

PLANKTIC FORAMINIFERA
OF THE CRETACEOUS AND PALEOCENE - EOCENE

PART I: CRETACEOUS

Course given by
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Caracas
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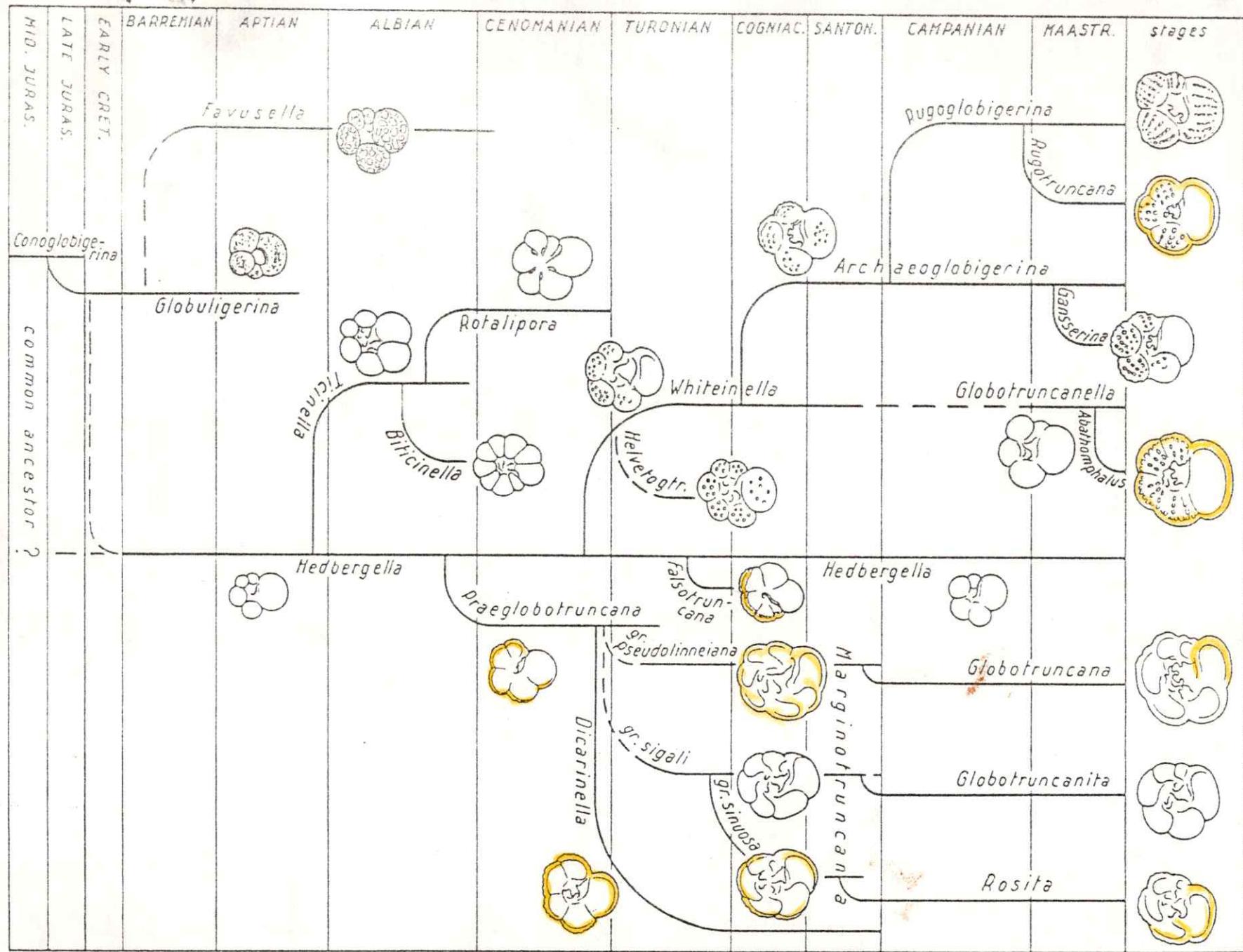
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4: Caron: Cretaceous planktic foraminifera

Table 1. Classification of the Cretaceous Globigerinacea

1. Test bi-, tri-, multiserial:	HETEROHELICIDAE	
2. Test planispiral	PLANOMALINIDAE	
3. Test trochospiral 'Globigerina-like', primitive forms: 'Hedbergella-lineage', evolved forms:	FAVUSELLIDAE 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	<i>Heterohelix</i> <i>Pseudotextularia</i> <i>Pseudoguembelina</i> <i>Guembelitria</i> <i>Racemiguembelina</i> <i>Planomalina</i> <i>Globigerinelloides</i> <i>Hastigerinoides</i> <i>Schackoyna</i> <i>Globuligerina</i> <i>Favusella</i> <i>Hedbergella</i> <i>Praeglobotruncana p.p.</i> <i>Falsotruncana</i> <i>Ticinella</i> <i>Biticinella</i> <i>Rotalipora</i> <i>Whiteinella</i> <i>Helvetoglobotruncana</i> <i>Praeglobotruncana p.p.</i> <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>
	primary aperture umbilical-extrumbilical-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-extrumbilical 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	



KEY TO CRETACEOUS PLANKTIC TROCHOSPIRAL GENERA

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

2. Chamber architecture

3. Primary aperture

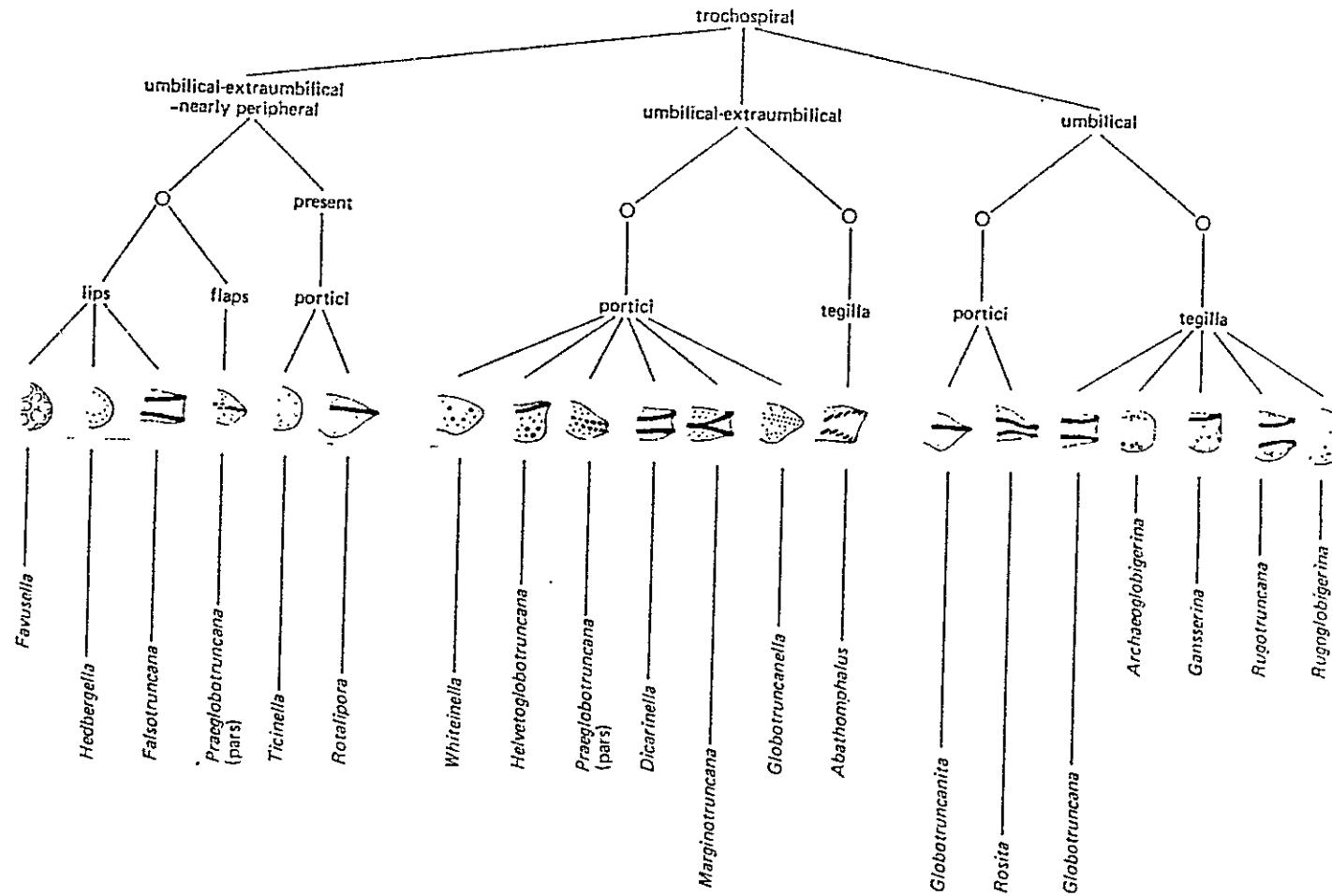
4. Supplementary apertures
on umbilical side

