ARCHAEGLOBIGERINA</i> + <i>GLOBIGERINELLOIDES</i> + <i>Margino truncana</i> + <i>marginata</i>	<i>cretacea</i> <i>concavata</i> <i>carinata</i>	<i>elevata</i> <i>asymetrica</i>	<i>carinata</i>	<i>HEDBERGELLA</i> <i>WHITEINELLA</i>
CONIACIAN		<i>concavata</i>	<i>concavata</i>	<i>concavata</i>	
TURONIAN		<i>primitiva</i> <i>coronata</i> <i>helvetica</i> <i>archeocretacea</i>	<i>primitiva</i> <i>sigali</i> <i>helvetica</i> <i>archeocretacea</i>	<i>primitiva</i> <i>sigali</i> <i>helvetica</i>	
CENOMANIAN	<i>WHITEINELLA</i>	<i>cushmani</i> <i>reicheli</i> <i>montsalvensis</i>	<i>cushmani</i> <i>reicheli</i>	<i>cushmani</i>	<i>reicheli</i>
ALBIAN	<i>appenninica</i> + <i>gandolfii</i> <i>GLOBIGERI -</i> <i>NELLOIDES</i>	<i>appenninica</i> <i>praeticinensis</i> <i>primula</i>	<i>brotzeni</i> <i>appenninica</i> <i>ticinensis</i> <i>praeticinensis</i> <i>breggiensis</i> <i>primula</i> <i>bejaouensis</i> <i>gorbachikae</i> <i>algeriana</i> <i>cabri</i> <i>blowi</i> <i>sigali</i> <i>hoterivica</i>	<i>buxtorfi</i> <i>GLOBIGERINELLOIDES</i> <i>breggiensis</i> <i>primula</i> <i>bejaouensis</i> <i>gorbachikae</i>	<i>HEDBERGELLA</i>
APTIAN	<i>HEDBERGELLA</i>				
BARREMIAN		?	<i>sigali</i>		
HAUTERIVIAN		<i>hoterivica</i>	<i>hoterivica</i>		

STAGE m. y.	MACROFOSSIL ZONES	PLANKTIC FORAMINIFERAL ZONES	BOUNDARY MARKERS (SPECIES)	DATUM MARKERS (GENERA)
65			L Globotruncanidae	
MAASTRICHTIAN	<i>Pachydiscus neubergicus</i>	<i>Abathomphalus mayaroensis</i>	F mayaroensis	F Abathomphalus
	<i>Hoplites constrictus</i>	<i>Gansserina gansseri</i>	F gansseri	
	<i>Acanthoscaphites tridens</i>	<i>Globotruncana aegyptiaca</i>	F aegyptiaca	
70		<i>Globotruncanella havanensis</i>		
	<i>Bostrychoceras polyplacum</i>	<i>Globotruncanella calcarata</i>	F calcarata	L calcarata
	<i>Hoplitoplacenticeras vari</i>	<i>Globotruncana ventricosa</i>	F ventricosa	F Rugotruncana
78	<i>Diplacnoceras bidorsatum</i>	<i>Globotruncanella elevata</i>	F elevata	F Rugoglobigerina L Dicarinella
	<i>Placenticeras syrtale</i>	<i>Dicarinella asymetrica</i>	F asymetrica	F Globotruncanella L Marginotruncana
82	<i>Texanites texanus</i>			F Globotruncana
CONIACIAN	<i>Parabovahites emscheri</i>	<i>Dicarinella concavata</i>	F concavata	
	<i>Barroisiceras haberfellneri</i>	<i>Dicarinella primitiva</i>	F primitiva	
86				F Archaeoglobigerina
	<i>Romaniceras deverianum</i>	<i>Marginotruncana sigali</i>		L helvetica L Praeglobotruncana
	<i>Collignoniceras woollgari</i>	<i>Helvetoglobotr. helvetica</i>	F helvetica	F Marginotruncana
92	<i>Mammites nodosoides</i>	<i>Whiteinella archaeocretacea</i>	F archaeocretacea	L cushmani L Rotalipora
	<i>Metoicoceras geslinianum</i>			
	<i>Calycoceras naviculare</i>	<i>Rotalipora cushmani</i>		F Dicarinella
CENOMANIAN	<i>Acanthoceras rhotomagensis</i>		F cushmani	L reicheli F Whiteinella
		<i>Rotalipora reicheli</i>	F reicheli	
	<i>Mantelliceras mantelli</i>	<i>Rotalipora brotzeni</i>	F brotzeni	
100	<i>Stoliczkaia dispar</i>	<i>Rotalipora appenninica</i>	F appenninica	L Planomalina L Ticinella
	<i>Mortoniceras inflatum</i>	<i>Rotalipora ticinensis</i>	F ticinensis	F Praeglobotruncana
		<i>Rotalipora subticinensis</i>	F subticinensis	
	<i>Diploceras cristatum</i>	<i>Biticinella breggiensis</i>	F breggiensis	F Rotalipora
	<i>Hoplites dentatus</i>	<i>Ticinella primula</i>	F primula	
	<i>Douvilleiceras mammatum</i>			
	<i>Leymeriella tardifurcata</i>	<i>Ticinella bejaouensis</i>		
108	<i>Diadochoceras nodosocostatum</i>		F bejaouensis	F Ticinella
	<i>Argonauticeras depereti</i>	<i>Hedbergella gorbachikae</i>		L algeriana F Planomalina
		<i>Globigerinelloides algeriana</i>	F algeriana	L cabri
	<i>Diadochoceras preciosum</i>	<i>Schackoina cabri</i>	F cabri	
115	<i>Pseudohaploceras matheroni</i>	<i>Globigerinelloides blowi</i>	F blowi	F Globigerinelloides
	<i>Silesites seranonis</i>			
	<i>Nicklesia pulchella</i>	<i>Hedbergella sigali</i>		
121			F sigali	F Hedbergella
		<i>Globuligerina hoterivica</i>	F hoterivica	
HAUTERIVIAN		minute planktic foraminifera		

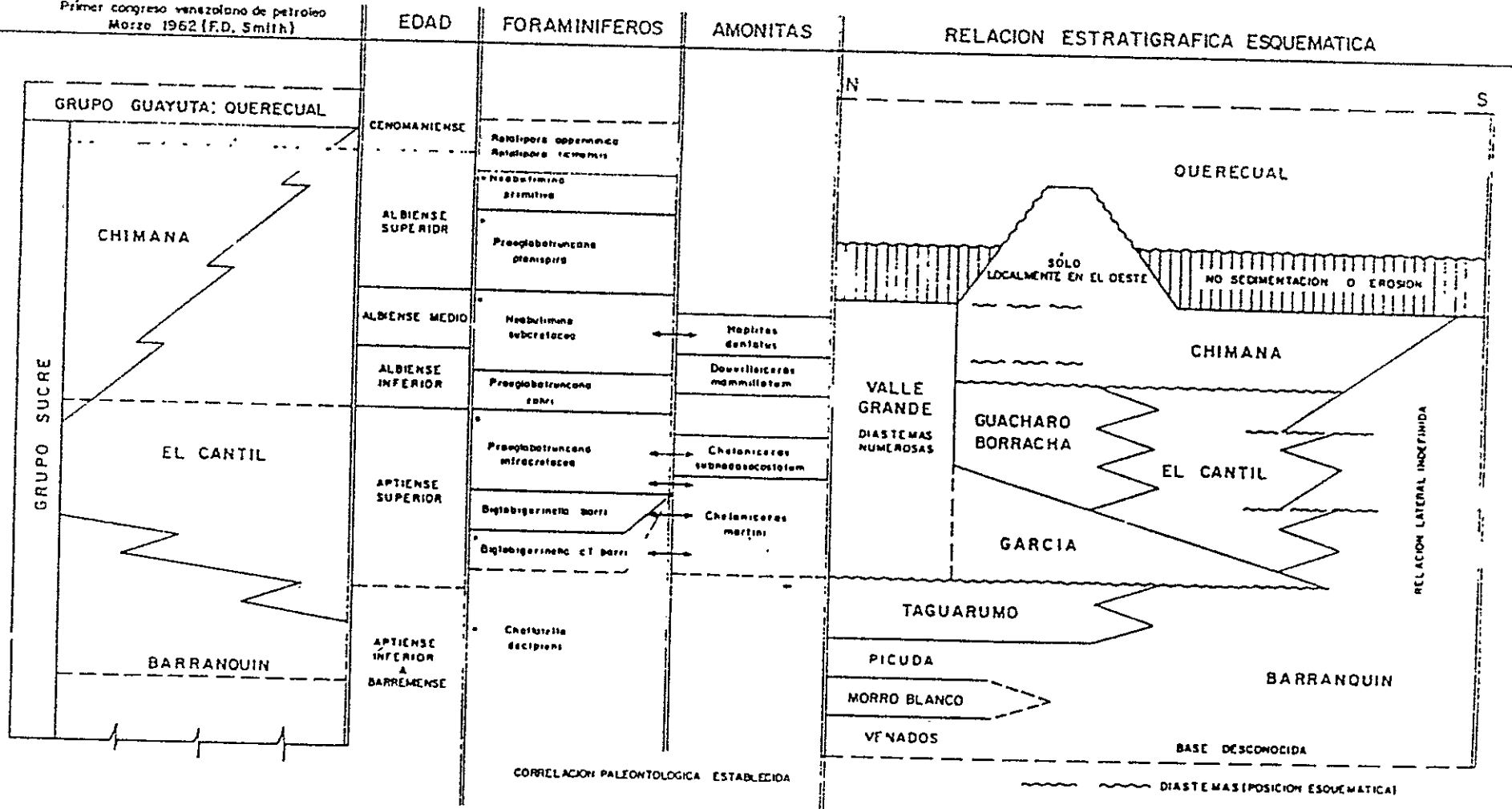


Correlation Chart of
EASTERN VENEZUELA AND TRINIDAD
(from Salvador & Stainforth, 4th Caribbean Geological Conference, 1965)

CUADRO DE CORRELACION ZONAS PALEONTOLOGICAS

RELACION ESTRATIGRAFICA
Primer congreso venezolano de petroleo
Marzo 1962 (F.D. Smith)

RELACION ESTRATIGRAFICA ESQUEMATICA



IV CONGRESO GEOLOGICO VENEZOLANO
CORRELACION ESTRATIGRAFICA

M.A. GULLAUME
FIG 1

TABLE 1 DISTRIBUTION OF PLANKTONIC FORAMINIFERA IN THE UPPER BARREMIAN TO LOWER CENOMANIAN IN EASTERN VENEZUELA SPECIES	BAR- RE- MIAN	APTIAN	U. APTIAN	APTIAN/ ALBIA N s.l.	L. ALBIA N	M. ALBIA N	U. ALBIA N		CENO- MANIA N
	CHOFFA- TELLA DECIPIENS ZONE	BIGLOBIGE- RINELLA cf. BARRI ZONE	BIGLOBIGE- RINELLA BARRI ZONE	PRAEGLOBO- TRUNCANA INFRACRETA- CEA ZONE	PRAEGLOBO- TRUNCANA ROHRI ZONE	NEOBULIMINA SUBCRETACEA ZONE	PRAEGLOBO- TRUNCANA PLANISPIRA ZONE	NEOBULIMINA PRIMITIVA ZONE	R. TICINEN- SIS/R. AP- PENINICA ZONE
Planomalina cf. escheri (KAUFMANN)									
Praeglobotruncana infracretacea (GLAESSNER)									
Biglobigerinella cf. barri BOLLI, LOEBLICH & TAPPAN									
Praeglobotruncana gautierensis (BRONNIMANN)									
Biglobigerinella barri BOLLI, LOEBLICH & TAPPAN									
Planomalina saundersi BOLLI									
Planomalina maridalsensis BOLLI									
Schackoina gandolfii REICHEL									
Globigerina kugleri BOLLI									
Hastigerinella aff. subcretacea TAPPAN									
Planomalina buxtorfi (GANDOLFI)				— cf —	— — —	— — —	— — —		
Globigerina washitensis CARSEY				— — —					
Planomalina cf. saundersi BOLLI									
Praeglobotruncana rohri BOLLI									
Praeglobotruncana cf. planispira (TAPPAN)									
Planomalina breggiensis (GANDOLFI)									
Praeglobotruncana planispira (TAPPAN)									
Schackoina sp.									
Praeglobotruncana modesta BOLLI									
Planomalina turensis (BRONNIMANN)									
Praeglobotruncana cf. gautierensis (BRONNIMANN)									
Rotalipora ticinensis (GANDOLFI)									
" appenninica s.l. (O. RENZ)									

Tentative Correlation with Stages of:		FORMATION	ZONE																																
GULF COAST	EUROPE			<i>Rotalipora hibernensis</i> [Gardale]	<i>Præglobotruncana</i> cf. <i>delioensis</i> [Plummer]	<i>Rotalipora appenninica appenninica</i> [O. Rom]	<i>Globotruncana isertata</i> , new species	<i>Globotruncana hibernica</i> Bolli	<i>Globotruncana schneeggeni</i> Sigal	<i>Globotruncana rati</i> Gardale	<i>Globotruncana leppanati</i> cf. <i>concolor</i> Bolli	<i>Globotruncana concolor</i> (Bolton)	<i>Globotruncana wilsoni</i> , new species	<i>Globotruncana lenticula</i> Plummer	<i>Globotruncana leppanati leppanati</i> Bolton	<i>Globotruncana leppanati belluodes</i> Vogler	<i>Globotruncana repanda</i> , new species	<i>Globotruncana globigibboides</i> Bolton	<i>Globotruncana conica</i> White	<i>Globotruncana ance</i> (Cushman)	<i>Globotruncana stuarti</i> (de Lapparent) group	<i>Globotruncana</i> cf. <i>conica</i> White	<i>Præglobotruncana cline</i> (Bolli)	<i>Præglobotruncana concolor</i> , new species	<i>Globotruncana rusticus</i> White	<i>Globotruncana leppanati hibernica</i> [Chenev]	<i>Globotruncana andrei</i> de Klau	<i>Globotruncana californica</i> [de Lapparent]	<i>Globotruncana goniat</i> Bolli	<i>Globotruncana concolor</i> [Cushman]	<i>Globotruncana gogobini</i> Tiler	<i>Abathomphalus intermedius</i> (Bolli)	<i>Abathomphalus mayaroensis</i> (Bolli)		
Mendes	Maestrichtian	GUAYAGUAYARE	<i>Abathomphalus mayaroensis</i>																																
			<i>Globotruncana goniat</i>																																
Havana	Campanian	NAVARINA HILL	<i>Globotruncana leppanati lenticula</i>																																
			<i>Globotruncana stuarti</i>																																
Taylor	Santonian		<i>Globotruncana lenticula</i>																																
			<i>Globotruncana concolor</i>																																
Austin	Coniacian		<i>Globotruncana rati</i>																																
			<i>Globotruncana isertata</i>																																
Eagle Ford	Turonian																																		
Washita	Mid-Lower Cenomanian	GAUTIER	<i>Rotalipora appenninica appenninica</i>																																
			<i>Globotruncana washitensis</i>																																
	7 Albian		<i>Rotalipora hibernensis</i>																																

Species distribution of *Præglobotruncana*, *Rotalipora*, *Globotruncana*, and *Abathomphalus* in Trinidad, B. W. I.

CENOMANIAN	TURONIAN- SENONIAN	MAESTRICHTIAN		PALEOCENE	Localities 1-4 Additional unspecified localities * Common - abundant • Rare
Globotruncana apenninica Zone	Globotruncana lapparenti s.l. Zone	Globotruncana gansseri Zone	Globotruncana mayaroensis Zone		
					Globigerina gautierensis
					" cretacea
					Rugoglobigerina reicheli reicheli
					" " pustulata
					" " hexacamerata
					" macrocephala macrocephala
					" " ornata
					" rugosa rugosa
					" " pennyi
					" " rotundata
					Plummerella hantkeninoides hantkeninoides
					" " costata
					" " inflata
					Globigerinella messinae messinae
					" " subcarinata
					" escheri escheri
					" " clavata
					" tururensis
					Hastigerinoides alexanderi
					" rohri
					Trinitella scotti
					Globigerina s.s.
					Rugoglobigerina s.s.
					Plummerella
					Globigerinella
					Hastigerinoides
					Trinitella

Text fig. 1. Stratigraphic distribution of Globigerinidae of the Upper Cretaceous of Trinidad.