5. Protection of primary
aperture and umbilicus

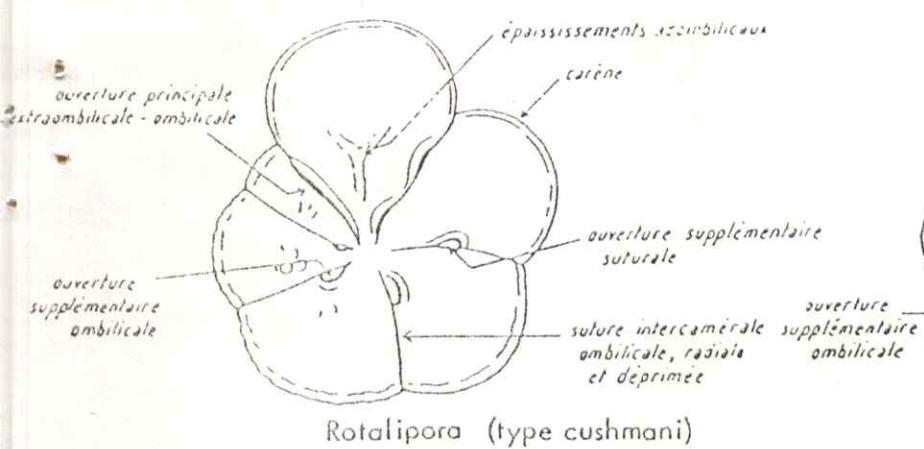
6. Keels (0, 1, 2)
or imperforate band

7. Heavy ornamentation
(reticulate, rugose
or costellate)

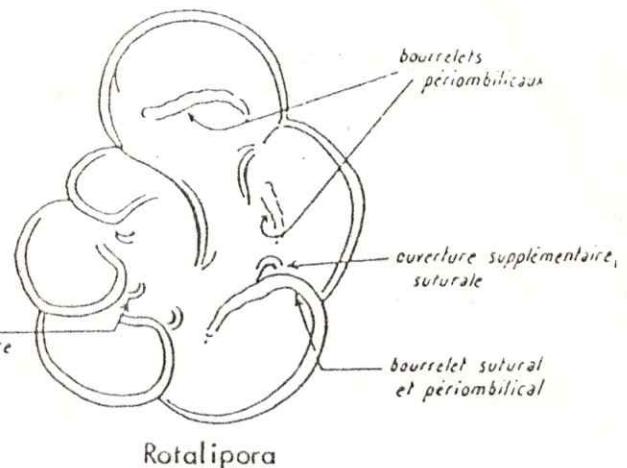
8. Umbilical sutures
depressed
raised



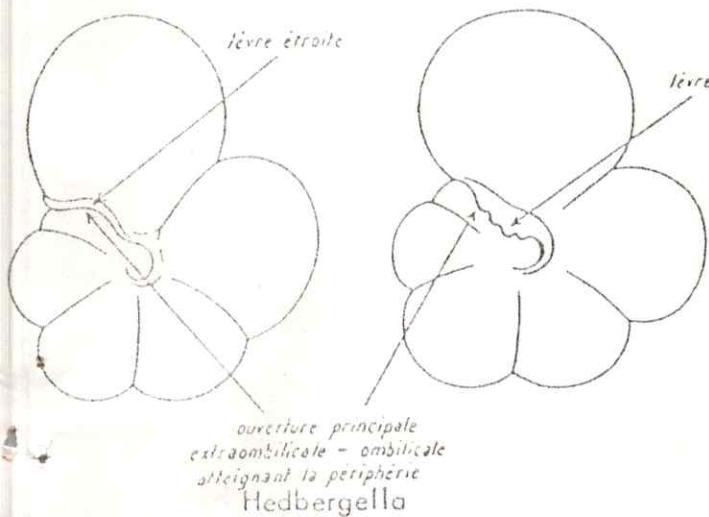
Distinctive features of some Cretaceous planktic foraminiferal genera



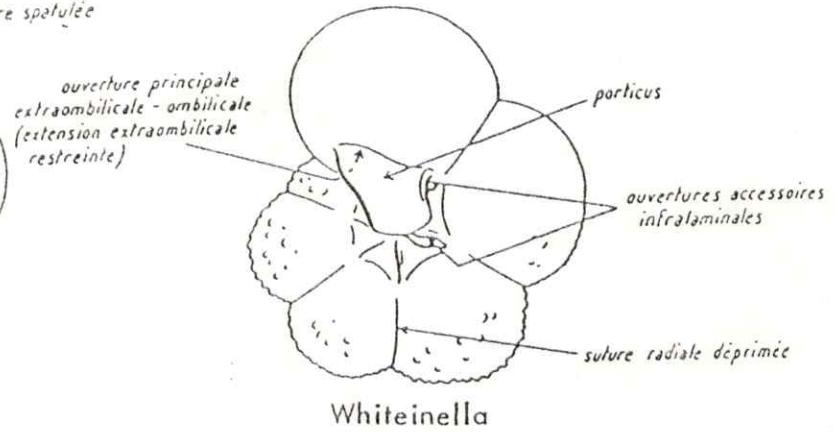
Rotalipora (type cushmani)



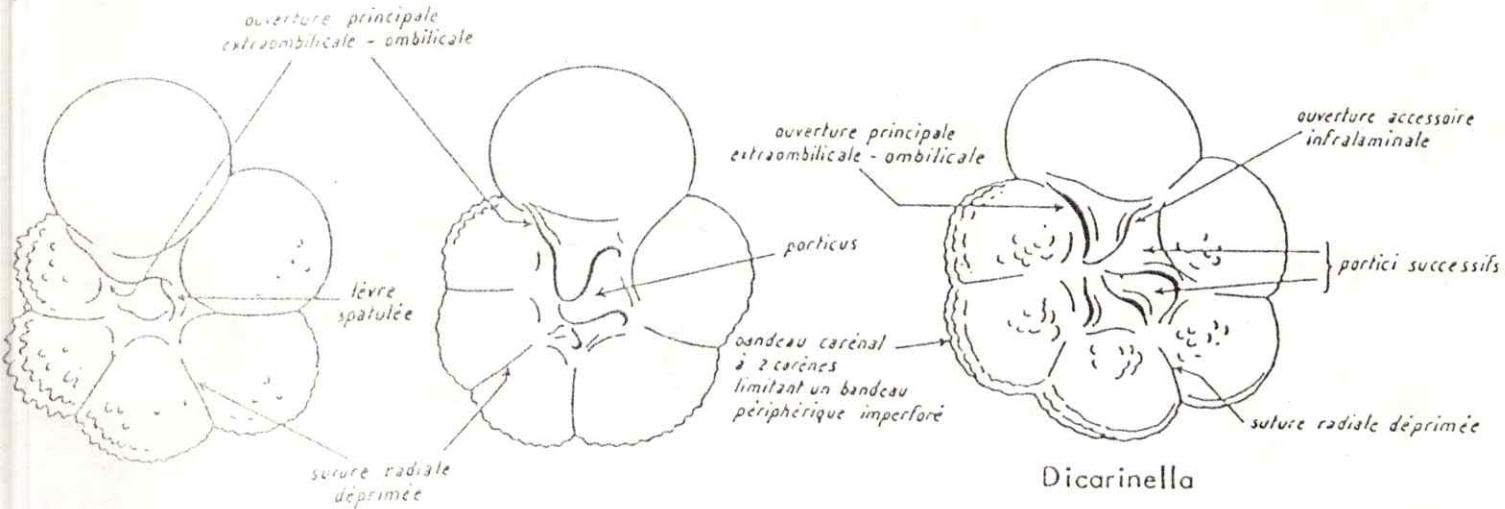
Rotalipora



Hedbergella

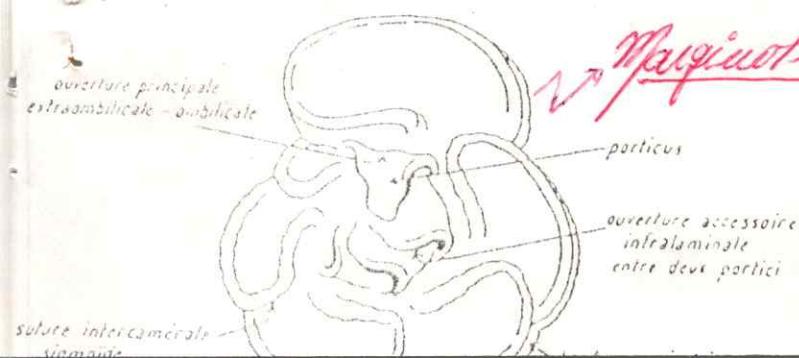


Whiteinella

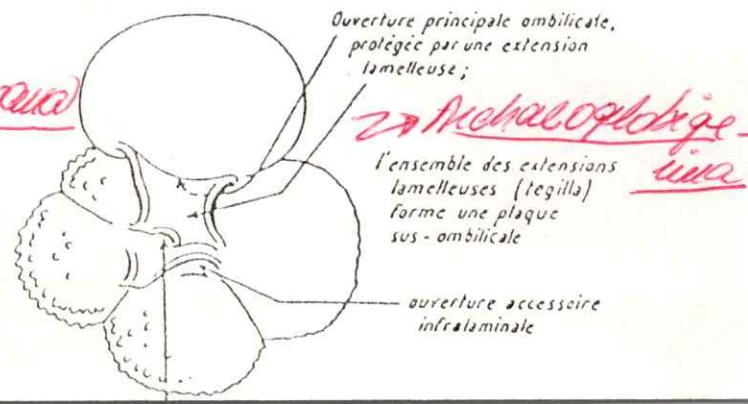


Dicarinella

Forme primitive Praeglobotruncaniforme évoluée



Magiostomaria



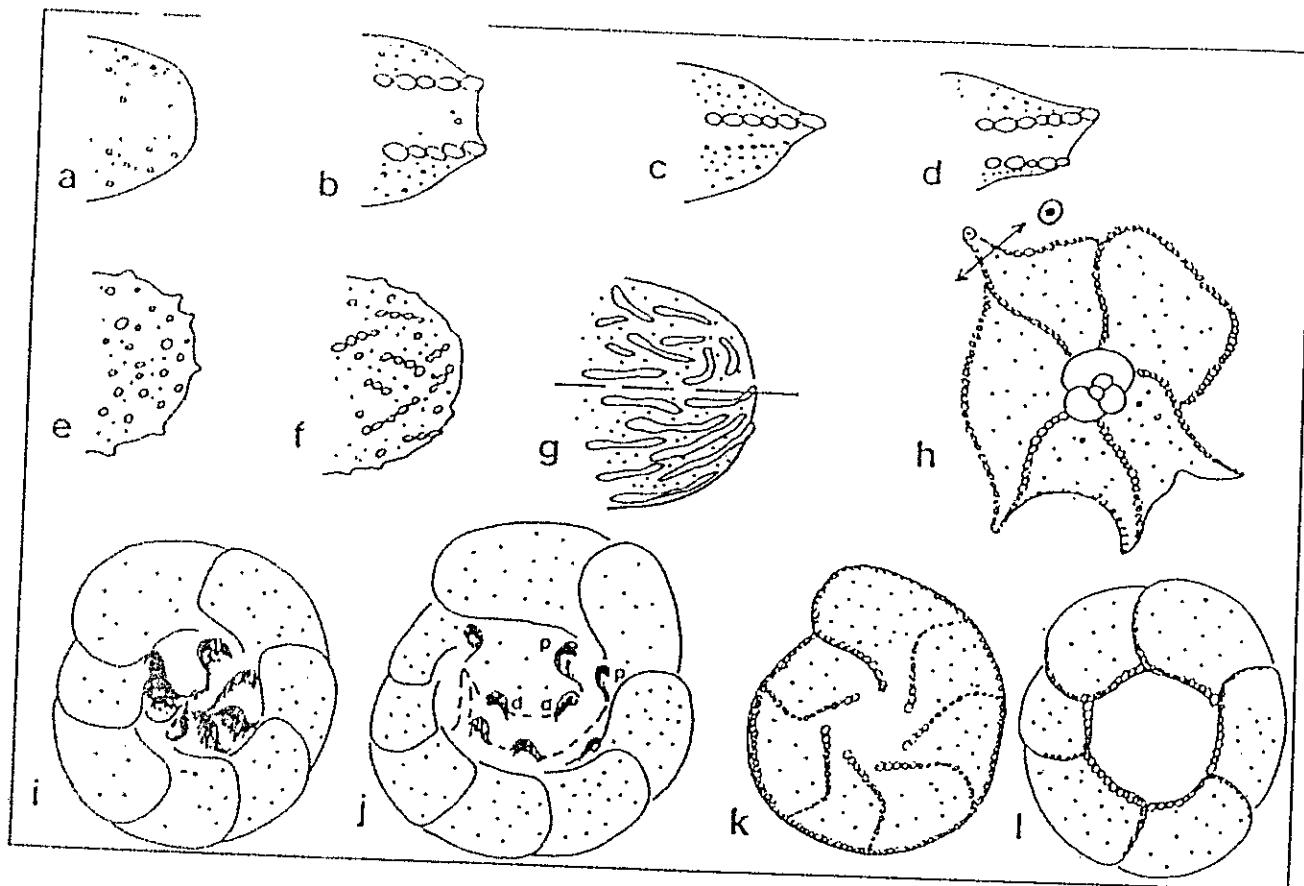
Michaeoplistis

l'ensemble des extensions lamelleuses (tegilla) forme une plaque sus - ombricale

ouverture accessoire infralaminale

characters		genera										GLOBOTRUNCANA				
		HEDB.	WHIT.	ARCH.	RUGG.	G'LLA	ABAT.	GANS.	DICA.	MARG.	arca-	linn.	aeg.	ROS.	G'ITA.	
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 : tubulospinous, 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) = "infralaminal accessory apertures" auct., and distal accessory apertures (d) = "intralaminal 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.

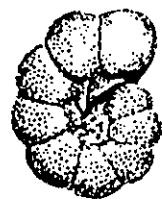
IV. DESCRIPTIVE TERMINOLOGY, GLOSSARY

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.G.P.F. (1979). However, some modifications and additions had to be made :

- Pustule : small isometric imperforate surface elevation.
- Rugosity : several conglutinated 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 ("infralaminal" apertures auct.) open near the primary aperture and the suture, and *distal* accessory apertures ("intralaminal" 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.

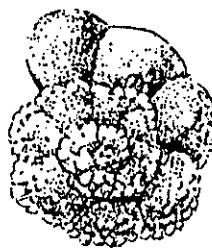
Planomalina breggiensis
x 100



Planomalina buxtorfi
x 90



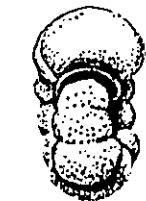
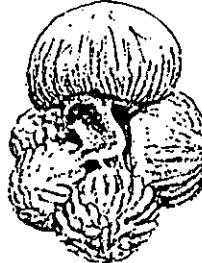
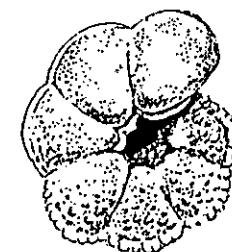
Praeglobotruncana stephani
x 115



Rugoglobigerina rugosa
x 110

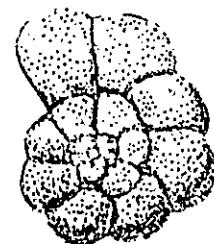


Trinitella scotti
x 160

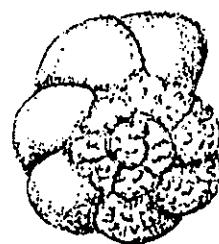


TICINELLA - ROTALIPORA

Ticinella roberti
x 115



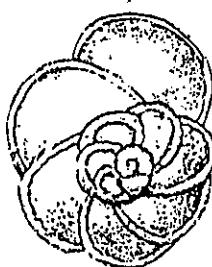
Rotalipora subticinensis
x 160



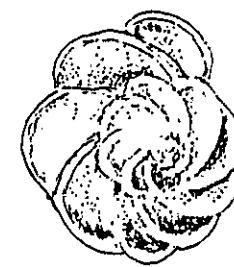
Rotalipora ticinensis
x 135



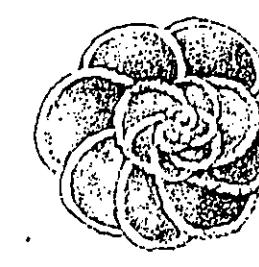
Rotalipora apenninica
x 125



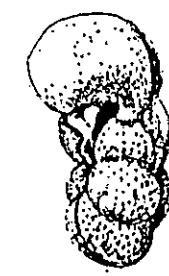
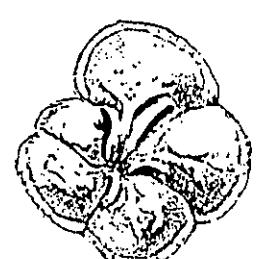
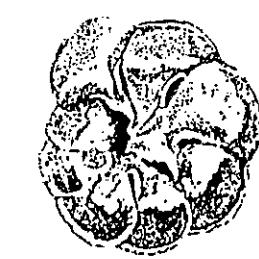
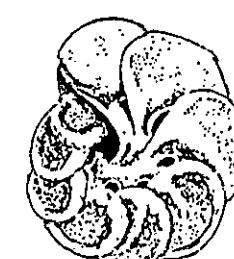
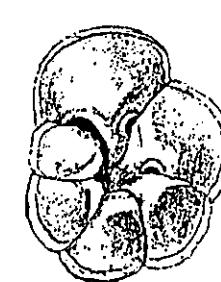
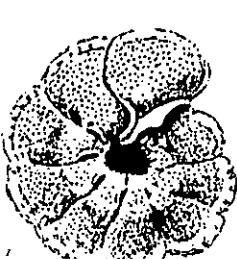
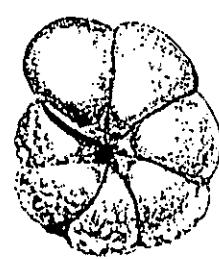
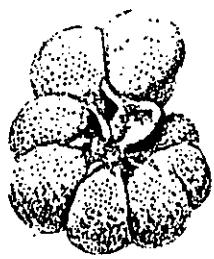
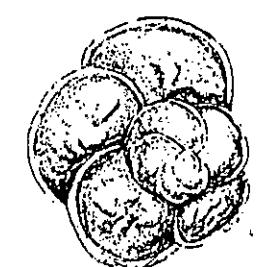
Rotalipora greenhornensis
x 75



Rotalipora reicheli
x 90

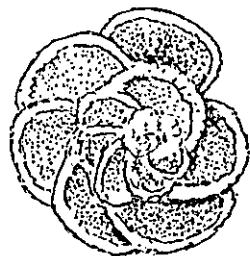


Rotalipora cushmani
x 90

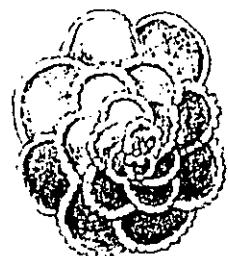


SINGLE KEELED GLOBOTRUNCANA SPECIES

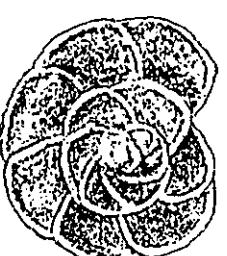
Globotruncana sigilli
x 110



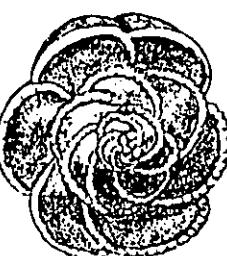
Globotruncana falsostuarti
x 80



Globotruncana stuarti
x 65



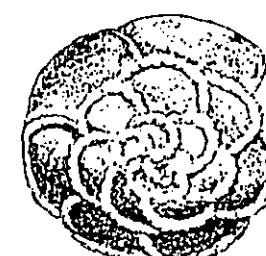
Globotruncana elevata
x 65



Globotruncana calcarata
x 85



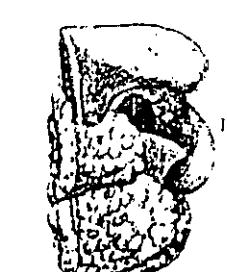
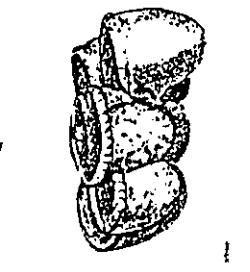
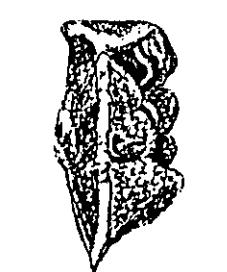
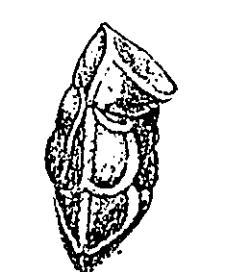
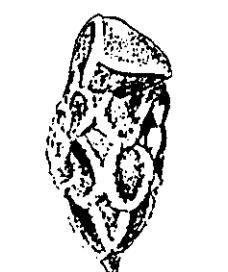
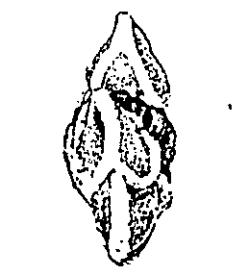
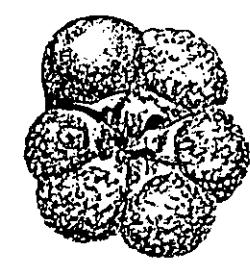
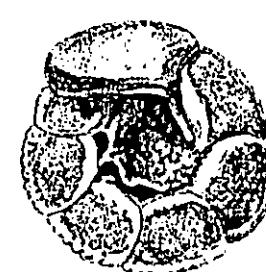
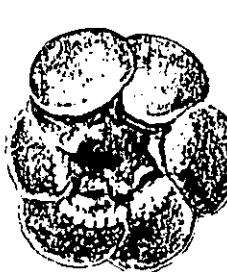
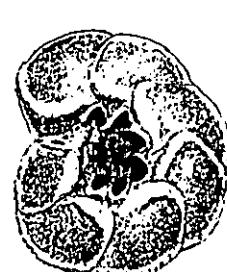
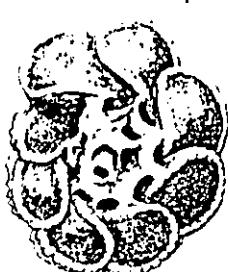
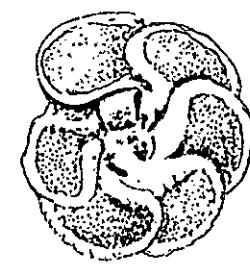
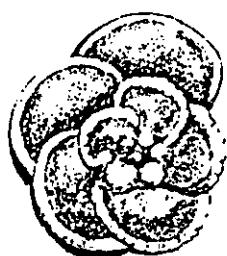
Globotruncana conica
x 95