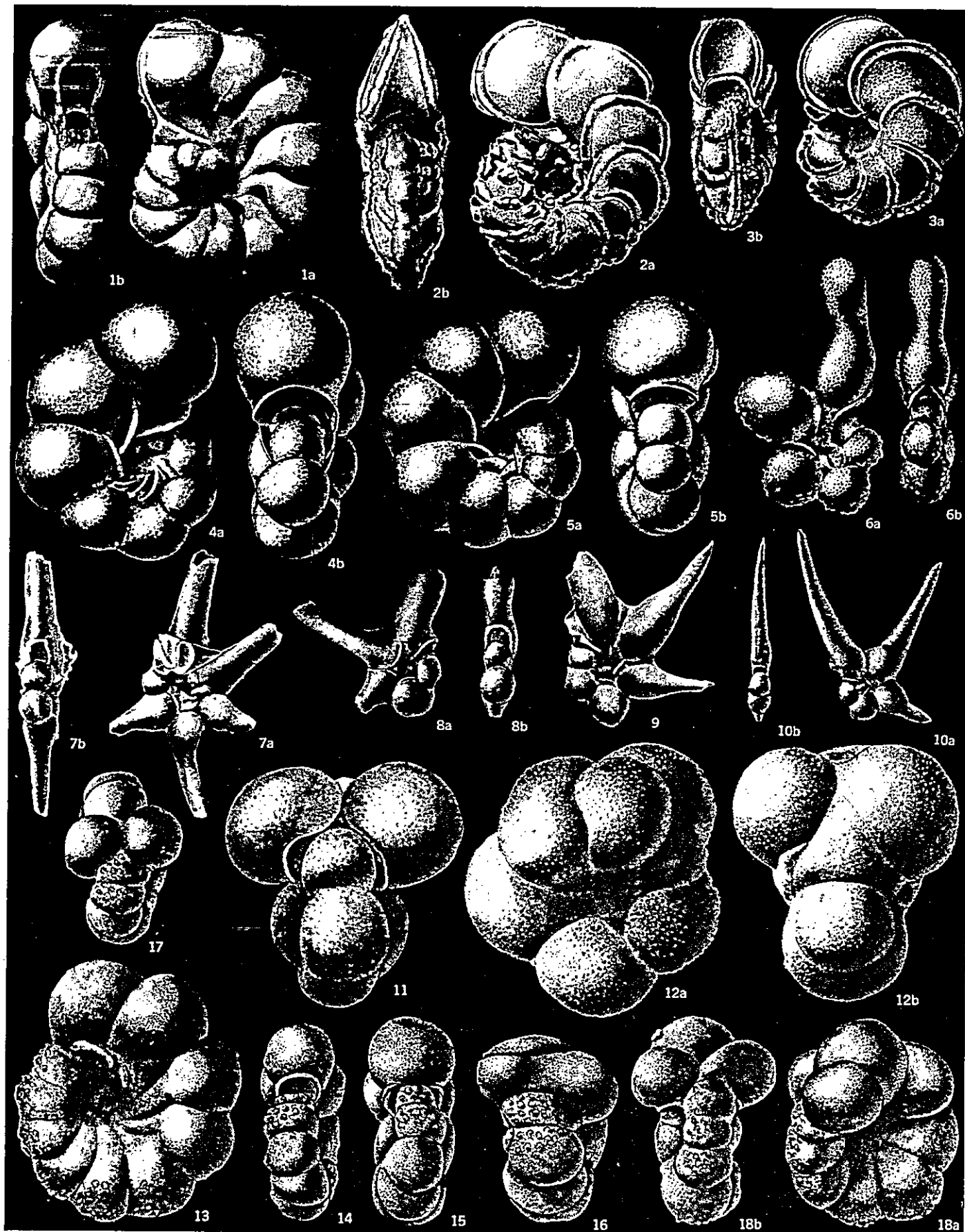
	Caron 1985 general	Premoli Sil va & Bolli, 1973 Caribbean (Leg 15)	Guillaume, Bolli & Beckmann, 1972 Eastern Venezuela	Bolli 1959 Trinidad	Bolli 1957 Trinidad	Bolli 1966 general
Maastrichtian	<i>A. mayaroensis</i>	<i>mayaroensis</i>		<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>
	<i>G. gansseri</i>	<i>confusa</i> <i>gansseri</i>		<i>gansseri</i>	<i>gansseri</i>	<i>gansseri</i>
	<i>G. zeyptilaca</i>	"tricarinata"		<i>lapparenti</i> <i>tricarinata</i>	<i>lapparenti</i> <i>tricarinata</i>	<i>lapparenti</i> <i>tricarinata</i>
	<i>G. havanensis</i>					
Campanian	<i>G. calcarata</i>	<i>calcarata</i>				<i>calcarata</i>
	<i>G. venificata</i>	<i>elevata</i>		<i>stuarti</i>	<i>stuarti</i>	<i>stuarti</i>
	<i>G. elevata</i>					
Santonian	<i>D. asymetrica</i>	<i>concavata carinata</i>		<i>fornicata</i>	<i>fornicata</i>	<i>fornicata</i>
Coniacian	<i>D. concavata</i>	<i>concavata concav.</i>		<i>concavata</i>	<i>concavata</i>	<i>concavata</i>
	<i>D. primitiva</i>	<i>schneegansi</i>		<i>renzi</i>	<i>renzi</i>	<i>schneegansi</i>
Turonian	<i>M. sigali</i>			<i>inornata</i>	<i>inornata</i>	<i>helvetica</i>
	<i>H. helvetica</i>					<i>gigantea</i>
	<i>W. archaetretacea</i>				<i>cushmani</i>	
Cenomanian	<i>R. cushmani</i>					<i>reicheli</i>
	<i>R. reicheli</i>					<i>bratzen</i>
	<i>R. bratzen</i>					
Albian	<i>R. appenninica</i>		<i>appenninica/</i> <i>ticinensis</i>	<i>appenninica</i>	<i>appenninica</i>	<i>appenninica</i>
	<i>R. ticinensis</i>		<i>washitensis</i>	<i>washitensis</i>	<i>ticinensis ticinensis</i>	
	<i>R. subticinensis</i>		<i>ticinensis ticinensis</i>	<i>ticinensis ticinensis</i>		
	<i>B. breppensis</i>		<i>primitiva</i>		<i>roberti</i>	
	<i>T. primata</i>		<i>planispira</i> <i>subcretacea</i>		<i>rohri</i>	
	<i>T. bejaouensis</i>		<i>rohri</i>	<i>rohri</i>		
Aptian	<i>H. garbachiakae</i>	<i>infracretacea</i>				
	<i>G. algeriana</i>	<i>barri</i>	<i>barri</i>	<i>barri</i>		
	<i>S. cubri</i>	<i>cf. barri</i>	<i>protuberans</i>	<i>protuberans</i>		
	<i>G. olumi</i>	<i>Choffatella</i> <i>decipiens</i>	<i>Lent. ouachensis</i>			
Barremian	<i>H. sigali</i>		<i>Lent. barri</i>			
Hauterivian	<i>G. haterivica</i>					

Correlation of zonal schemes established for the Caribbean, E.-Venezuela and Trinidad, with general zonations by Cron, 1985 and Bolli, 1966

MAGNETIC POLARITY (1)	MILLION YEARS (2) (3)		AGE	STAGE	PLANKTIC FORAMINIFERA (4)	CALCAREOUS NANNOFOSSILS (5)		RADIOLARIA (6)		DINOFLAGELLATES (7)		CALPIONELLIDS (8)
30		65	LATE	MAASTRICHTIAN	<i>Abathomphalus mayaroensis</i>	CC26	<i>Nephrolithus frequens</i>	<i>Amphipyndax tylosus</i>	<i>Dinogymnium euclaense</i>			
31	70				<i>Gansserina gansseri</i>	CC25	<i>Arkhangelskiella cymbiformis</i>					
32		73			<i>Globotruncana aegyptiaca</i>	CC24	<i>Reinhardtites levis</i>					
	75	70			<i>Globotruncanella hevanensis</i>	CC23	<i>Tranolithus phacelosus</i>					
33	80			CAMPANIAN	<i>Globotruncanita calcarata</i>	CC22	<i>Quadrum trifidum</i>	<i>Amphipyndax pseudoconulus</i>	<i>Odontochitina operculata</i>			
					<i>Globotruncana ventricosa</i>	CC21	<i>Quadrum sissinghii</i>					
	85				<i>Globotruncanita elevata</i>	CC20	<i>Ceratolithoides aculeus</i>					
34	90	83		SANTONIAN	<i>Dicarinella asymetrica</i>	CC16	<i>Lucianorhabdus cayauxii</i>	<i>Thecampe urna</i>	<i>Cordosphaeridium truncigerum</i>			
					<i>Dicarinella concavata</i>	CC15	<i>Reinhardtites anthophorus</i>		<i>Callaiosphaeridium asymmetricum</i> – <i>Oligosphaeridium pulcherrimum</i>			
	95	87.5		CONIACIAN	<i>Dicarinella primitiva</i>	CC14	<i>Micola decussata</i>	<i>Obesacapsula somphedia</i>	<i>Surculosphaeridium longifurcatum</i>			
			<i>Marginotruncana sigali</i>		CC13	<i>Marthasterites furcatus</i>	<i>Bacchidium polypes</i>					
	100	88.5	TURONIAN	<i>Helvetotruncana helvetica</i>	CC12	<i>Lucianorhabdus maleformis</i>	<i>Acaeniotyle umbilicata</i>	<i>Xenascus ceratoides</i> – <i>Carpodinium obliquicostatum</i>				
				<i>Whiteinella archeocratacea</i>	CC11	<i>Quadrum gartneri</i>			<i>Protoellipsodinium spinocristatum</i>			
	105	91		<i>Rotalipora cushmani</i>	CC10	<i>Microrhabdulus decoratus</i>			<i>Hystriochsphaerina schindewolfii</i> – <i>Subtilisphaera perlucida</i>			
	110	97.5	CENOMANIAN	<i>Rotalipora reicheli</i>	CC9	<i>Eiffelithus turreseiffelii</i>	<i>Stichocapsa euganea</i>					
	115			<i>Rotalipora brotzeni</i>				CC8			<i>Prediscosphaera columnata</i>	
				<i>Rotalipora appenninica</i>					CC7			<i>Chiastozygus litterarius</i>
M0	120	ALBIAN	<i>Rotalipora ticinensis</i>	CC6	<i>Micrantholithus hoeschulzii</i>	<i>Crotanium pythiae</i>						
M1			<i>Rotalipora subticinensis</i>				CC5	<i>Lithraphidites bollii</i>			<i>Dibolachras tythopora</i>	
M2	125		<i>Biticinella breggiensis</i>						CC4			<i>Cretarhabdus loriei</i>
M3		<i>Ticinella primula</i>	CC3	<i>Calcicalathina oblongata</i>	<i>Biorbifera johnevingii</i> – <i>Cribraperridium orthoceras</i>							
M4	130	<i>Ticinella bejaouiensis</i>				CC2	<i>Stradneria crenulata</i>	<i>Calpionellites</i>				
		<i>Hedbergella gorbachikae</i>							CC1		<i>Nannoconus steinmannii</i>	<i>Calpionellopsis</i>
M9	135	APTIAN	<i>Globigerinelloides algerians</i>	CC1	<i>Nannoconus steinmannii</i>							
M10			<i>Schackoina cabri</i>			CC1	<i>Nannoconus steinmannii</i>	<i>Crassicollaria</i>				
M11	140		<i>Globigerinelloides blowi</i>						CC1		<i>Nannoconus steinmannii</i>	<i>Crassicollaria</i>
M12	145	BARREMIAN	<i>Hedbergella sigali</i>	CC1	<i>Nannoconus steinmannii</i>							
M13			HAUTERIVIAN			<i>Globuligerina hauterivica</i>	CC1	<i>Nannoconus steinmannii</i>				
M14	150					VALANGINIAN			<i>Globuligerina hauterivica</i>		CC1	<i>Nannoconus steinmannii</i>
M15		BERRIASIAN		<i>Globuligerina hauterivica</i>	CC1				<i>Nannoconus steinmannii</i>	<i>Crassicollaria</i>		
M16	155		LATE TITHONIAN	<i>Globuligerina hauterivica</i>			CC1	<i>Nannoconus steinmannii</i>				
M17				JUR.		<i>Globuligerina hauterivica</i>					CC1	<i>Nannoconus steinmannii</i>
		JUR.			<i>Globuligerina hauterivica</i>	CC1			<i>Nannoconus steinmannii</i>	<i>Crassicollaria</i>		
			JUR.		<i>Globuligerina hauterivica</i>		CC1	<i>Nannoconus steinmannii</i>				

PLATE 1. HANTKENINIDAE: PLANOMALININAE

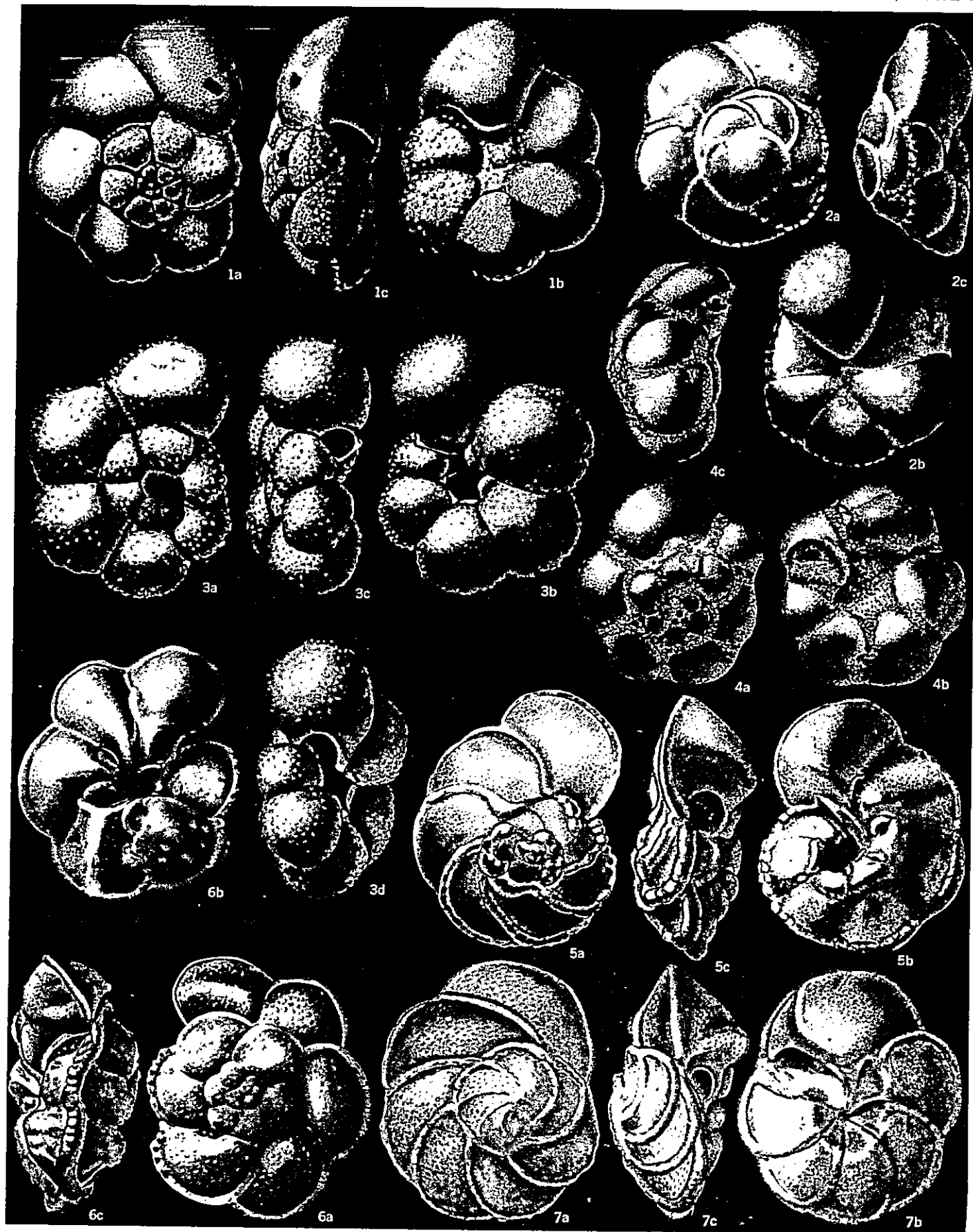
- FIGURES 1a, b. *Globigerinelloides algeriana* Cushman and ten Dam 21
 1a, Side view of paratype (Cushman Coll. 56790), showing evolute coil, umbilical chamber extensions and sinuate sutures. 1b, Edge view, showing low arched equatorial aperture. From the Aptian (Lower Cretaceous) of Algeria. $\times 75$.
- FIGURES 2a-3b. *Planomalina apsidostroba* Loeblich and Tappan 23
 2a, Side view of holotype (Cushman Coll. 45667), showing peripheral keel, limbate sutures and the lips of the lateral relict apertures. 2b, Edge view, showing equatorial primary aperture. $\times 110$. 3a, Side view of hypotype (USNM P5394) with well preserved relict apertures in later chambers. 3b, Edge view, $\times 145$. From the Lower Cretaceous (Albian) of Texas.
- FIGURES 4a-5b. *Planomalina caseyi* Bolli, Loeblich, and Tappan, new species 24
 4a, Side view of holotype (USNM P4869) showing planispiral test and relict apertures. 4b, Edge view, showing equatorial primary aperture, with the secondary relict apertures of earlier chambers remaining open. 5a, Side view of paratype (USNM P4870). 5b, Edge view of paratype. Both from the Gault (Albian), Lower Cretaceous, of England. $\times 180$.
- FIGURES 6a, b. *Hastigerinoides watersi* (Cushman) 24
 6a, Side view of topotype (USNM P3934), showing well preserved relict supplementary apertures. 6b, Edge view, showing low arched primary aperture. From the Austin chalk (Upper Cretaceous) of Texas. $\times 130$.
- FIGURES 7a-10b. *Hastigerinoides alexanderi* (Cushman) 24
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- FIGURES 11-12b. *Biglobigerinella multispina* Licker 25
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- FIGURES 13-18b. *Biglobigerinella barri* Bolli, Loeblich, and Tappan, new species 25
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HANTKENINIDAE; PLANOMALININAE