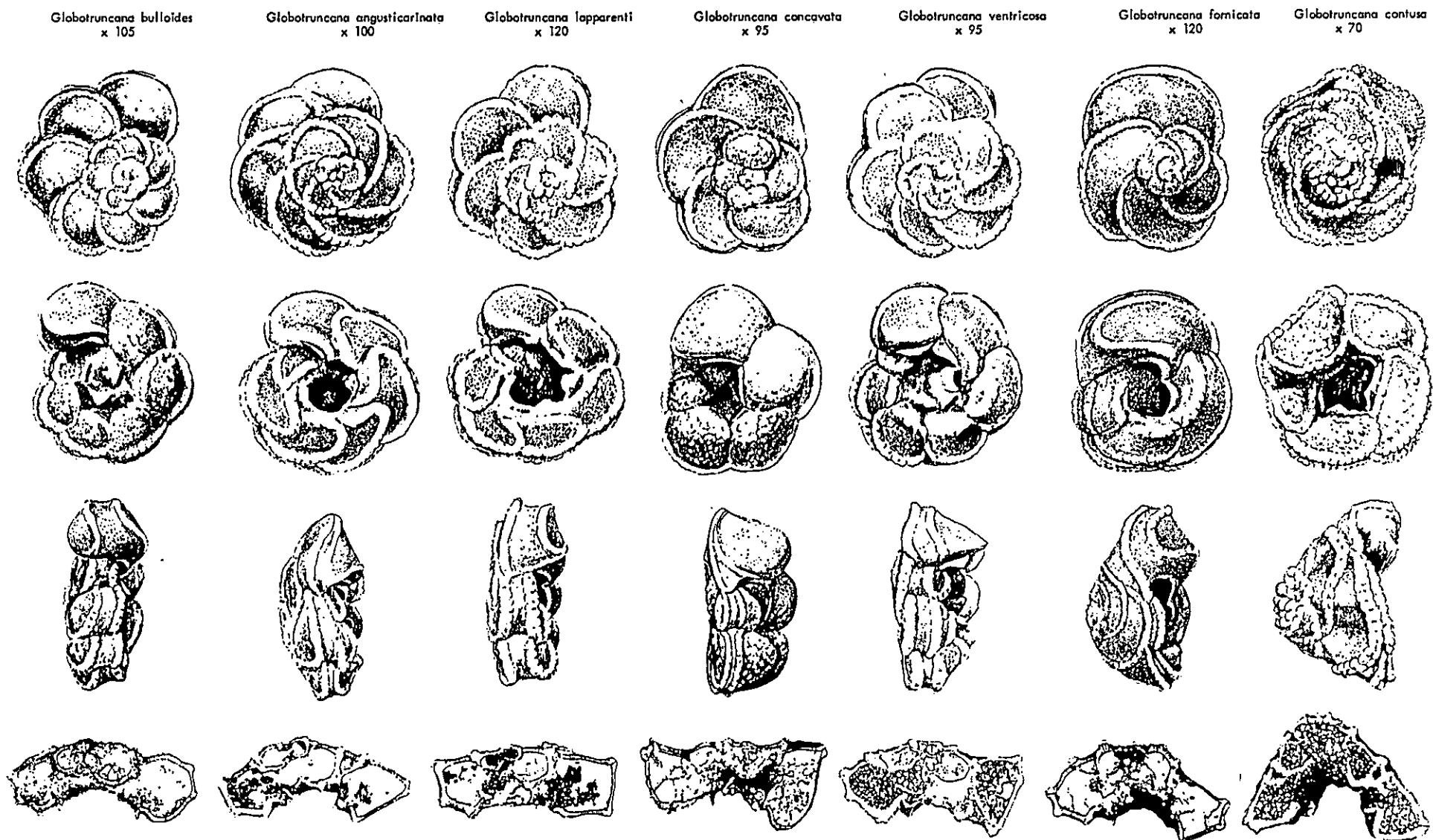
Globotruncana helvetica
x 90

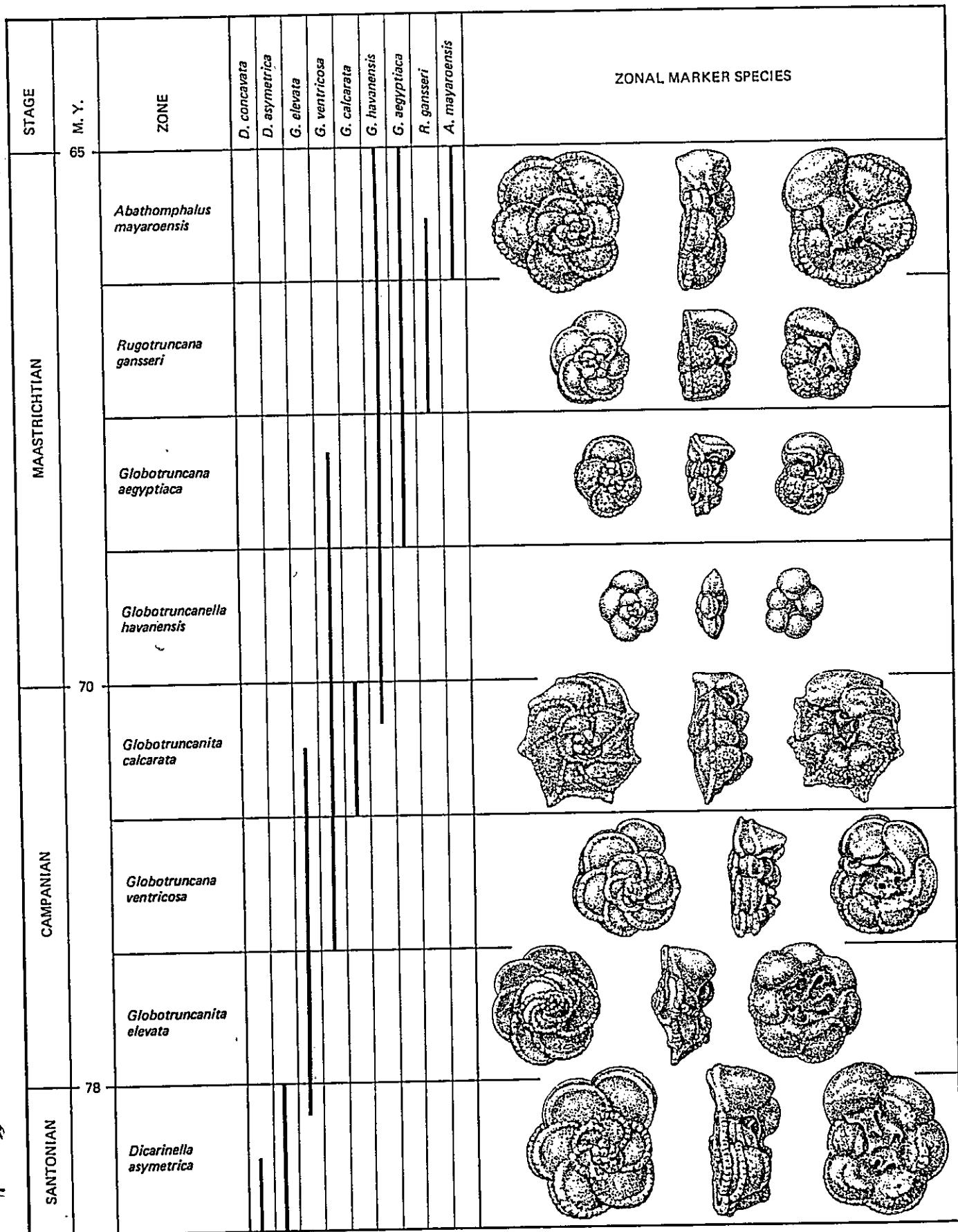


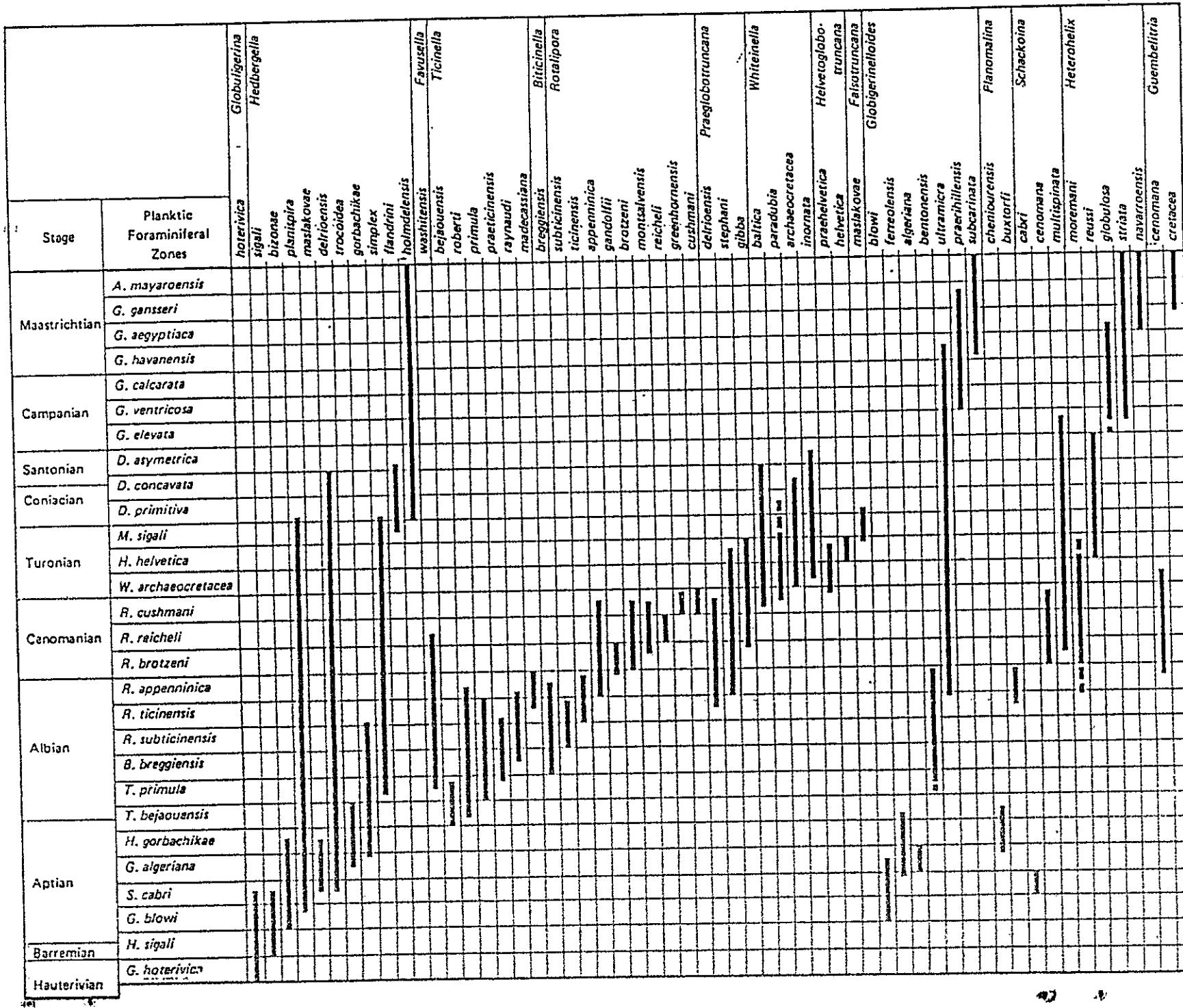
Globotruncana gansseri
x 120



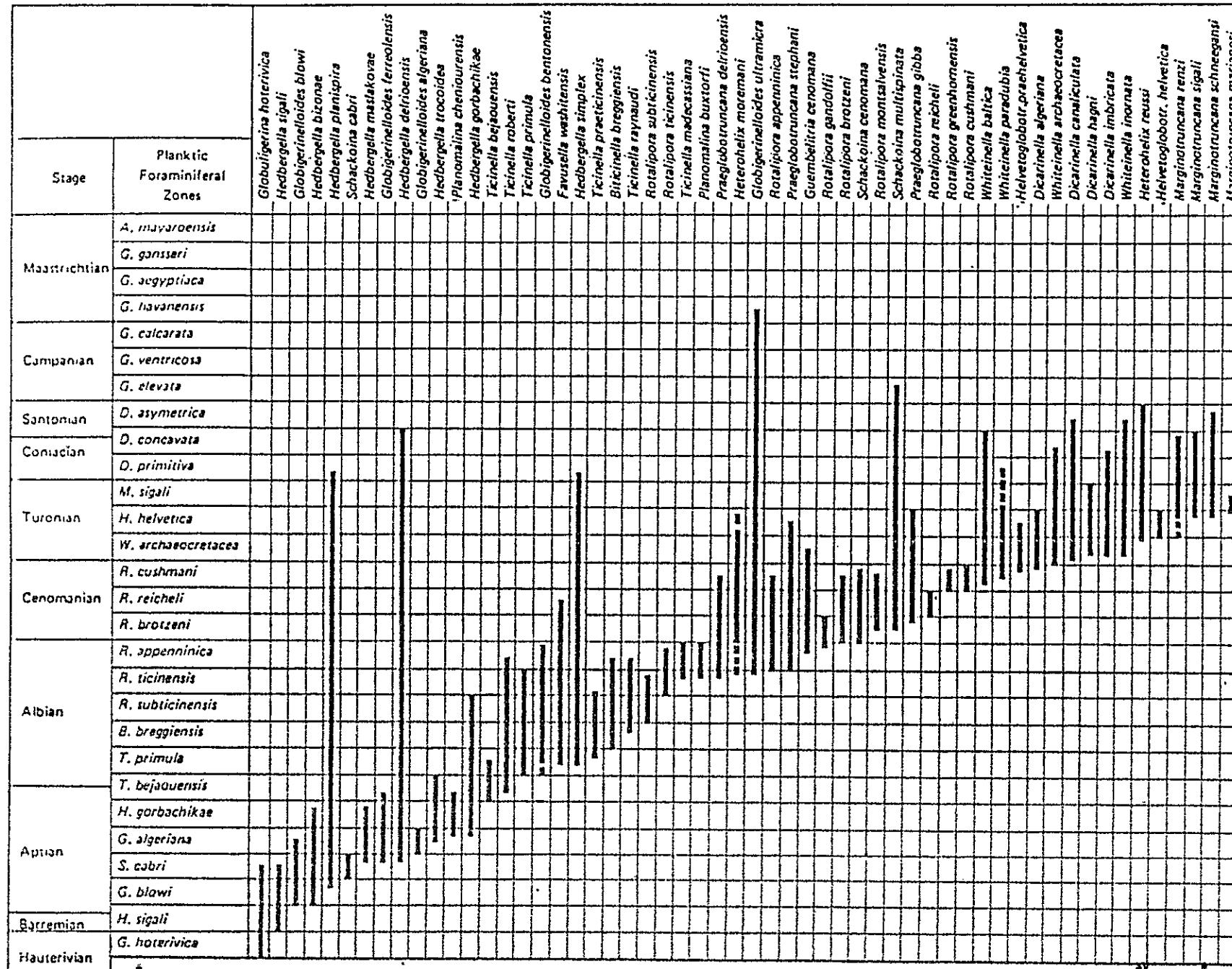
DOUBLE KEELED GLOBOTRUNCANA SPECIES

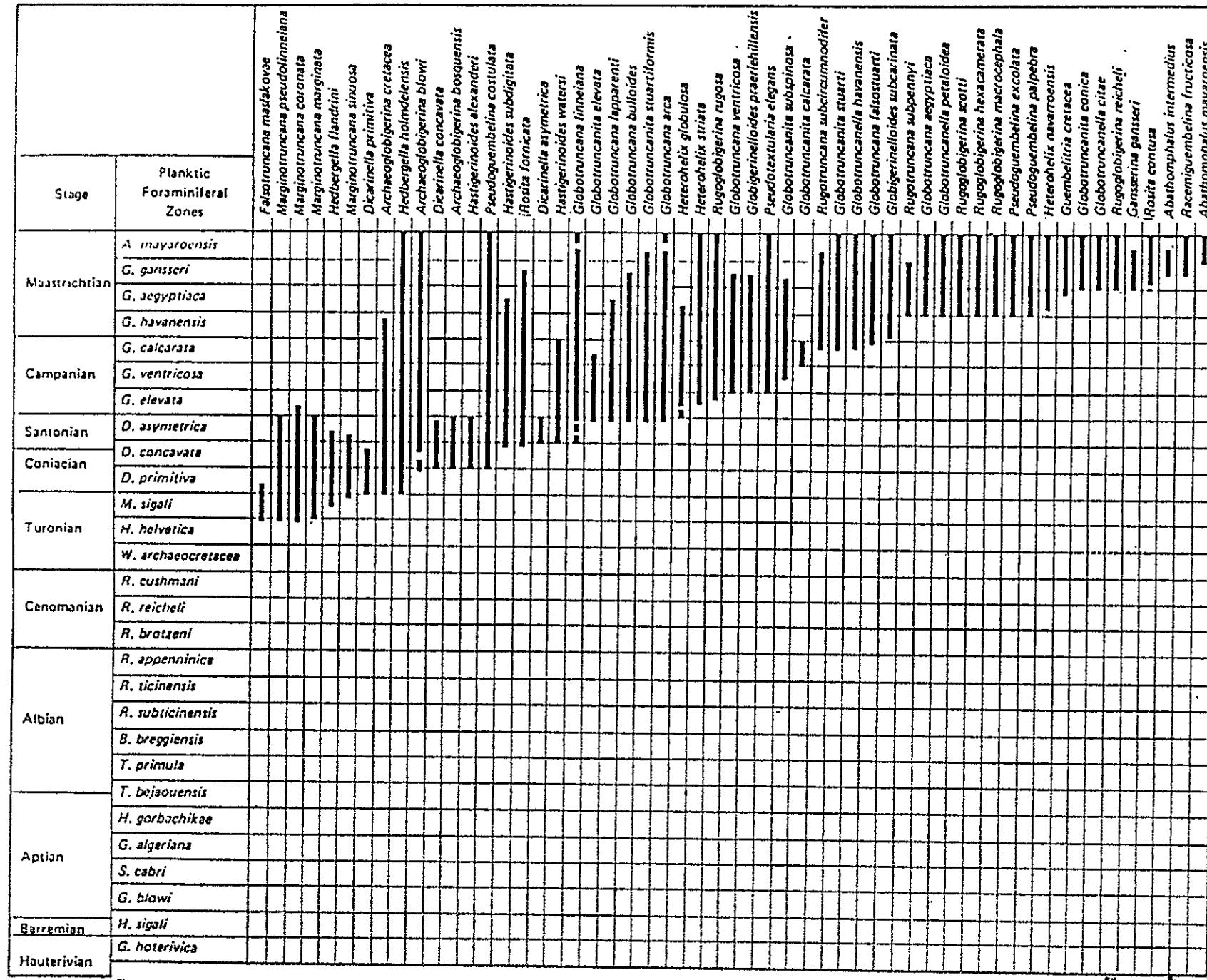


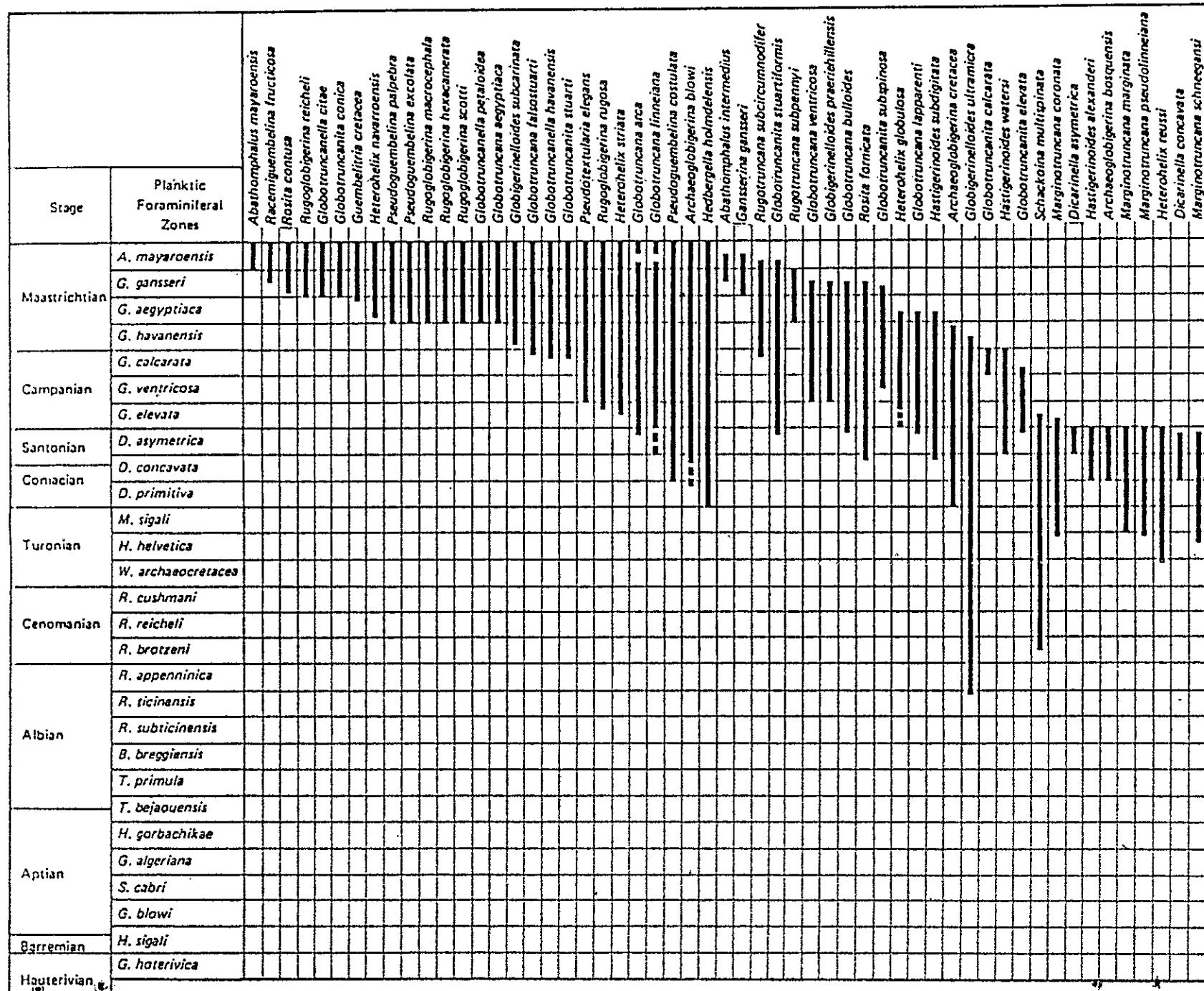




		<i>Dicarinella</i>	<i>Globotruncana</i>	<i>Rugoglobigerina</i>	<i>Gansserina</i>
Stage	Planktic Foraminiferal Zones				
Maastrichtian	<i>A. mayaroensis</i>	<i>algeriana</i>			
	<i>G. gansseri</i>	<i>canaliculata</i>			
	<i>G. aegyptiaca</i>	<i>imbricata</i>			
	<i>G. havanensis</i>	<i>hagni</i>			
Campanian	<i>G. calcarea</i>	<i>primitive</i>			
	<i>G. ventricosa</i>	<i>concavata</i>			
	<i>G. elevata</i>	<i>asymmetrica</i>			
Santonian	<i>D. asymmetrica</i>				
Coniacian	<i>D. concavata</i>				
	<i>D. primitive</i>				
	<i>M. sigali</i>				
Turonian	<i>H. helvetica</i>				
	<i>W. archaeocretacea</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. bregiensis</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>				
	<i>G. hoterivica</i>				
Hauterivian					





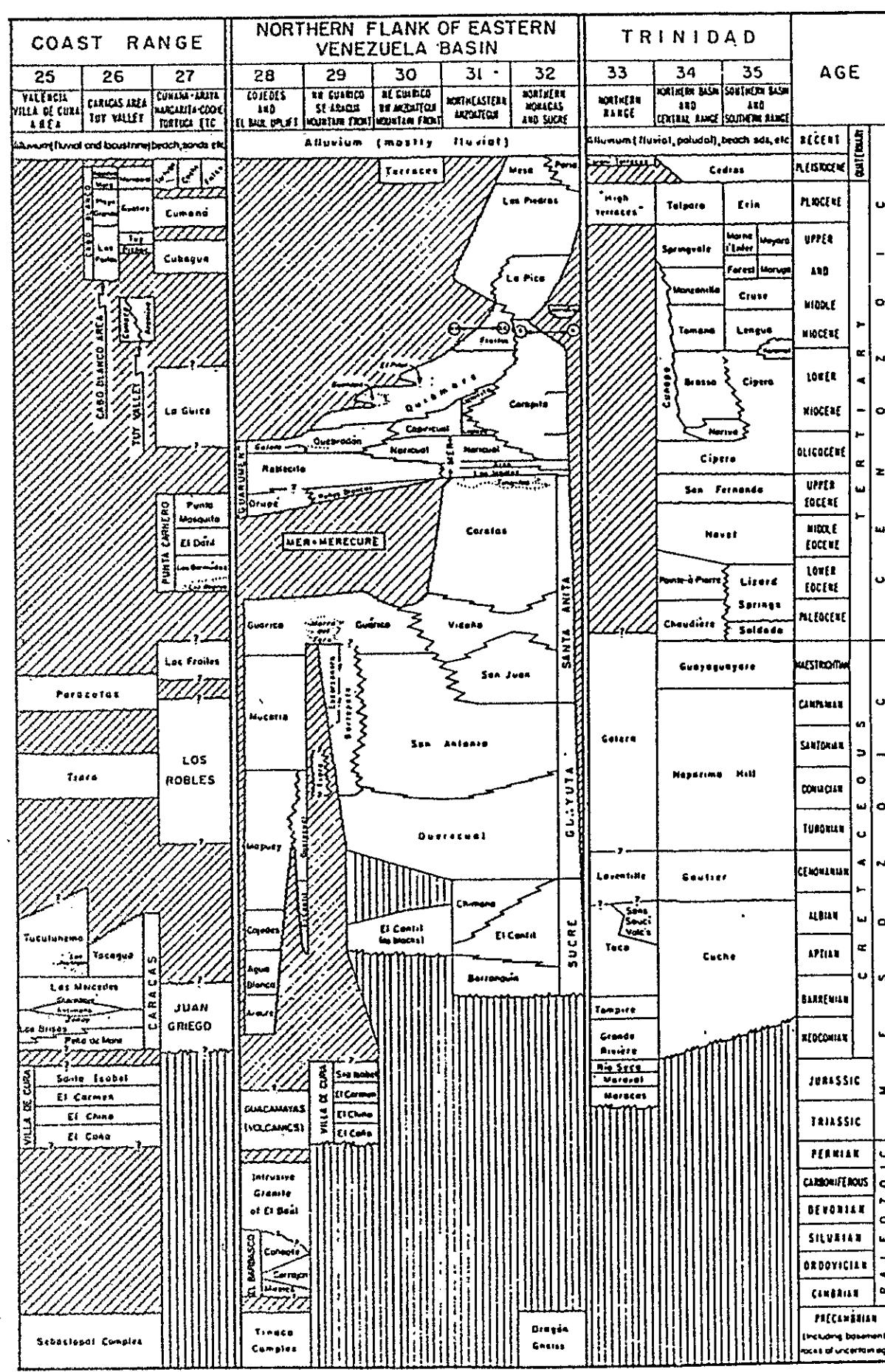


STAGE m. y.	CARON this chapter	WONDERS 1980	VAN HINTE 1976	SIGAL 1976	POSTUMA 1971	PESSAGNO 1967	BOLLI 1966		
65	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>		