PLATE 9. GLOBOROTALIIDAE

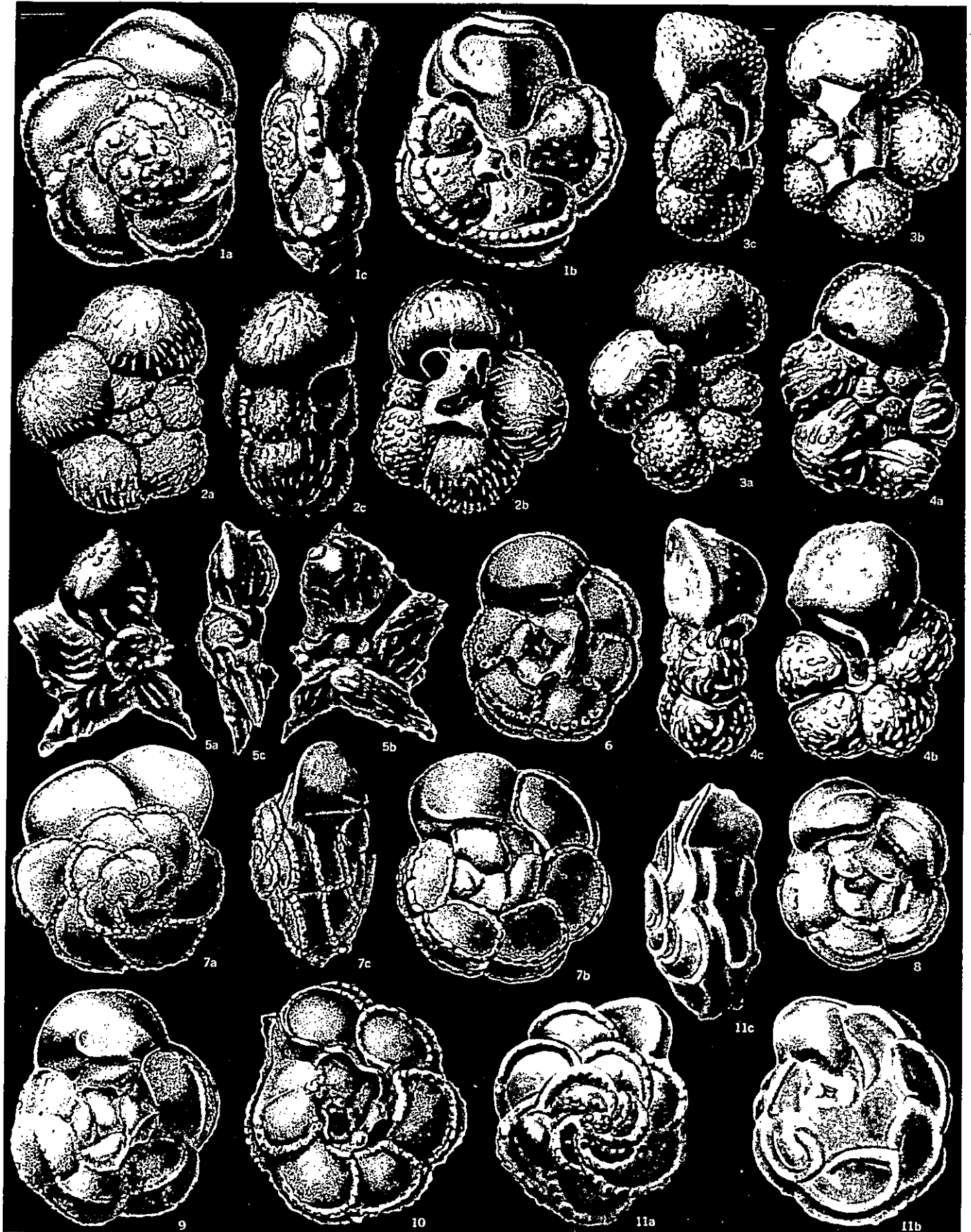
- FIGURES 1a-c. *Praeglobotruncana delrioensis* (Plummer) 39
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- FIGURES 2a-c. *Praeglobotruncana stephani* (Gandolfi) 39
 2a, Spiral side of topotype (USNM P4848) of the type species of *Rotundina* Subbotina. 2b, Umbilical side, showing extraumbilical-umbilical aperture. 2c, Edge view. From the Cenomanian of Switzerland. $\times 95$.
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- FIGURES 4a-c. *Praeglobotruncana?* *seminolensis* (Harlton) 39
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- FIGURES 5a-c. *Rotalipora* cf. *appenninica* (Renz) 41
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- FIGURES 6a-c. *Rotalipora turonica* Brotzen 41
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GLOBOROTALIIDAE

PLATE 11. GLOBOTRUNCANIDAE

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| 1c, Edge view. From the Maestrichtian Guayaguayare formation of Trinidad, B.W.I. $\times 90$. | | FIGURES 6-11c. <i>Globotruncana arca</i> (Cushman) | 44 |
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| 3b, Umbilical view, showing development of tegilla from successive chambers, and extending across umbilicus. | | The primary umbilical aperture can be seen here, although in life it was always covered. Specimens such as this have led to the common misconceptions as to the distinctions between <i>Globorotalia</i> and <i>Globotruncana</i> . | |
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GLOBOTRUNCANIDAE

PLATE 12. ROTALIPORA, PRAEGLOBOTRUNCANA

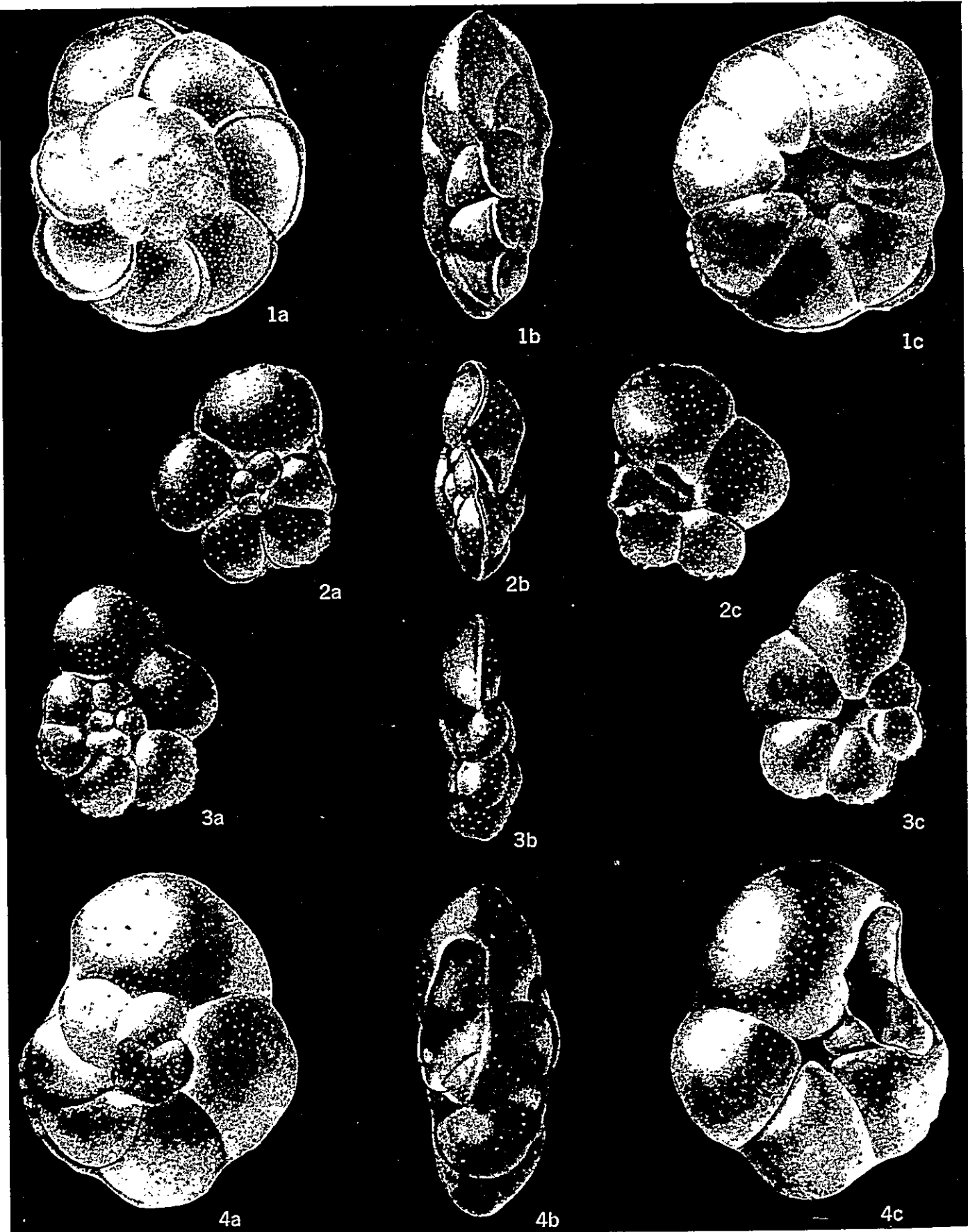
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| FIGURES 1a-c. <i>Rotalipora ticinensis ticinensis</i> (Gandolfi) | 56 | view of paratype (USNM P4795). 3b, Side view. 3c, Umbilical view. Both from the <i>Globotruncana stuarti</i> zone, Naparima Hill formation, Trinidad, B.W.I. $\times 110$. | |
| 1a, Spiral view of hypotype (USNM P4792). | | FIGURES 4a-c. <i>Praeglobotruncana</i> cf. <i>delrioensis</i> (Plummer) | 55 |
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| 2a, Spiral view of holotype (USNM P4794). | | | |
| 2b, Side view. 2c, Umbilical view. 3a, Spiral | | | |

PLATE 13. GLOBOTRUNCANA

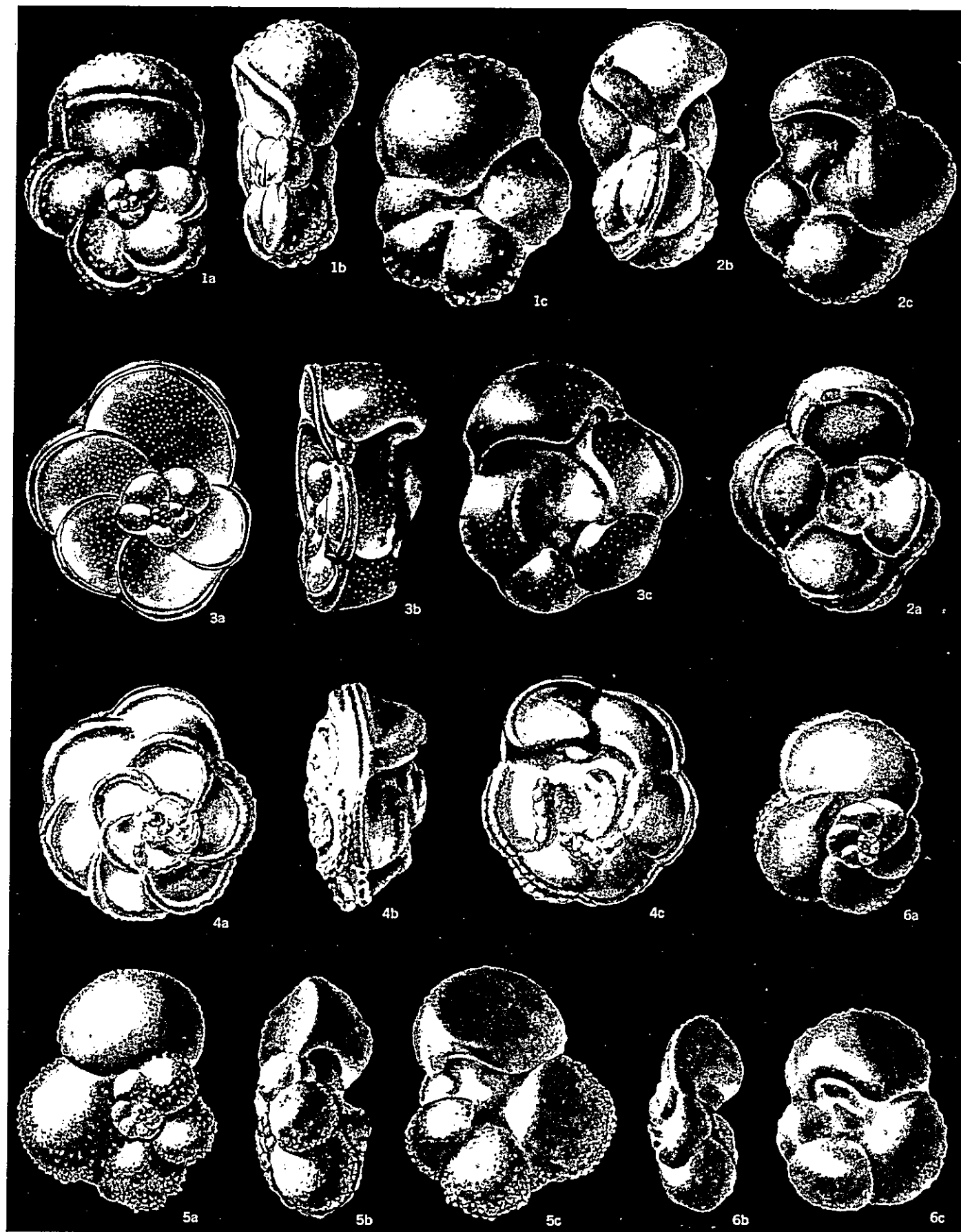
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| FIGURES 1a-c. <i>Globotruncana helvetica</i> Bolli | 56 | <i>Globotruncana concavata</i> zone, Naparima Hill formation, Trinidad, B.W.I. $\times 73$. | |
| 1a, Spiral view of hypotype (USNM P4796). | | FIGURES 4a-c. <i>Globotruncana ventricosa</i> White | 57 |
| 1b, Side view. 1c, Umbilical view. From the <i>Globotruncana inornata</i> zone, Naparima Hill formation, Trinidad, B.W.I. $\times 112$. | | 4a, Spiral view of hypotype (USNM P4799). | |
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| FIGURES 3a-c. <i>Globotruncana concavata</i> (Brotzen) | 57 | 5b, Side view. 5c, Umbilical view. $\times 102$. | |
| 3a, Spiral view of hypotype (USNM P4798). | | 6a, Spiral view of paratype (USNM P4801). 6b, Side view. 6c, Umbilical view. $\times 80$. Both from the <i>Globotruncana inornata</i> zone, Naparima Hill formation, Trinidad, B.W.I. | |
| 3b, Side view. 3c, Umbilical view. From the | | | |

PLATE 14. GLOBOTRUNCANA

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| 1a, Spiral view of hypotype (USNM P4802). | | 4a, Spiral view of holotype (USNM P4805). | |
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| 3b, Side view. 3c, Umbilical view. From the <i>Globotruncana renzi</i> zone, Naparima Hill formation, Trinidad, B.W.I. $\times 80$. | | 6b, Side view. 6c, Umbilical view. From the <i>Globotruncana lapparenti tricarinata</i> zone, Guayaguayare formation, Trinidad, B.W.I. $\times 73$. | |



ROTALIPORA, PRAEGLOBOTRUNCANA



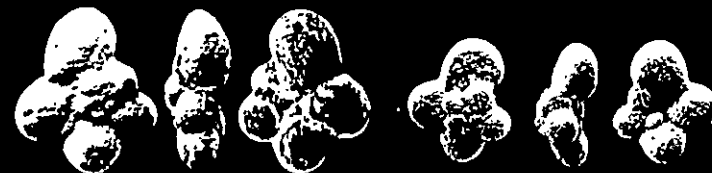
GLOBOTRUNCANA



GLOBOTRUNCANA



H. holmdelensis



H. flandrini



H. simplex



H. gorbachikae



H. delrioensis



H. maslakovae



H. planispira



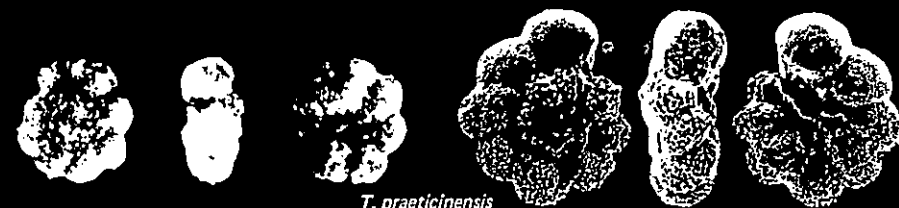
H. bizonae



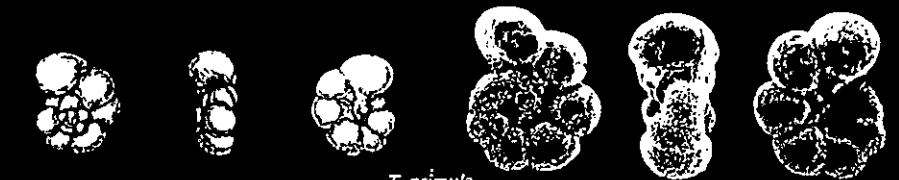
H. sigali

Characteristic Hedbergella and
Ticinella species
(Primary types on left side)

Stage	Planktic Foraminiferal Zones	Hedbergella										Ticinella			
		sigali	holmdelensis	flandrini	simplex	gorbachikae	delrioensis	maslakovae	planispira	bizonae	sigali	holmdelensis	flandrini	simplex	gorbachikae
Maastrichtian	<i>A. niyazovensis</i>														
	<i>G. ganzeri</i>														
	<i>G. acyptirica</i>														
	<i>G. havanensis</i>														
	<i>G. calcarata</i>														
Campanian	<i>G. ventricosa</i>														
	<i>G. elevata</i>														
Santonian	<i>D. asymetrica</i>														
	<i>D. concavata</i>														
Coniacian	<i>D. primitiva</i>														
	<i>M. sigali</i>														
Turonian	<i>H. helvetica</i>														
	<i>W. archaocretacea</i>														
	<i>R. cushmani</i>														
Cenomanian	<i>R. reicheli</i>														
	<i>R. brotzeni</i>														
	<i>R. appenninica</i>														
Albian	<i>R. ticinensis</i>														
	<i>R. subticinensis</i>														
	<i>B. breggiensis</i>														
	<i>T. primula</i>														
	<i>T. bejaouensis</i>														
Aptian	<i>H. gorbachikae</i>														
	<i>G. algeriana</i>														
	<i>S. cabri</i>														
Barremian	<i>G. blowi</i>														
	<i>H. sigali</i>														
Hauterivian	<i>G. holtervica</i>														



T. praeticeinensis



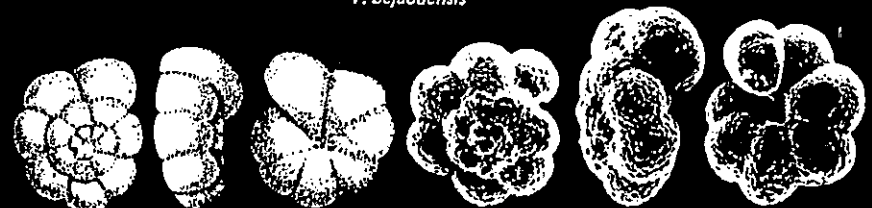
T. primula



T. roberti



T. bejaouensis



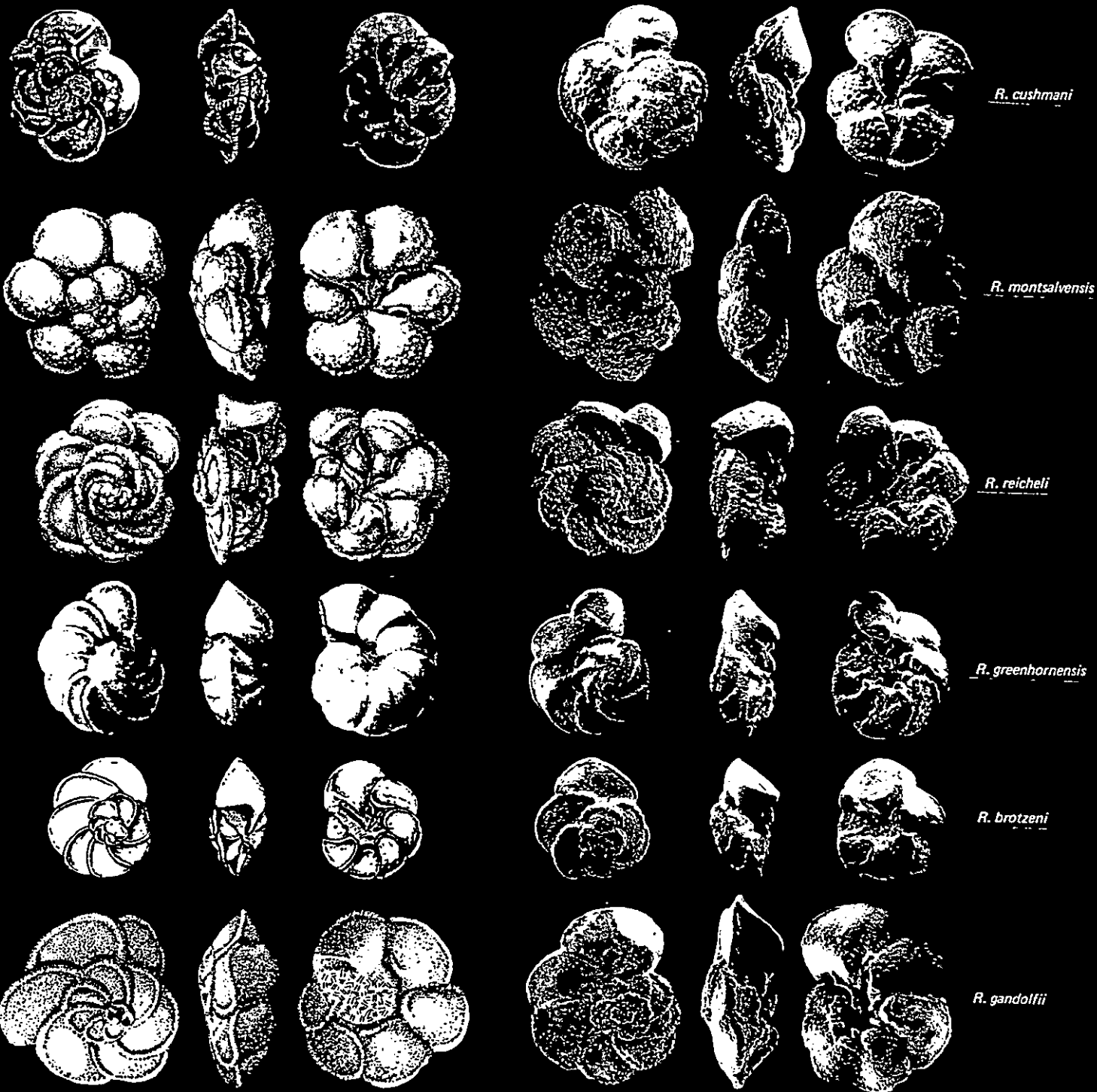
H. trochoidea



T. madecassiana

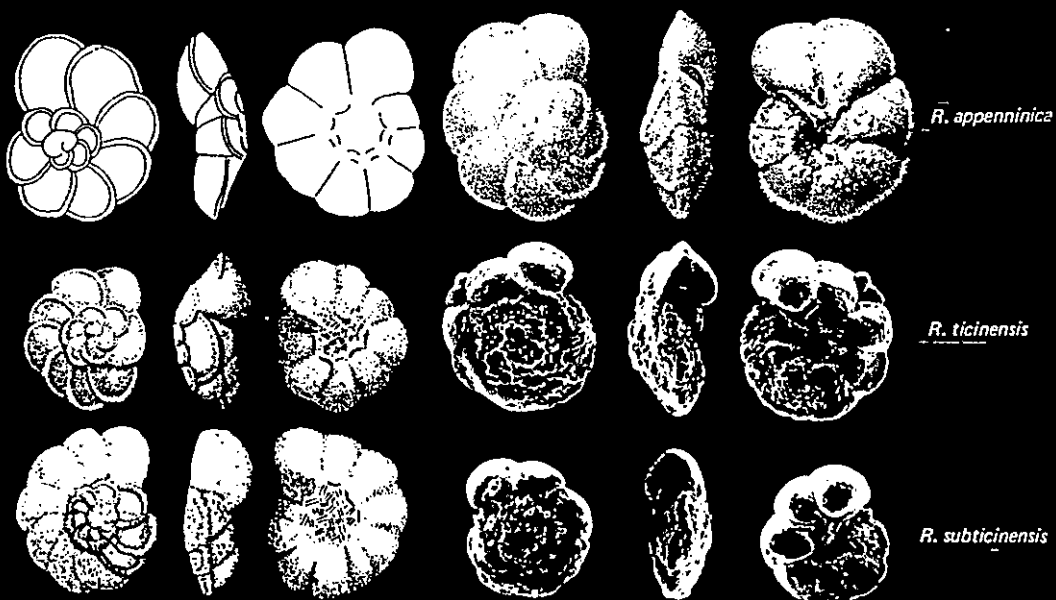


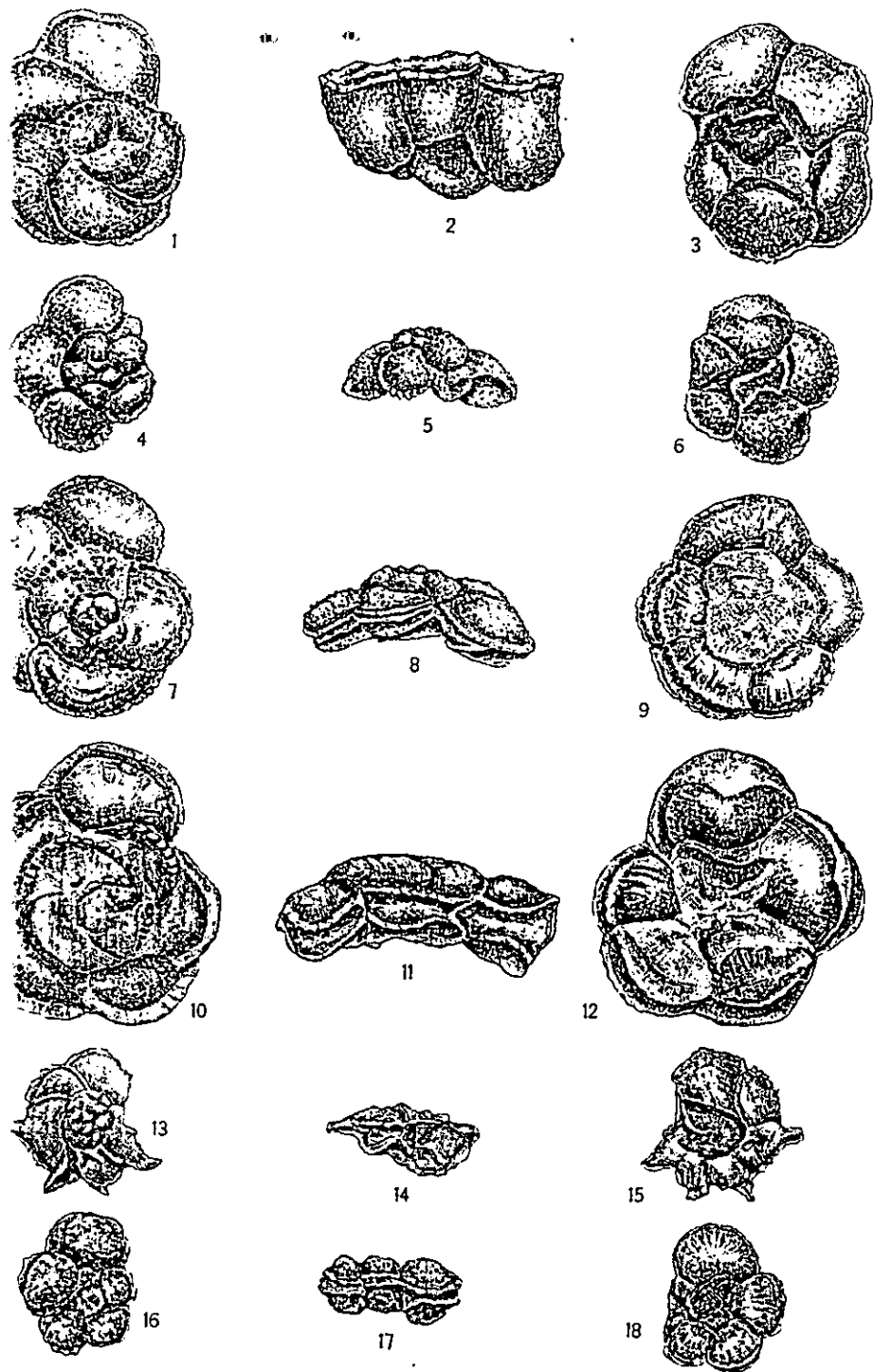
T. raynaudi



Characteristic Rotalipora species
(Primary types on left side)

Stage	Planktic Foraminiferal Zones	Rotalipora									
		subticinensis	ticinensis	apenninica	gandolfii	brotzeni	montsalvensis	reicheli	greenhornensis	cushmani	
Cenomanian	<i>R. cushmani</i>										
	<i>R. reicheli</i>										
	<i>R. brotzeni</i>										
Albian	<i>R. apenninica</i>										
	<i>R. ticinensis</i>										
	<i>R. subticinensis</i>										
	<i>R. breyensis</i>										
	<i>T. primula</i>										
	<i>T. dejasouensis</i>										
Aptian	<i>H. porbachikae</i>										
	<i>G. algeriana</i>										
	<i>S. cabri</i>										
	<i>G. blowi</i>										
Barremian	<i>H. sigali</i>										
Hauterivian	<i>G. noterivica</i>										