MAASTRICHTIAN	<i>gansseri</i>	<i>contusa</i>	<i>contusa</i>	<i>gansseri</i>	<i>gansseri</i>	<i>contusa</i>	<i>mayaroensis</i>		
			<i>stuarti</i>						
		<i>gansseri</i>	<i>gansseri</i>						
		<i>aegyptiaca</i>	" <i>tricarinata</i> "						
	<i>havanensis</i>	<i>calcarata</i>	<i>scutilla</i>	<i>stuarti</i> + <i>falsostuarti</i>	<i>stuartiformis</i>	<i>subcircumnoditer</i>	<i>lapp. tricar.</i>		
			<i>calcarata</i>	<i>calcarata</i>	<i>calcarata</i>				
70	<i>ventricosa</i>	<i>ventricosa</i>	<i>subspinosa</i>	<i>elevata</i> + <i>stuartiformis</i>	<i>elevata</i>	<i>form. stuartiformis</i>	<i>calcarata</i>		
<i>stuartiformis</i>									
<i>elevata</i>		<i>elevata</i>							
		<i>concavata</i> + <i>carinata</i>							
78	<i>asymetrica</i>	<i>carinata</i>	<i>elevata</i> + <i>concavata</i>			<i>A. blowi</i>	<i>fornicata</i>		
<i>concavata</i> + <i>sigali</i>									
<i>concavata</i>		<i>sigali</i> + <i>renzi</i>							
		<i>sigali</i>							
82	<i>primitiva</i>	<i>primitiva</i>	<i>helvetica</i>	<i>helvetica</i>	<i>helvetica</i>	<i>archaeocretacea</i>	<i>helvetica</i>		
<i>archaeocretacea</i>									
86		<i>M. sigali</i>	<i>lehmanni</i>						
<i>cushmani</i>									
92	<i>helvetica</i>	<i>archaeocretacea</i>	<i>cushmani</i>	<i>cushmani</i>	<i>cushmani</i>	<i>gigantea</i>	<i>gigantea</i>		
<i>reicheli</i>									
<i>brotzeni</i>		<i>globotruncanoides</i>	<i>greenhornensis</i>						