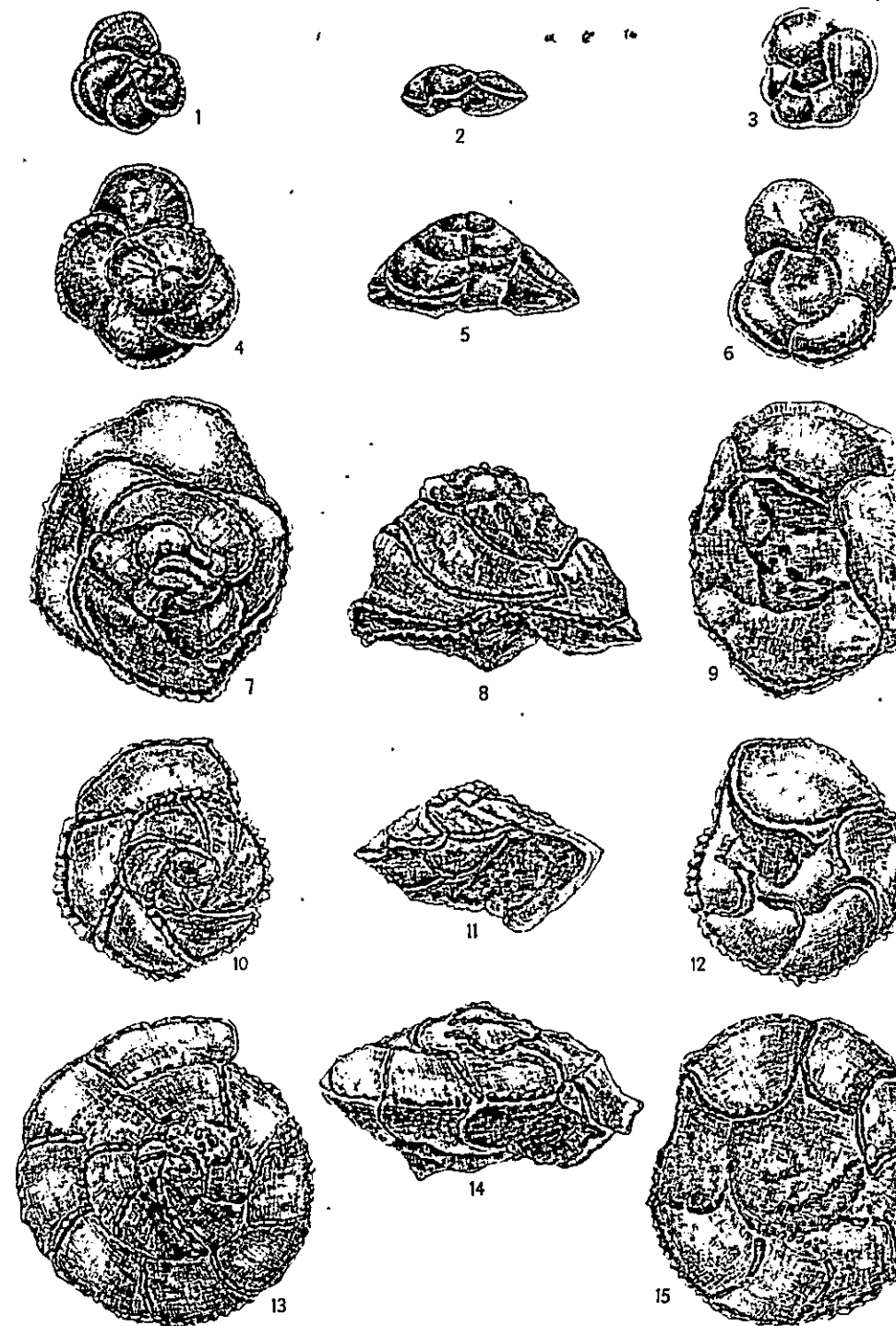




Bolli, Trinidad Globotruncanae

EXPLANATION OF PLATE 35
All figures $\times 65$

- FIGS. 1-3—*Globotruncana gansseri* Bolli, n. sp. Holotype: 1, dorsal view; 2, side view; 3, ventral view. (p. 196)
- 4-6—*Globotruncana citae* Bolli, n. sp. Holotype: 4, dorsal view; 5, side view; 6, ventral view. (p. 197)
- 7-9—*Globotruncana intermedia* Bolli, n. sp. Holotype: 7, dorsal view; 8, side view; 9, ventral view. (p. 197)
- 10-12—*Globotruncana mayaroensis* Bolli, n. sp. Holotype: 10, dorsal view; 11, side view; 12, ventral view. (p. 198)
- 13-15—*Globotruncana* cf. *calcarata* Cushman. 13, dorsal view; 14, side view; 15, ventral view. (p. 198)
- 16-18—*Globotruncana* cf. *globigerinoides* Brotzen. 16, dorsal view; 17, side view; 18, ventral view. (p. 198)



EXPLANATION OF PLATE 34
All figures $\times 65$

- FIGS. 1-3—*Globotruncana apenninica* cf. α Gandolli. 1, Dorsal view; 2, side view; 3, ventral view. (p. 193)
 4-6—*Globotruncana caliciformis* (de Lapparent). 4, Dorsal view; 5, side view; 6, ventral view. (p. 194)
 7-9—*Globotruncana contusa* (Cushman). 7, Dorsal view; 8, side view; 9, ventral view. (p. 196)
 10-12—*Globotruncana stuarti* (de Lapparent). 10, Dorsal view; 11, side view; 12, ventral view. (p. 196)
 13-15—*Globotruncana conica* White. 13, Dorsal view; 14, side view; 15, ventral view. (p. 196)

Bolli, Trinidad *Globotruncanae*

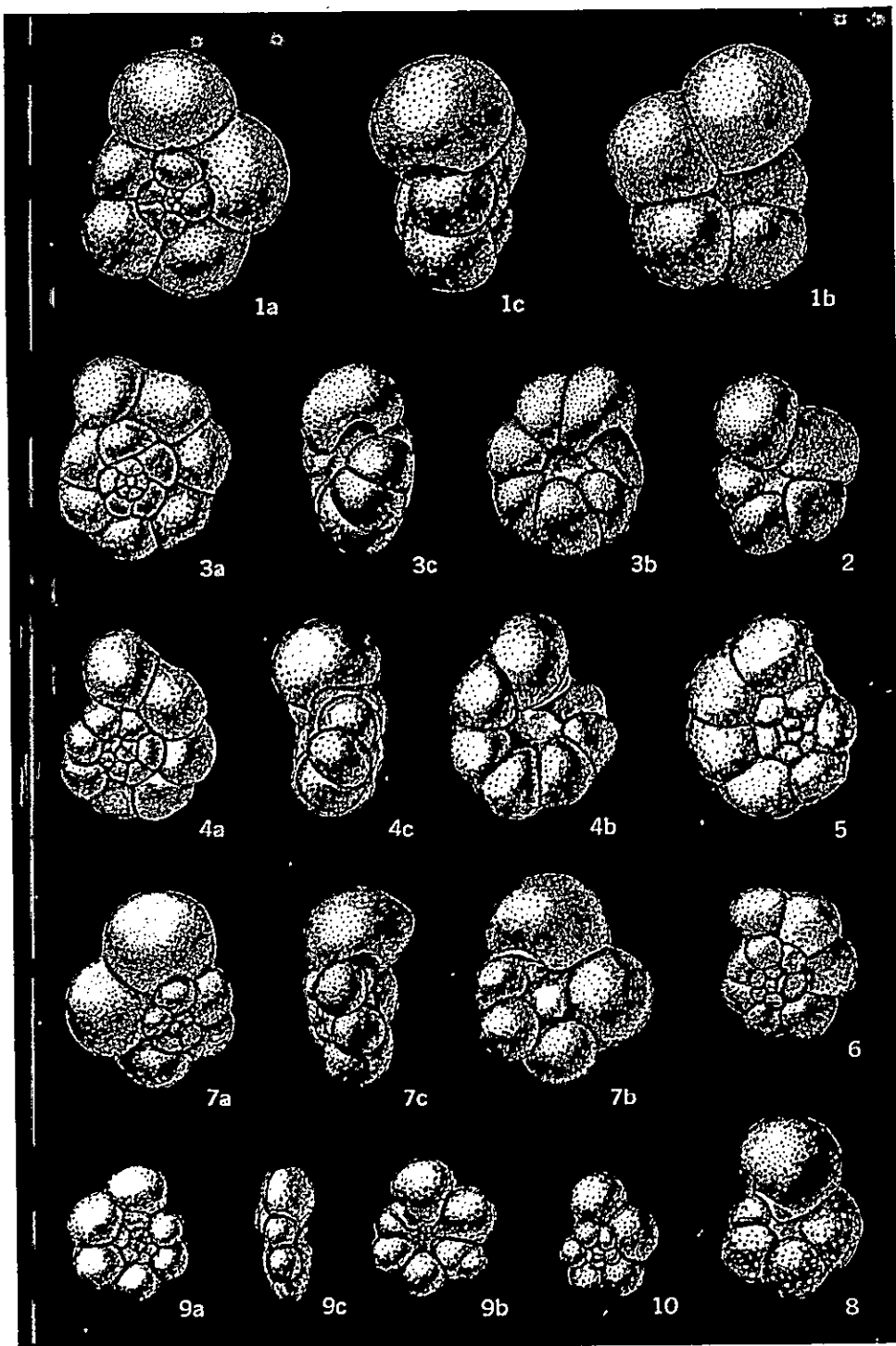
EXPLANATION OF PLATE 21

All figures x 80

Figure

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- 1, 2. *Praeglobotruncana crassa* Bolli, n. sp. 265
 1a. Spiral view of holotype (USNM 626315). 1b. Umbilical view.
 1c. Edge view. 2. Umbilical view of paratype (USNM 626316).
 Both from the *Globotruncana renzi* zone, Naparima Hill formation.
- 3-6. *Praeglobotruncana gautierensis* (Bronnimann) 265
 3a. Spiral view of hypotype (USNM 626324). 3b. Umbilical view.
 3c. Edge view. 4a. Spiral view of paratype (USNM 626309). 4b.
 Umbilical view. 4c. Edge view. 5. Spiral view of hypotype (USNM
 626328). 6. Spiral view of paratype (USNM 626310). 3 and 5
 from the *Praeglobotruncana robri* zone, Maridale formation; 4 and
 6 from the *Rotalipora appenninica appenninica* zone, Gautier forma-
 tion.
- 7, 8. *Praeglobotruncana cf. gautierensis* (Bronnimann) 266
 7a. Spiral view. 7b. Umbilical view. 7c. Edge view. (USNM
 626311). 8. Umbilical view. (USNM 626312). Both from the
Rotalipora appenninica appenninica zone, Gautier formation.
- 9, 10. *Praeglobotruncana infracretacea* (Glaessner) 266
 9a. Spiral view of hypotype (USNM 626295). 9b. Umbilical view.
 9c. Edge view. 10. Spiral view of hypotype (USNM 626296). Both
 from the *Lenticulina (L.) ouachensis ouachensis* zone, Cuche forma-
 tion.



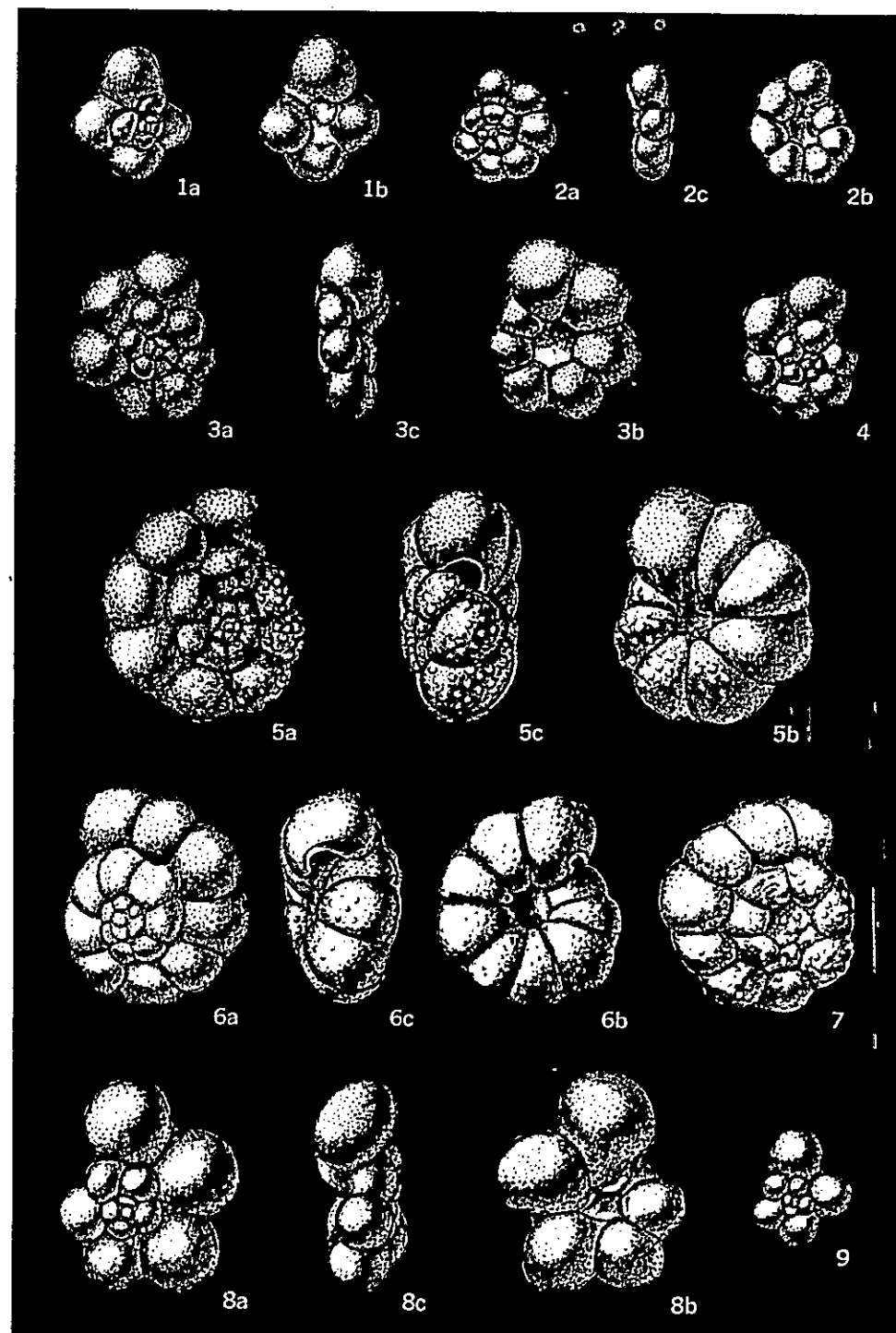
EXPLANATION OF PLATE 22

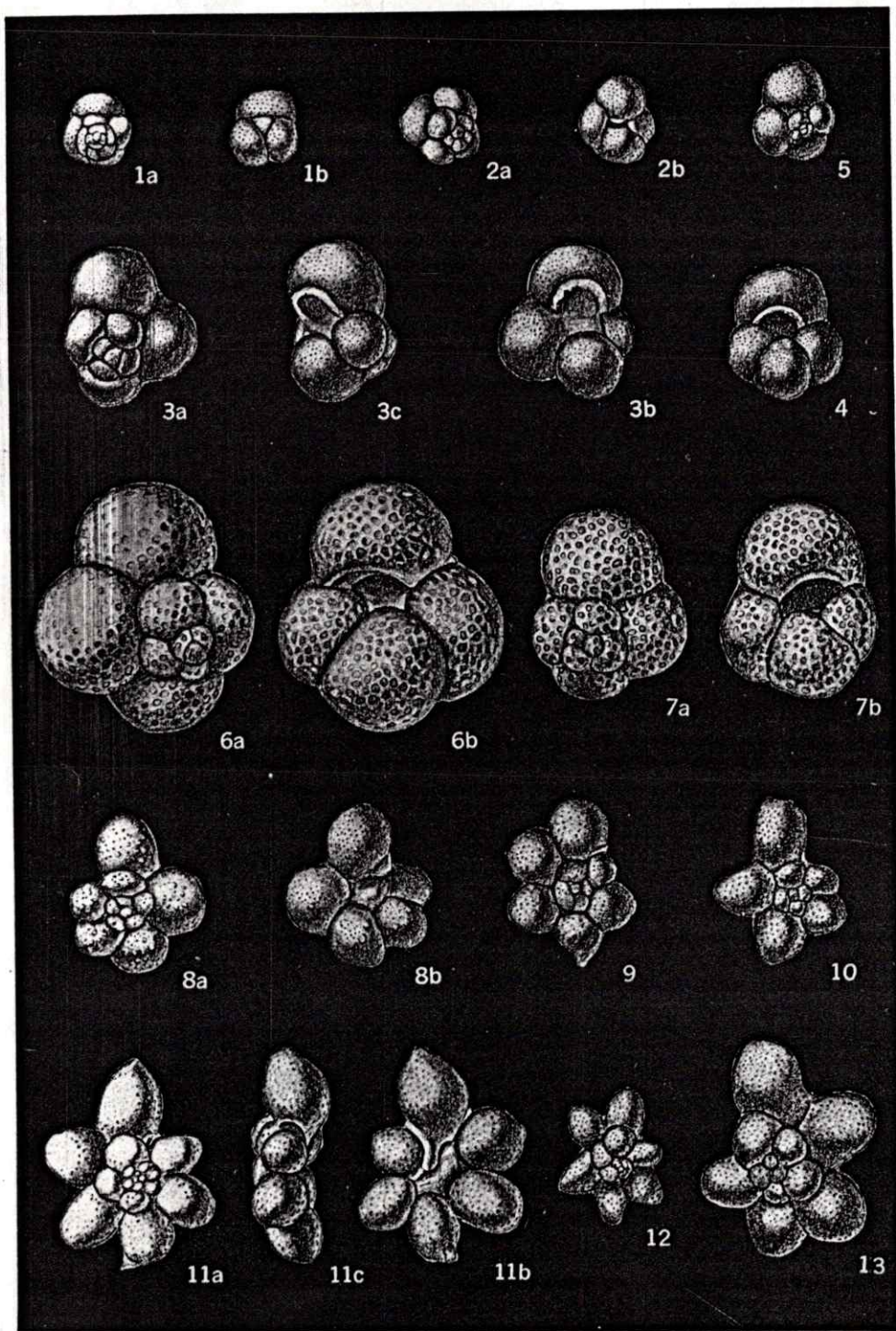
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Figure

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1. *Praeglobotruncana* cf. *infracretacea* (Glaessner).....266
 1a. Spiral view. 1b. Umbilical view. (USNM 626294). Such specimens which possess fewer chambers appear to be related by transitional forms to the typical *Praeglobotruncana infracretacea*. From the *Lenticulina* (L.) *onachensis onachensis* zone, Cuche formation.
2. *Praeglobotruncana modesta* Bolli, n. sp.....267
 2a. Spiral view of holotype (USNM 626308). 2b. Umbilical view. 2c. Edge view. From the *Rotalipora appenninica appenninica* zone, Gautier formation.
- 3, 4. *Praeglobotruncana planispira* (Tappan).....267
 3a. Spiral view of hypotype (USNM 626317). 3b. Umbilical view. 3c. Edge view. 4. Spiral view of hypotype (USNM 626318). Both from the *Globotruncana inornata* zone, Naparima Hill formation.
- 5-7. *Praeglobotruncana rohri* Bolli, n. sp.....267
 5a. Spiral view of paratype (USNM 626325). 5b. Umbilical view. 5c. Edge view. 6a. Spiral view of holotype (USNM 626326). 6b. Umbilical view. 6c. Edge view. 7. Spiral view of paratype (USNM 626327). All from the *Praeglobotruncana rohri* zone, Maridale formation.
- 8, 9. *Globigerina cretacea* d'Orbigny.....270
 8a. Spiral view of hypotype (USNM 626313). 8b. Umbilical view. 8c. Edge view. 9. Spiral view of small hypotype (USNM 626314). Both from the *Globotruncana inornata* zone, Naparima Hill formation.





EXPLANATION OF PLATE 23

All figures x 80

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|--|------|
| 1, 2. <i>Globigerina graysonensis</i> Tappan..... | 270 |
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Plate I. *Schackoina*
All figures $\times 110$

- Figs. 1-4. *Schackoina pustulans pustulans* n. sp., n. subsp.
1, Side view of paratype with all bulb-shaped extensions broken off. 2, Side view of paratype with bulb-shaped extension of ultimate chamber preserved. 3, Side view of holotype with bulb-shaped extensions preserved on two chamber of final whorl. 3a, Edge view, showing position of the slightly excentric aperture. 4, Side view of fully preserved paratype.
- Fig. 5. Side view of a specimen close to *Schackoina pustulans pustulans*, n. sp., n. subsp. with two apertures in the final chamber, one on each side. The ultimate chamber partly embraces the 5th last chamber. This specimen indicates the close relationship of *Schackoina* and *Leupoldina* n. gen. It might in fact be regarded as an immature specimen of *Leupoldina* where the multiple extensions are not developed in the last chamber.
- Figs. 6-7. *Schackoina pustulans quinquecamerata* n. sp., n. subsp.
6, Side view of paratype with all bulb-shaped extensions broken off. 7, Side view of holotype with bulb-shaped extensions preserved in the 3 last chambers. 7a, Edge view, showing slightly excentric position of aperture.
- Figs. 8-10. *Schackoina reicheli* n. sp.
8, Side view of paratype showing the bulb-shaped extension preserved in the ultimate chamber. 9, Side view of paratype showing the strongly elongated, tapering chambers with all bulb-shaped extensions broken off. 10, Side view of holotype with bulb-shaped extension on the penultimate chamber preserved. 10a, Edge view, showing slightly excentric position of aperture.

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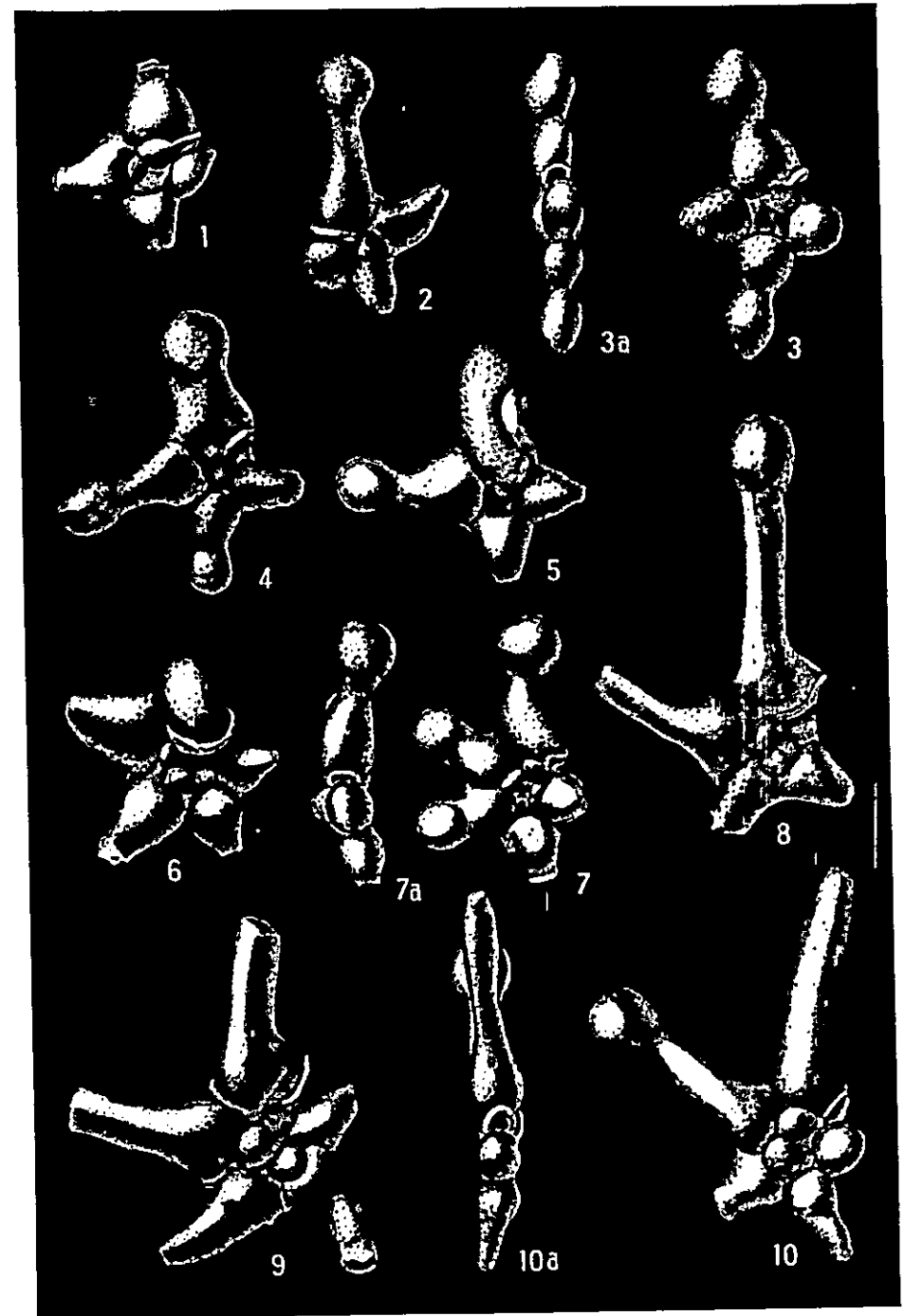


Plate II. *Leupoldina* n. gen.All figures $\times 110$ Figs. 1-13. *Leupoldina protuberans*, n. gen., n. sp. 277

1, Side view of paratype with the paired extensions of the ultimate chamber broken off. The aperture of the last chamber is still undivided and equatorial in position, which indicates an immature specimen. 2, Side view of paratype with the paired extensions of the last two chambers broken off. 3, Side view of paratype showing paired bulb-shaped extensions of ultimate chamber and single ones in earlier chambers preserved. 3a, Edge view, showing *Schackoina*-like aperture in a slightly excentric position; the double aperture characteristic for *Leupoldina* is not yet developed in the final chamber, it might therefore be regarded as a juvenile specimen. 4-6, 10, Side views of paratypes with paired bulb-shaped extensions restricted to the final chamber; one of the two extra-umbilical apertures of the final chamber is visible. 7, Side view of holotype showing paired bulb-shaped extensions in the two last chambers. The single bulb-shaped extensions of the two earlier chambers of the last whorl are broken off. One of the two interiomarginal, umbilical apertures of the ultimate chamber is visible. 7a, Edge view of holotype, showing the almost completely divided ultimate chamber with the two bulb-shaped extensions and the two interiomarginal, umbilical apertures. 8, 8a, Side and edge views of paratype showing similar features as holotype (figs. 7, 7a). 9, 11, Side view of paratypes showing probable relict apertures in the penultimate chambers. 12, Side view of paratype with three bulb-shaped extensions in the last chamber. The single extensions in the three earlier chambers of the last whorl are broken off. The equatorial aperture of the ultimate chamber indicates that the specimen is immature. 13, Side view of paratype showing three bulb-shaped extensions in the last chamber. The paired extensions in the three earlier chambers of the last whorl are broken off. The first chamber of the last whorl, partly embraced by the ultimate chamber and its central protuberance, has the single bulb-shaped extension preserved. One of the two interiomarginal, extraumbilical apertures is visible. 13a, Edge view, showing the three bulb-shaped extensions and the two interiomarginal, umbilical apertures of the ultimate chamber.

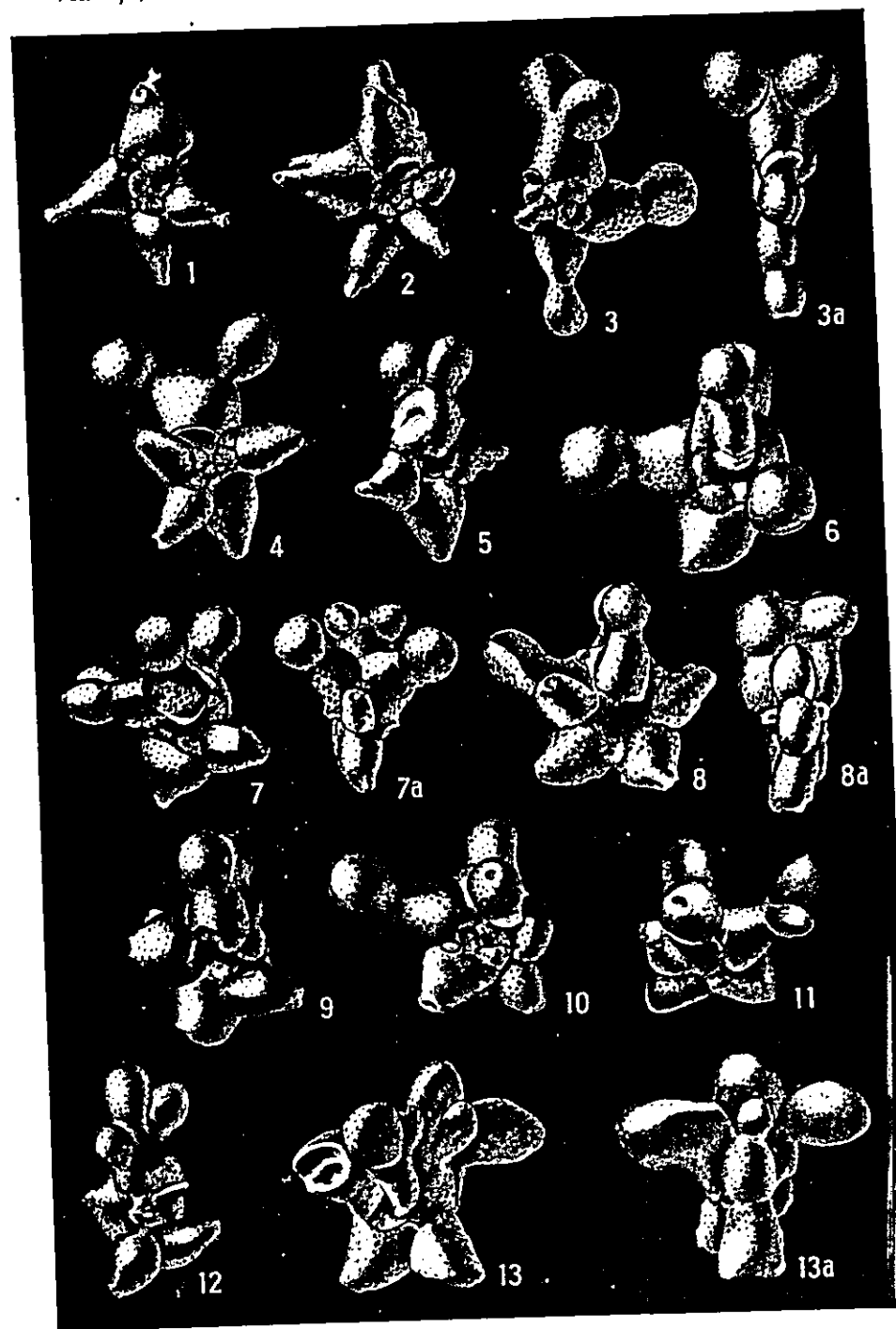


Plate I. *Grimsdaleinella*, n. gen.All figures $\times 75$ Figs. 1-11. *Grimsdaleinella spinosa*, n. gen., n. sp.

1a. Side view of holotype showing asymmetrically situated comma shaped aperture in ultimate chamber. Initial chamber globular, later ones becoming increasingly elongated, tapering to spines which are partly broken off with the exception of that of the last chamber.

1b. View of opposite side of holotype.

1c. Apertural view of holotype showing comma shaped aperture.

2, 3a. Side views of paratypes showing asymmetrically situated comma shaped apertures in ultimate chambers. Tapering spines are partly broken-off.

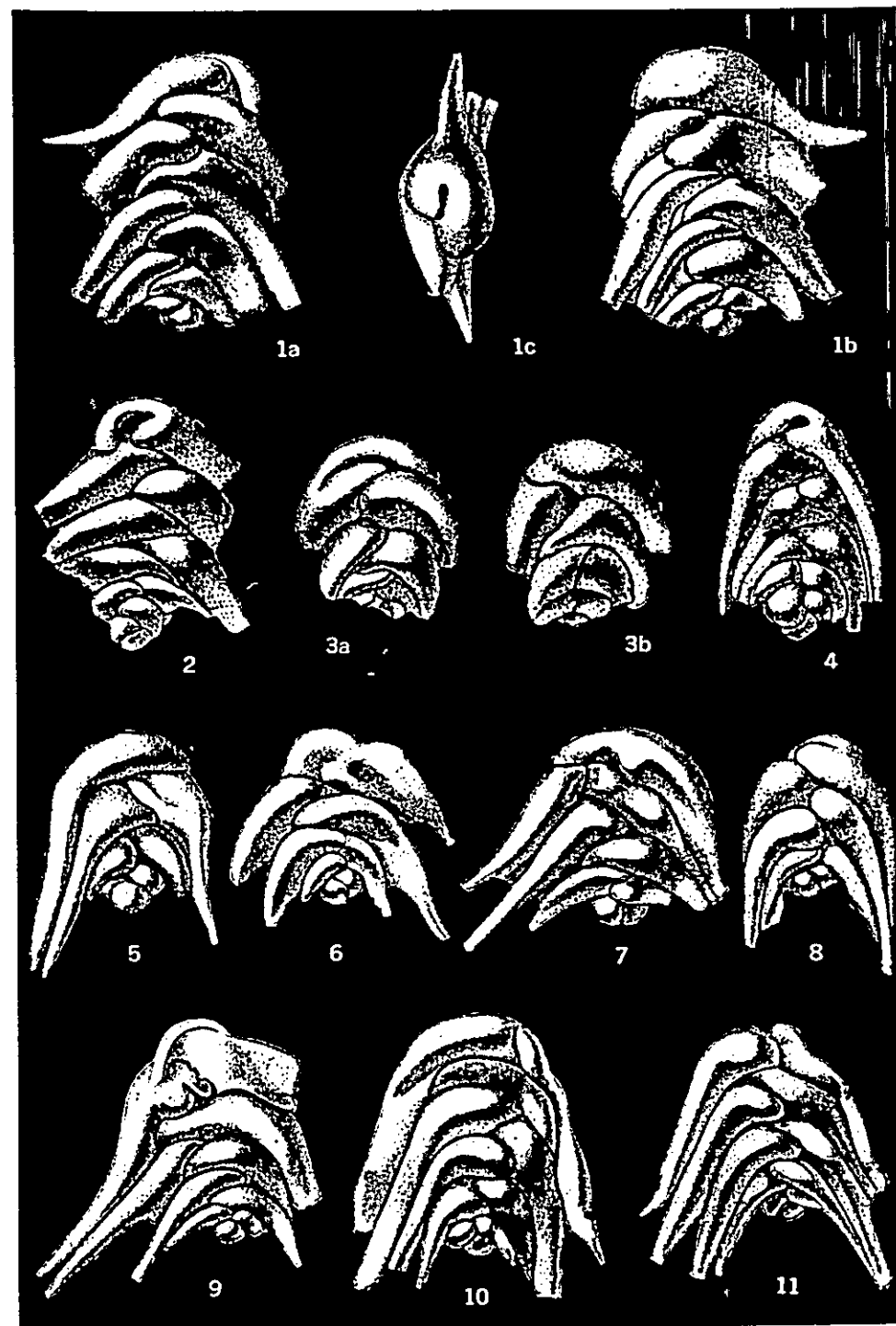
3b. View of opposite side.