		<i>gandolfii</i> + <i>greenhornensis</i>							
100	<i>appenninica</i>	<i>appenninica</i>	<i>appenninica</i> + <i>buxtorfi</i>	<i>appenninica</i> + <i>buxtorfi</i>	<i>greenhornensis</i>	<i>reicheli</i>	<i>reicheli</i>		
<i>ticinensis</i> + <i>buxtorfi</i>									
<i>praebuxtorfi</i>		<i>praebuxtorfi</i>	<i>appenninica</i>						
		<i>ticinensis</i>							
ALBIAN	<i>subticinensis</i>	<i>subticinensis</i>	<i>subticinensis</i>	<i>breggiensis</i>	<i>breggiensis</i>	<i>appenninica</i>	<i>appenninica</i>		
			<i>breggiensis</i>						
		<i>primula</i>	<i>primula</i>		<i>subticinensis</i>				
			<i>bejaouensis</i>						
	<i>bejaouensis</i>	<i>bejaouensis</i>	<i>recheli</i> + <i>primula</i>		<i>ticinensis</i>	<i>ticinensis</i>			
			<i>planispira</i>						
		<i>ferreolensis</i> + <i>bejaouensis</i>	<i>bejaouensis</i>				<i>roberti</i>		
			<i>trochoidea</i>						
		<i>algeriana</i>	<i>algeriana</i>				<i>roberti</i>		
			<i>ferreolensis</i>						
APTIAN	<i>cabri</i>	<i>cabri</i>	<i>cabri</i>	<i>cabri</i>	<i>cabri</i>	<i>roberti</i>	<i>roberti</i>		
			<i>blowi</i>						
		<i>blowi</i>	<i>blowi</i>						
			<i>gottisi</i> / <i>duboisii</i>						
	<i>H. sigali</i>	<i>sigali</i>	<i>similis</i>						
			<i>sigali</i>						
115	<i>hauerivica</i>	<i>hauerivica</i>	<i>gr. hauerivica</i>						
BARREMIAN									
121	<i>minute planktic foraminifera</i>								
HAUTERIVIAN									

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	MAASTRICHTIAN	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>contusa</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>	<i>mayaroensis</i>
70			<i>gansseri</i>		<i>gansseri</i>	<i>contusa</i>	<i>caliciformis</i> + <i>citae</i>	<i>gansseri</i>	<i>gansseri</i>
			<i>subcircumnodifer</i>	<i>rugosa</i>	<i>subcircumnodifer</i>	<i>lap. tricarinata</i>		<i>stuarti</i>	<i>stuarti</i>
78	CAMPANIAN	<i>japonica</i> <i>robusta</i>	<i>calcarata</i>	<i>marisi</i>	<i>calcarata</i>	<i>calcarata</i>	<i>calcarata</i>	<i>morozovae</i>	
			<i>stuartiformis</i> + <i>elevata</i>	<i>rosetta</i>	<i>churchi</i>	<i>elevata</i>	<i>ventricosa</i>	<i>elevata</i> + <i>stuartiformis</i>	
			<i>stuartiformis</i> + <i>elevata</i>		<i>blowi</i>	<i>elevata</i>		<i>elevata</i>	
82	SANTONIAN	<i>hanzavae</i>	<i>carinata</i>	<i>coronata</i> + <i>linneiana</i>	<i>bullardes</i> <i>fornicata</i>	<i>fornicata</i>	<i>conc. carinata</i> + <i>concavata</i>	<i>carinata</i>	<i>fornicata</i>
			<i>concavata</i>			<i>concavata</i>			<i>concavata</i>
			<i>primitiva</i>	<i>cachensis</i>		<i>primitiva</i>			<i>primitiva</i>
86	CONIACIAN	<i>japonica</i>	<i>renzi</i>	<i>helvetica</i>	<i>archaeocretacea</i>	<i>archaeocretacea</i>	<i>schneegansi</i>	<i>schneegansi</i>	<i>angusticarinata</i>
			<i>helvetica</i>			<i>sigali</i>			<i>lapparenti</i>
									<i>helvetica</i>
92	TURONIAN	<i>rugosa</i>	<i>cushmani</i>	<i>helvetica</i>	<i>archaeocretacea</i>	<i>helvetica</i>	<i>schneegansi</i>	<i>schneegansi</i>	<i>cushmani</i>
			<i>stephani</i>			<i>"grandes</i> <i>globigerines"</i>			<i>deekiei</i>
			<i>greenhornensis</i> <i>gandolfii</i> <i>brotzeni</i>			<i>cushmani</i> + <i>greenhornensis</i>			<i>appenninica</i>
100	CENOMANIAN	<i>brotzeni</i>	<i>greenhornensis</i>	<i>appenninica</i>	<i>Rotalipora</i> s.s.	<i>appenninica</i>	<i>globotruncanoides</i> + <i>brotzeni</i>	<i>montsalvensis</i>	<i>globotruncanoides</i> + <i>brotzeni</i>
			<i>evoluta</i> + <i>appenninica</i>			<i>evoluta</i>			
			<i>appenninica</i> + <i>buxtorfi</i>			<i>washitensis</i>			
108	ALBIAN	<i>breggiensis</i>	<i>ticinensis</i>	<i>buxtorfi</i>	<i>ticinensis</i>	<i>appenninica</i> + <i>buxtorfi</i>	<i>appenninica</i>	<i>appenninica</i> + <i>buxtorfi</i>	<i>ticinensis</i>
			<i>breggiensis</i>			<i>breggiensis</i>			
			<i>roberti</i>			<i>primula</i>	<i>ticinensis</i>	<i>praeiticinensis</i>	<i>breggiensis</i>
115	APTIAN	<i>primula</i>	<i>roberti</i>	<i>roberti</i>	<i>rohri</i>	<i>bejaouensis</i>	<i>rischi</i>	<i>rischi</i> + <i>primula</i>	<i>planispira</i>
			<i>trocoidea</i>			<i>bejaouensis</i>			
			<i>barri</i>			<i>cheniourensis</i>			
121	BARREMIAN	<i>gorbachikae</i> <i>cheniourensis</i> <i>algerianus</i> <i>ferreolensis</i> <i>aptica</i> <i>gottisi</i> <i>sigali</i>	<i>gorbachikae</i>	<i>protuberans</i>	<i>trocoidea</i>	<i>trocoidea</i>	<i>algeriana</i>	<i>algeriana</i>	<i>algeriana</i>
			<i>algerianus</i>			<i>algeriana</i>			
			<i>ferreolensis</i>			<i>ferreolensis</i>			
121	HAUTERIVIAN	<i>blowi</i>	<i>blowi</i>	<i>protuberans</i>	<i>cabri</i>	<i>cabri</i>	<i>ferreolensis</i>	<i>cabri</i>	<i>protuberans</i>
			<i>cabri</i>			<i>cabri</i>			
			<i>maridalensis</i>			<i>blowi</i>			
		<i>gottisi</i>	<i>gottisi</i>		<i>blowi</i> + <i>gottisi</i>	<i>gottisi</i> + <i>duboisi</i>	<i>similis</i>	<i>gottisi</i>	<i>gottisi</i>
		<i>sigali</i>		<i>sigali</i>	<i>sigali</i>	<i>aptica</i> + <i>similis</i>	<i>sigali</i>	<i>sigali</i>	<i>tuschebpsensis</i>
						<i>tuschebpsensis</i>			
		<i>hauterivica</i>			<i>sigali</i>	<i>hauterivica</i>		<i>sigali</i>	

STAGE m. y.	BOREAL 40°N	TEMPERATE 20-25°N	TROPICAL 20-25°S	TEMPERATE 40°S	AUSTRAL 40°S
65		<i>mayaroensis</i>	<i>mayaroensis</i>		
MAASTRICHTIAN	<i>contusa</i> + <i>arca</i>	<i>contusa</i>	<i>gansseri</i>	<i>gansseri/</i> <i>contusa</i>	
70		<i>gansseri</i>	<i>aegyptiaca</i>	<i>tricarinata/</i> <i>havanensis</i>	
CAMPANIAN		<i>arca</i>	<i>havanensis</i>	<i>calcarata</i>	<i>arca</i>
78			<i>calcarata</i>	<i>elevata</i>	<i>havanensis</i>
SANTONIAN			<i>ventricosa</i>		<i>HEDBERGELLA</i>
82					<i>HETEROHELIX</i>
CONIACIAN					
86					
TURONIAN					
92					
CENOMANIAN	<i>cretacea</i> + <i>Marginotruncana</i> <i>marginata</i>	<i>conca</i> <i>carinata</i>	<i>asymetrica</i>	<i>carinata</i>	<i>HEDBERGELLA</i>
		<i>concavata</i>	<i>concavata</i>	<i>concavata</i>	
		<i>primitiva</i>	<i>primitiva</i>		
		<i>coronata</i>	<i>sigali</i>	<i>primitiva</i>	
		<i>helvetica</i>	<i>helvetica</i>	<i>sigali</i>	
		<i>archeocretacea</i>	<i>archeocretacea</i>		<i>helvetica</i>
		<i>cushmani</i>	<i>cushmani</i>	<i>cushmani</i>	<i>HEDBERGELLA</i>
		<i>reicheli</i>	<i>reicheli</i>		<i>reicheli</i>
100	<i>appenninica</i> + <i>gandolfii</i>	<i>montsalvensis</i>	<i>brotzeni</i>		
ALBIAN	<i>GLOBIGERI -</i> <i>NELLOIDES</i>	<i>appenninica</i>	<i>appenninica</i>	<i>buxtorfi</i>	<i>GLOBIGERINELLOIDES</i>
		<i>praeticinensis</i>	<i>ticinensis</i>		
		<i>primula</i>	<i>praeticinensis</i>		
			<i>breggiensis</i>	<i>breggiensis</i>	
			<i>primula</i>	<i>primula</i>	
			<i>bejaouensis</i>	<i>bejaouensis</i>	
			<i>gorbachikae</i>	<i>gorbachikae</i>	<i>HEDBERGELLA</i>
			<i>algeriana</i>		
			<i>cabri</i>		
			<i>blowi</i>		
			<i>sigali</i>		
APTIAN		<i>hoterivica</i>	<i>hoterivica</i>		
115					
BARREMIAN					
121					
HAUTERIVIAN					