4. Side view of paratype showing asymmetrically situated comma shaped aperture in ultimate chamber. Tapering spines in most chambers well preserved.

5-8. Sideviews of paratypes with well preserved chambers tapering to spines. The angles of the spines to the longitudinal axis vary considerably in the figured specimens.

9-11. Side views of large paratypes showing well preserved chambers tapering to spines. The thin walled ultimate chambers are somewhat deformed and compressed.

(Figured specimens deposited in the Museum of Natural History, Basle [holotype C 2519, paratypes C 2520-C 2529])



Discussion of genera

ABATHOMPHALUS Bolli, Loeblich & Tappan, 1957

Type species: *Globotruncana mayaroensis* Bolli, 1951.

The genus differs from *Globotruncana* in the umbilical-extra-umbilical position of the primary aperture and in the radial sutures on the umbilical side. *Globotruncanella* is regarded as the ancestor of *Abathomphalus*, based on the evolutionary lineage *G. citae* - *A. intermedius* - *A. mayaroensis*.

ARCHAEOGLOBIGERINA Pessagno, 1967

Type species: *Archaeoglobigerina blowi* Pessagno, 1967.

A wide imperforate peripheral band bordered by two faint keels are present on the globular early chambers of the last whorl. This is typical for the genus which evolved from *Whiteinella* (*W. archaocretacea* - *A. cretacea*). *Archaeoglobigerina* itself is probably the ancestor of the inflated and ornamented (rugose, costellate) Late Cretaceous genera *Rugoglobigerina*, *Rugotruncana* and *Gansserina*.

BITICINELLA Sigal, 1956

Type species: *Anomalina breggiensis* Gandolfi, 1942.

The genus differs from *Globigerinelloides* in the presence of true supplementary apertures like those of *Ticinella* in one umbilicus and relict apertures in the other. In comparison, *Globigerinelloides* has relict apertures in both umbilici. *Biticinella* differs from *Planomalina* in the absence of a keel.

DICARINELLA Porthault, 1970

Type species: *Globotruncana indica* Jacob & Sastry, 1950; synonym of *Dicarinella hagni* Scheibnerova, 1962 (see Robaszynski & Caron, 1979).

The genus differs from *Praeglobotruncana* in its well developed keels and portici; from *Marginotruncana* in the umbilical sutures which are depressed and usually radial. In the *D. primitiva* - *D. concavata* - *D. asymetrica* lineage, the genus shows a trend towards curved umbilical sutures, a tendency already present in certain specimens of the ancestral *D. algeriana*.

FALSOTRUNCANA Caron, 1981

Type species: *Falsotruncana maslakovae* Caron, 1981.

The species belonging to this genus have long been confused with *Praeglobotruncana* from which they differ in the presence of a long primary aperture with a long, slim lip and the absence of a flap or porticus. They evolved from a *Hedbergella* ancestor, retaining its rudimentary primary aperture and developing a stout double keel.

FAVUSELLA Michael, 1973

Type species: *Globigerina washitensis* Carsey, 1926.

The test surface is reticulated into coarse regular polygonal areas by ridges forming a honeycomb-like pattern; each polygonal area has more than twenty minute pores. *Favusella* differs from *Globigerina* in its regular reticulate sculpture and in the position of the primary aperture which may become umbilical-extraumbilical. It differs from *Hedbergella* in the reticulate sculpture.

GANSSEERINA Robaszynski, Caron, Gonzalez & Wonders, 1984

Type species: *Globotruncana gansseri* Bolli, 1951.

The test is plano-convex, flat on the spiral side, inflated umbilically. Early whorls are globigeriniform with weakly developed double keel, visible in thin sections (Pessagno, 1967). Rugosities and sometimes faint, discontinuous costellae are present mainly on the umbilical side. Like *Rugotruncana*, *Gansserina* is thought to have originated from an *Archaeoglobigerina* ancestor through the development of a single keel and coarse rugosities.

GLOBIGERINELLOIDES Cushman & Ten Dam, 1948

Type species: *Globigerinelloides algeriana* Cushman & Ten Dam, 1948.

The successive apertures remain as relict apertures on both sides of the typically planispiral test. *Globigerinelloides* differs from *Biticinella* in the lack of supplementary apertures and from *Planomalina* in the absence of a peripheral keel.

GLOBOTRUNCANA Cushman, 1927

Type species: *Pulvinulina arca* Cushman, 1926.Synonym: *Rosalinella* Marie, 1941.

Globotruncana differs from *Marginotruncana* in having its umbilical primary aperture covered by a series of tegilla; from *Rugotruncana* in the absence of meridionally arranged rugosities; from *Abathomphalus* in the umbilical position of the primary aperture and in having sigmoidal and raised umbilical sutures.

GLOBOTRUNCANELLA Reiss, 1957

Type species: *Globotruncana citae* Bolli, 1951.

Emendation: Pessagno, 1967.

Globotruncanella differs from *Hedbergella* in the presence of portici, and from *Archaeoglobigerina* in the absence of tegilla and of a large imperforate peripheral band. *Globotruncanella* is a homeomorph of *Whiteinella* but is segregated because of the wide chronological gap that separates them.

GLOBOTRUNCANITA Reiss, 1957

Type species: *Rosalina stuarti* de Lapparent, 1918.

The genus was proposed by Reiss to separate the Late Cretaceous species with an umbilical system of portici and a single peripheral keel from the genus *Globotruncana*. Some authors still contest this separation and maintain the name *Globotruncana* for all keeled species of the Late Cretaceous.

GLOBULIGERINA Bignot & Guyader, 1971

Type species: *Globigerina oxfordiana* Grigelis, 1958.Synonyms: *Polskanella* Fuchs, 1973.*Caucasella* Longoria, 1974.*Globuligerina* Grigelis, 1974.

The trochoid test is very small with 4-6 inflated and compacted chambers forming the last whorl; the surface is sculptured as tubercles or sometimes an irregular reticulation with 3 to 4 minute pores in each polygon. *Globuligerina* is regarded as a descendant from the Jurassic genus *Conoglobigerina* Morozova & Moskalenko, 1961, from which it differs in its trochoid test and its reticulate sculptured chamber surface.

Globuligerina seems itself to be a form intermediate to the genus *Favusella* which differs from it essentially in the great variability of the number of chambers, height of spire, position of primary aperture and more regular reticulate sculpture. According to Grigelis & Gorbachik (1980), it is possible to establish a phylogenetic sequence extending from Middle Jurassic to Cenomanian. This would include in the family Favusellidae all members of the three genera *Conoglobigerina* Morozova, *Globuligerina* Bignot & Guyader and *Favusella* Michael.

GUEMBELITRIA Cushman, 1933

Type species: *Guembelitra cretacea* Cushman, 1933.

The very small (150–200 μ m), triserial test consists of globular chambers. The walls are finely perforate, each pore is surrounded by a blunt cone (sometimes there are two pores per cone).

HASTIGERINOIDES Brönnimann, 1952

Type species: *Hastigerinella alexanderi* Cushman, 1931.

The test is planispiral, the periphery lobate to stellate. Relict apertures are visible in both umbilici. *Hastigerinoides* differs from *Schuckoina* in having digitiform last chambers instead of chambers extended as tubulospines and in being planispiral from its initial stage.

HEDBERGELLA Brönnimann & Brown, 1958

Type species: *Anomalina lorneiana* d'Orbigny, var. *trocoidea* Gandolfi, 1942.

Emendation: Longoria, 1974.

Hedbergella is regarded as the common ancestor of all genera belonging to the family Globotruncanidae. Its characters changed so slowly during the Cretaceous that only minor morphological differences developed between *H. delrioensis* of Albian age and *H. holmdelensis* of Maastrichtian age. *Hedbergella* differs from *Globuligerina* and *Favusella* by the lack of a reticulate ornamentation; from *Ticinella* by the absence of umbilical supplementary apertures and from *Whiteinella* by the absence of portici.

HELVETOGLOBOTRUNCANA Reiss, 1957

Type species: *Globotruncana helvetica* Bolli, 1945.

The test is plano-convex, flat on the spiral side, strongly inflated umbilically. A peripheral keel may be present. The umbilicus is covered by a system of portici with infralaminar accessory apertures. Numerous pustules cover particularly the umbilical side of the test.

Helvetoglobotruncana is a short-lived genus of Early to Middle Turonian age. It evolved from a *Hedbergella* stock in the Late Cenomanian, via a *Whiteinella* stage. *Helvetoglobotruncana* is a close homeomorph of the Middle Maastrichtian *Gansserina gansseri*. However, the absence of a phyletic relationship and the wide chronological gap clearly separate them.

HETEROHELIX Ehrenberg, 1843

Type species: *Spiroplecta americana* Ehrenberg, 1844. (Now considered a junior synonym of *Heterohelix navarroensis* Loeblich, 1951, on the basis that '*H. [Spiroplecta] americana* Ehrenberg, 1844, is a junior secondary homonym of *H. [Textilaria] americana* Ehrenberg, 1843' (Brown, 1969).)

Synonym: *Guembelina* Egger, 1899.

Test either with a minute initial planispiral coil followed by a biserial stage, or biserial throughout. *Heterohelix* differs from *Pseudotextularia* in the width of chambers exceeding thickness.

MARGINOTRUNCANA Holker, 1956

Type species: *Rosulina marginata* Reuss, 1845.

Emendations: Pessagno, 1967. Porthault, 1970.

Marginotruncana differs from *Dicarinella* in its umbilical, sigmoidal and raised sutures; from *Globotruncana* in the extraumbilical position of its primary aperture and lack of tegilla; from *Rosita*, whose primary aperture opens in the umbilical area, in its umbilical-extraumbilical position. *Marginotruncana* may possess two keels, widely spaced as in *marginata* or closely spaced as in *sinuosa*, or a single one as in *sigali* and *murianosi*.

PLANOMALINA Loeblich & Tappan, 1946

Type species: *Planomalina aspidostroba* Loeblich & Tappan, 1946. (Junior synonym of *Planomalina buxtorfi* (Gandolfi), 1942.)

Emendations: Reiss, 1957. Wonders, 1975.

Planomalina differs from *Globigerinelloides* in a truncated test and the presence of a peripheral keel resulting in an acute edge view.

PRAEGLOBOTRUNCANA Bermudez, 1952

Type species: *Globorotalia delrioensis* Plummer, 1931.

Synonym: *Rotundina* Subbotina, 1953.

Emendations: Reiss, 1957. Banner & Blow, 1959. Porthault, 1970.

The umbilical-extraumbilical primary aperture carries a flap (*P. delrioensis*) or a porticus (*P. stephani*). Relict flaps or portici may be visible in the umbilical area. *Praeglobotruncana* evolved from *Hedbergella* by acquisition of an acute, imperforate periphery and pustules. Through development of a true double keel it gave rise to *Dicarinella* with *D. algeriana* as transitional form. *Praeglobotruncana* differs from *Marginotruncana* in its umbilical, radial and depressed sutures, and in the absence of a true double keel; from *Falsotruncana* in its relict flaps or portici in the umbilical area and in the absence of a true double keel.

PSEUDOGUEMBELINA Brönnimann & Brown, 1953

Type species: *Guembelina excolata* Cushman, 1926.

A sutural supplementary aperture, present only in the last chambers, opens backwards at the point where the base of the chamber meets the median suture. It is sometimes covered by a tubular flap. Longitudinal costae are fine or coarse. *Pseudoguembelina* differs from *Heterohelix* in the presence of sutural supplementary apertures along the median suture of the last chambers.

PSEUDOTEXTULARIA Rzehak, 1891

Type species: *Cuneolina elegans* Rzehak, 1891.

Pseudotextularia differs from all other Heterohelidae in having a greater number of chambers (typically 8-10 pairs). The primary aperture is a low wide arch at the base of the septal face.

RACEMIGUEMBELINA Montanaro-Galitelli, 1957

Type species: *Guembelina fructuosa* Egger, 1899.

With its proliferation of chambers and conically-shaped test this monospecific genus is readily distinguished from all other heterohelid genera.

ROSITA Robaszynski, Caron, Gonzalez & Wonders, 1984

Type species: *Globotruncana fornicata* Plummer, 1931.

The spiral side of the test can be moderately high as in *R. fornicata* or extremely high as in *R. contusa*. The umbilical area is covered by portici in helicoidal arrangement, situated deep in the umbilical cavity in high spired forms. The last chambers have a characteristic undulating surface. The two keels are closely spaced.

ROTALIPORA Brotzen, 1942

Type species: *Rotulipora turonica* Brotzen, 1942. (Now junior synonym of *Rotulipora cushmani* (Morrow), 1934.)

Synonyms: *Thalmaninella* Sigal, 1948.

Anaticinella Eicher, 1972.

Pseudotacinella Longoria, 1973.

Emendations: Reichel, 1950. Sigal, 1958.

Rotulipora differs from *Ticinella* in the presence of a keel and from *Globotruncanella* in the presence of umbilical sutural, supplementary apertures.

RUGOLOBIGERINA Brönnimann, 1952

Type species: *Globigerina rugosa* Plummer, 1927.

Synonyms: *Trinitella* Brönnimann, 1952.

Plummerina Brönnimann, 1952.

Kuglerina Brönnimann & Brown, 1956.

Emendation: Pessagno, 1967.

Rugoglobigerina differs from *Rugotruncana* in the lack of a double keel. According to Pessagno (1967), *Archaeoglobigerina* could have given rise to *Rugoglobigerina* by acquisition of meridionally arranged costellae. Later, *Rugotruncana* evolved from *Rugoglobigerina* by flattening of its chambers and by development of a true double keel.

RUGOTRUNCANA Brönnimann & Brown, 1956

Type species: *Rugotruncana tilevi* Brönnimann & Brown, 1956. (Junior synonym of *Rugotruncana subcircumnadifer* Gandolfi, 1955.)

Emendation: Pessagno, 1967.

Rugotruncana differs from *Rugoglobigerina* in the presence of a double keel; from *Globotruncana* in the presence of globigeriniform early chambers and costellae.

SCHACKOINA Thalmann, 1932

Type species: *Siderolina cenomana* Schacko, 1897.

Synonym: *Leupoldina* Bolli, 1957.

Schackoina differs from *Hastigerinoides* in its tubulespines or bulbousextensions of chambers instead of digitiform chambers, in the minute initial trochospiral stage and absence of relict apertures.

TICINELLA Reichel, 1950

Type species: *Anomalina roberti* Gandolfi, 1942.

Ticinella differs from *Rotulipora* in the lack of a peripheral keel.

WHITEINELLA Pessagno, 1967

Type species: *Whiteinella archaeocretacea* Pessagno, 1967.

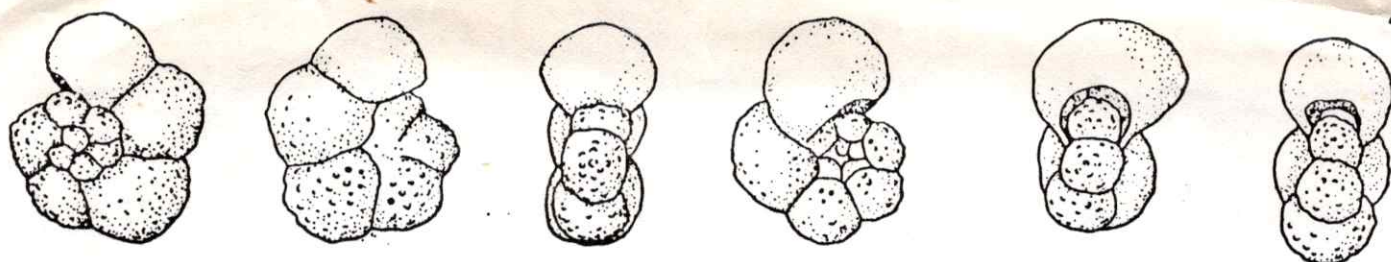
Whiteinella differs from *Heidelbergella* in the presence of portici; from *Archaeoglobigerina* in the absence of tegilla and absence of the wide imperforate peripheral band; from *Praeglobotruncana* in the absence of imbricated pustules along the peripheral margin. *Whiteinella* is a homeomorph of *Globotruncanella* but is segregated because of the wide chronological gap that separates them.

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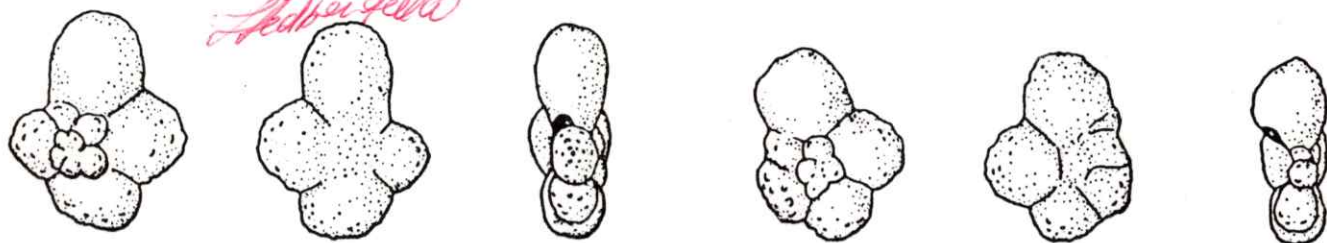
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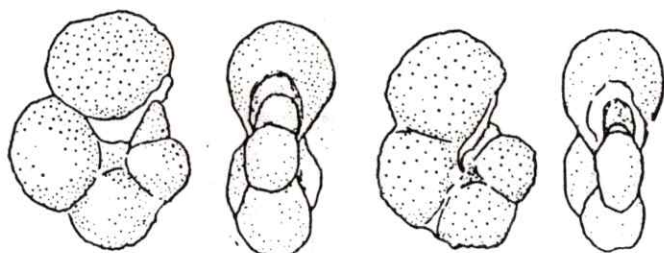
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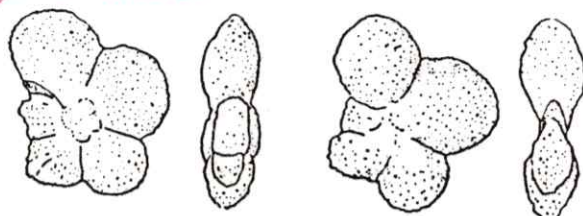
Globigerina gautierensis Brönnimann. Specimen on left: Holotype



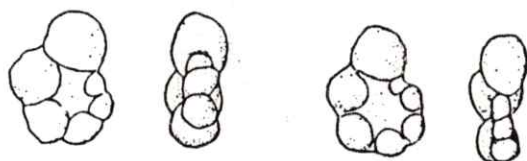
Globigerina cretacea d'Orbigny



Globigerinella messinae messinae Brönnimann. Holotype



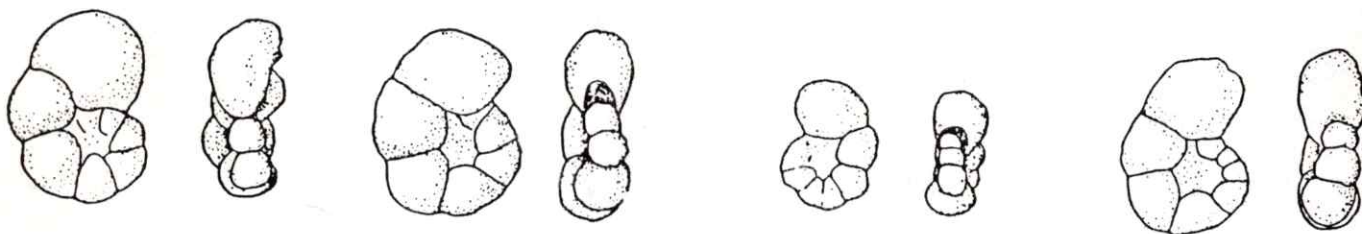
Globigerinella messinae subcarinata Brönnimann. Holotype



Globigerinella escheri escheri (Kaufmann)



Globigerinella escheri clavata Brönnimann



Globigerinella tururensis Brönnimann. Specimen on left: Holotype

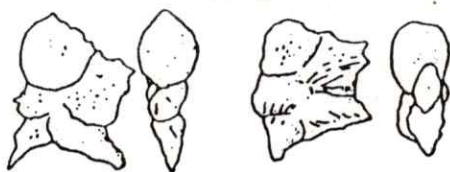
all specimens x 80

Globigerina =
Strebegella

Globigerinella =
Globigerinoides

Globigerinelloides

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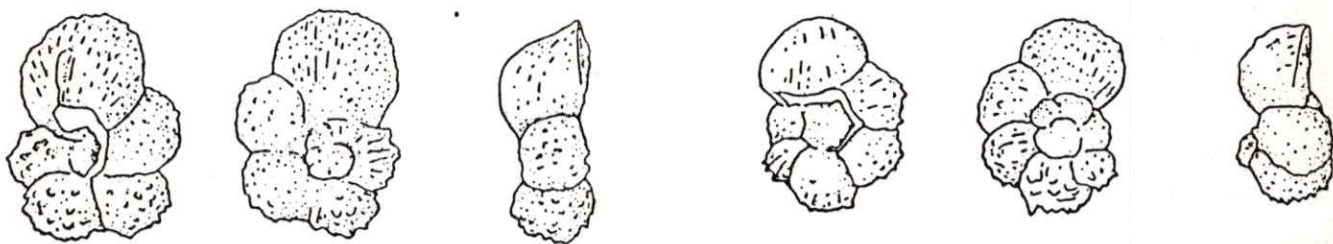
Plummerita hantkeninoides hantkeninoides Brönnimann. Specimen on left: Holotype



Plummerita hantkeninoides costata Brönnimann. Holotype

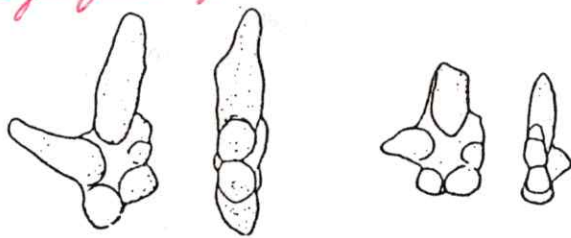


Plummerita hantkeninoides inflata Brönnimann. Specimen on left: Holotype

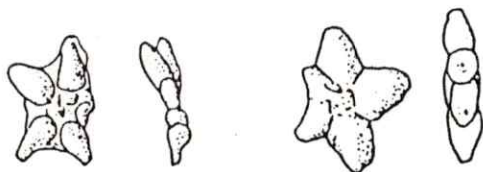


Trinitella scotti Brönnimann. Specimen on left: Holotype

Bugofolipeina



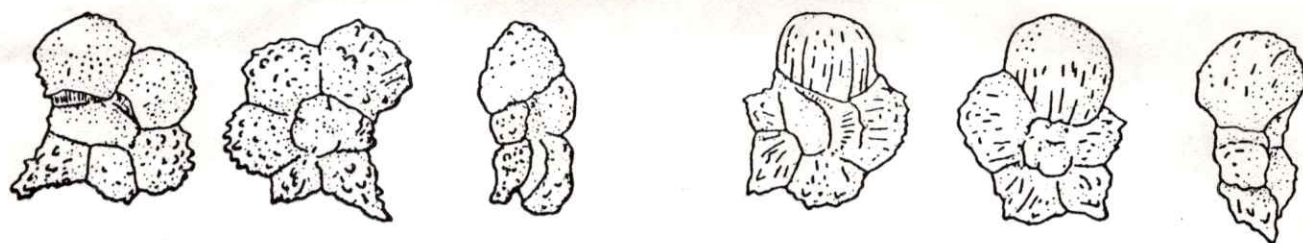
Hastigerinoides alexanderi (Cushman)



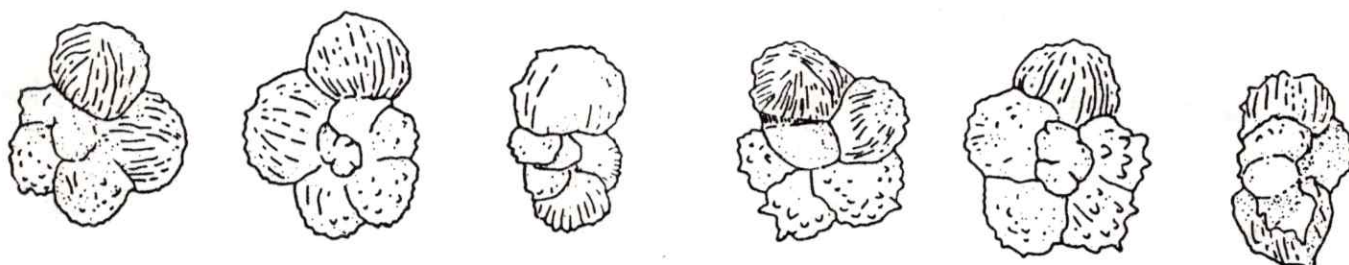
Hastigerinoides rohri Brönnimann

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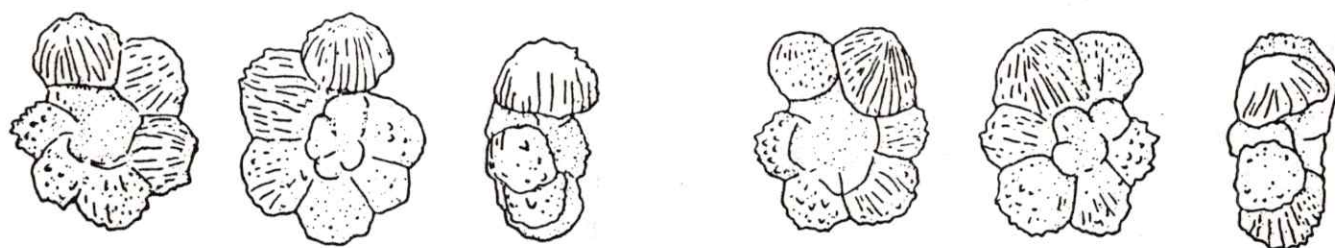
all specimens x 80



Rugoglobigerina reicheli reicheli Brönnimann



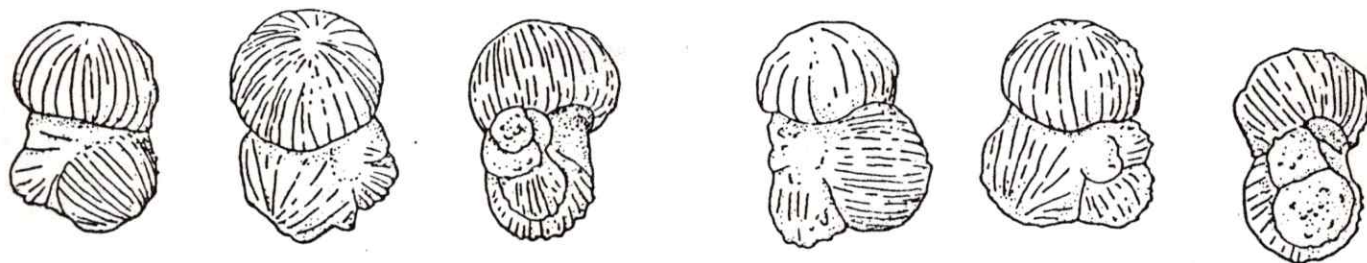
Rugoglobigerina reicheli pustulata Brönnimann



Rugoglobigerina reicheli hexacamerata Brönnimann

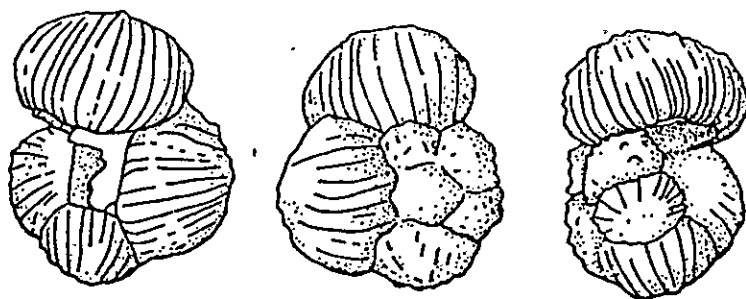


Rugoglobigerina macrocephala macrocephala Brönnimann

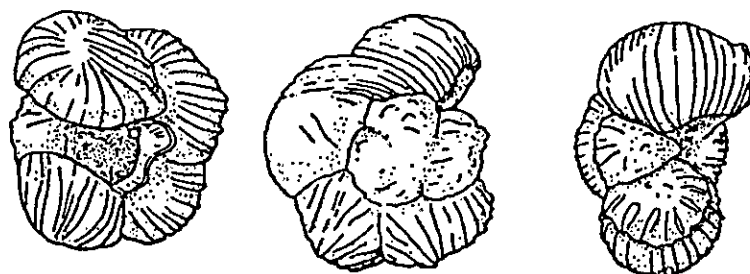


Rugoglobigerina macrocephala ornata Brönnimann

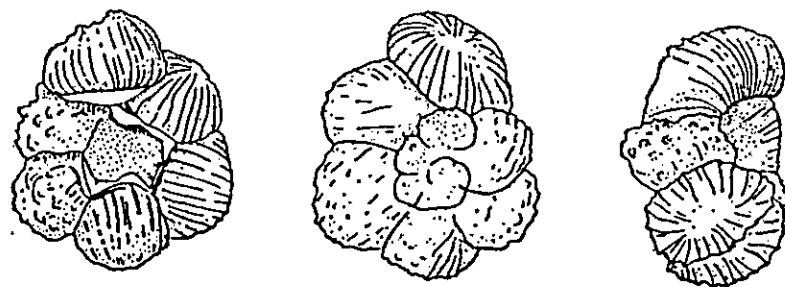
all specimens x 80



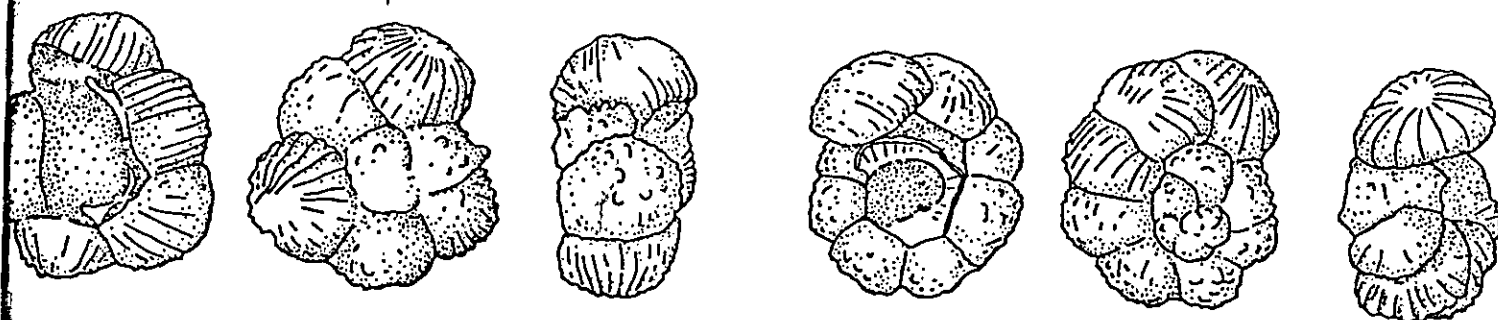
Rugoglobigerina rugosa rugosa (Plummer) 4-chambered specimen



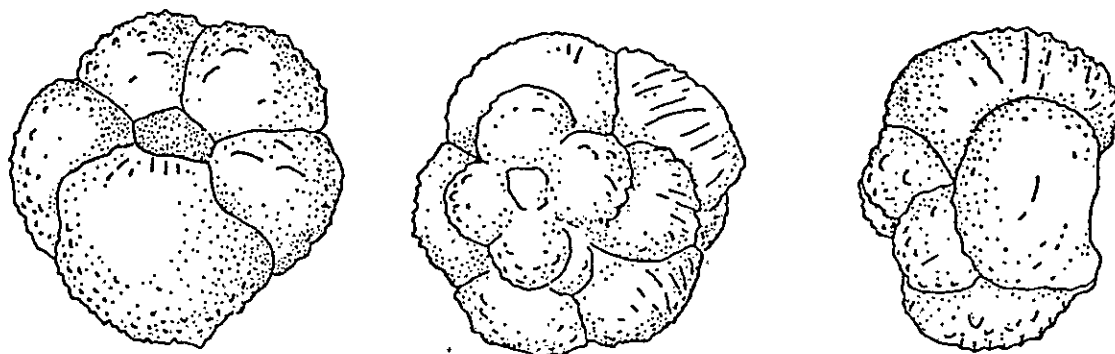
Rugoglobigerina rugosa rugosa (Plummer) 5-chambered specimen



Rugoglobigerina rugosa rugosa (Plummer) 6-chambered specimen



Rugoglobigerina rugosa pennyi Brönnimann



Rugoglobigerina rugosa rotundata Brönnimann

all Specimens x 80

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