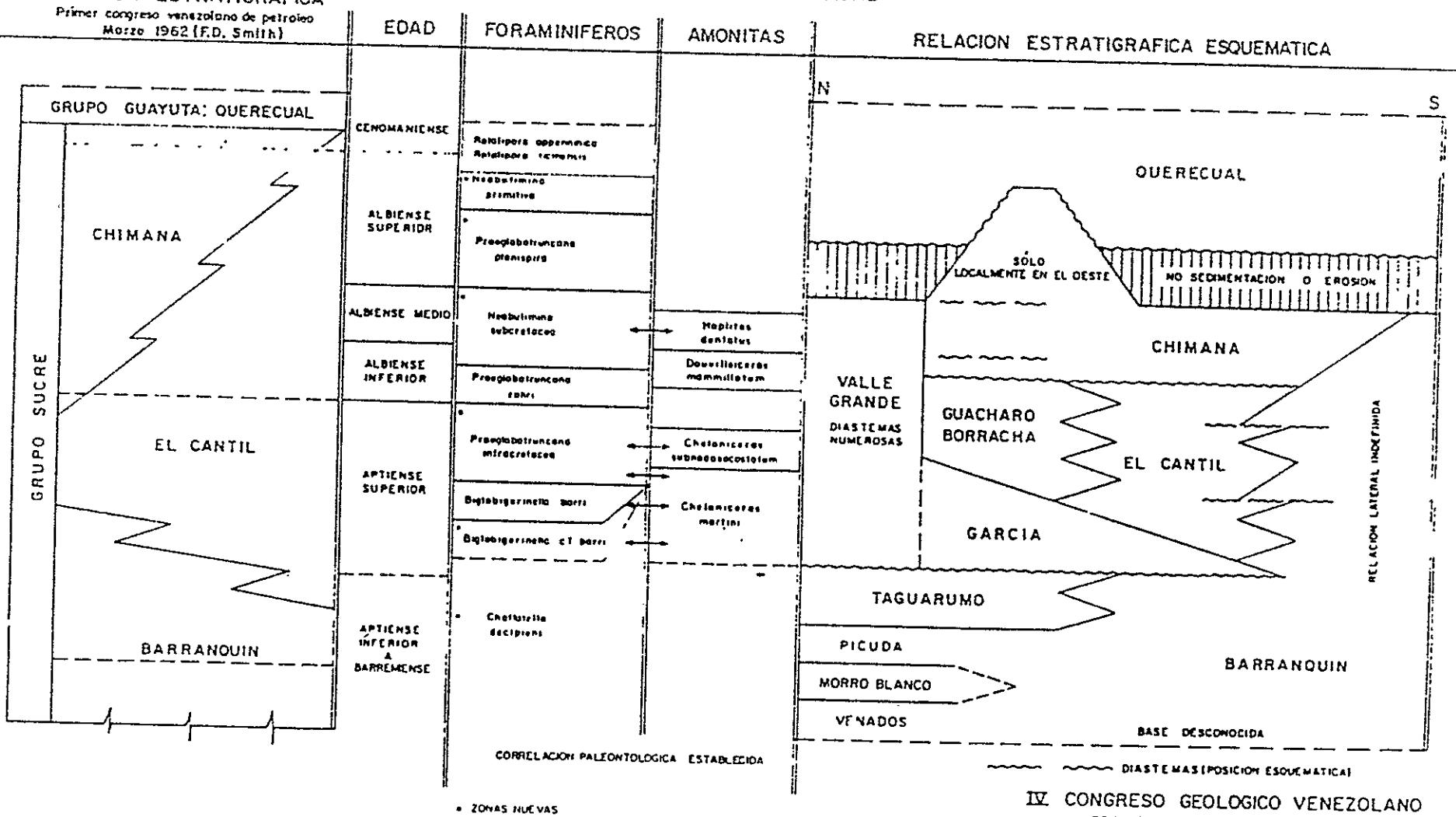
STAGE m. y.	MACROFOSSIL ZONES	PLANKTIC FORAMINIFERAL ZONES	BOUNDARY MARKERS (SPECIES)	DATUM MARKERS (GENERA)
65				L. Globotruncanidae
MAASTRICHTIAN	<i>Pachydiscus neubergicus</i>	<i>Abathomphalus mayaroensis</i>	F. mayaroensis	- F. Abathomphalus
	<i>Hoplites constrictus</i>	<i>Gansserina gansseri</i>	F. gansseri	
	<i>Acanthoscaphites tridens</i>	<i>Globotruncana aegyptiaca</i>	F. aegyptiaca	
		<i>Globotruncanella havanensis</i>		
CAMPANIAN	<i>Bastrychoceras polyplocus</i>	<i>Globotruncanita calcarata</i>	F. calcarata	- F. Rugotruncana
	<i>Hoplitoplacenticeras vari</i>	<i>Globotruncana ventricosa</i>	F. ventricosa	
	<i>Diplacnoceras bidorsatum</i>	<i>Globotruncanita elevata</i>	F. elevata	- F. Rugoglobigerina L. Dicarinella
SANTONIAN	<i>Placenticeras syrtale</i>	<i>Dicarinella asymmetrica</i>	F. asymmetrica	- F. Globotruncana L. Marginotruncana
	<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	- F. Archaeoglobigerina L. Praeglobotruncana
TURONIAN	<i>Romaniceras deverianum</i>	<i>Marginotruncana sigali</i>		
	<i>Collignoniceras woollgari</i>	<i>Helvetoglobotr. helvetica</i>	F. helvetica	- F. Marginotruncana
	<i>Mammmites nodosoides</i>	<i>Whiteinella archaeocretacea</i>	F. archaeocretacea	L. Rotalipora
CENOMANIAN	<i>Metoioceras geslinianum</i>		L. cushioni	
	<i>Calycoceras naviculare</i>	<i>Rotalipora cushioni</i>		- F. Dicarinella
	<i>Acanthoceras rhomagense</i>	<i>Rotalipora reicheli</i>	F. cushioni	- F. Whiteinella
	<i>Mantelliceras mantelli</i>	<i>Rotalipora brotzeni</i>	F. reicheli	L. Planomalina
ALBIAN	<i>Stoliczkaia dispar</i>	<i>Rotalipora appenninica</i>	F. brotzeni	L. Ticinella
	<i>Mortoniceras inflatum</i>	<i>Rotalipora ticinensis</i>	F. appenninica	- F. Praeglobotruncana
	<i>Diploceras cristatum</i>	<i>Rotalipora subticinensis</i>	F. ticinensis	
	<i>Hoplites dentatus</i>	<i>Biticinella breggiensis</i>	F. subticinensis	- F. Rotalipora
	<i>Douvilleiceras mammillatum</i>	<i>Ticinella primula</i>	F. breggiensis	
	<i>Leymeriella tardifurcata</i>	<i>Ticinella bejaouensis</i>	F. primula	
APTIAN	<i>Diadochoceras nodosostatum</i>		F. bejaouensis	- F. Ticinella
	<i>Argonauticeras depereti</i>	<i>Hedbergella gorbatchikae</i>		L. algeriana
	<i>Diadochoceras preciosum</i>	<i>Globigerinelloides algeriana</i>	F. algeriana	- F. Planomalina
	<i>Pseudohaploceras matheroni</i>	<i>Schackinella cabri</i>	F. cabri	L. cabri
BARREMIAN	<i>Silesites seranonis</i>	<i>Globigerinelloides blowi</i>	F. blowi	- F. Globigerinelloides
	<i>Nicklesia pulchella</i>	<i>Hedbergella sigali</i>	F. sigali	
HAUTERIVIAN		<i>Globuligerina hoterivica</i>	F. hoterivica	- F. Hedbergella
		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)



IV CONGRESO GEOLOGICO VENEZOOLANO
CORRELACION ESTRATIGRAFICA

H.A. GUILAUME
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/ ALBIAN s.l.	L. ALBIAN	M. ALBIAN	U. ALBIAN		CENO- MANIAN
		CHOFFA- TELLA DECIPiens ZONE	BIGLOBIGE- RINELLA cf. BARRI ZONE					PRAEGLOBO- TRUNCANA ROHRI ZONE	NEOBULIMINA SUBCRETACEA ZONE	
<i>Planomalina cf. escheri</i> (KAUFMANN)										
<i>Praeglobotruncana infracretacea</i> (GLAESSNER)										
<i>Globigerinella cf. barri</i> BOLLI, LOEBLICH & TAPPAN										
<i>Praeglobotruncana gautierensis</i> (BRONNIMANN)										
<i>Globigerinella barri</i> BOLLI, LOEBLICH & TAPPAN										
<i>Planomalina saundersi</i> BOLLI										
<i>Planomalina maridalensis</i> BOLLI										
<i>Schackoina gandolfii</i> REICHEL										
<i>Globigerina kugleri</i> BOLLI										
<i>Hastigerinella aff. subcretacea</i> TAPPAN										
<i>Planomalina buxtorfi</i> (GANDOLFI)								— cf —	— — —	
<i>Globigerina washitensis</i> CARSEY								— —	— —	
<i>Planomalina cf. saundersi</i> BOLLI								— —	— —	
<i>Praeglobotruncana rohri</i> BOLLI								— —	— —	
<i>Praeglobotruncana cf. planispira</i> (TAPPAN)								— —	— —	
<i>Planomalina breggiensis</i> (GANDOLFI)								— —	— —	
<i>Praeglobotruncana planispira</i> (TAPPAN)								— —	— —	
<i>Schackoina</i> sp.								— —	— —	
<i>Praeglobotruncana modesta</i> BOLLI								— —	— —	
<i>Planomalina tururensis</i> (BRONNIMANN)								— —	— —	
<i>Praeglobotruncana cf. gautierensis</i> (BRONNIMANN)								— —	— —	
<i>Rotalipora ticticensis</i> (GANDOLFI)								— —	— —	
" <i>appenninica</i> s.l. (O. RENZI)								— —	— —	

		Tentative Correlation with Stages of:		FORMATION	ZONE												
GULF COAST	EUROPE																
Mendes						<i>Rotalipora tricarinata</i> [Reineck] [Gaudant]											
						<i>Praeglobotruncana cf. dolomica</i> [Plummer]											
						<i>Rotalipora appenninica</i> [O. Ruzi]											
						<i>Globotruncana ignea</i> , new species											
						<i>Globotruncana katherinae</i> Belli											
						<i>Globotruncana schaegegensis</i> Sigal											
						<i>Globotruncana reissi</i> Gaudant											
						<i>Globotruncana lappensis</i> et. corona Belli											
						<i>Globotruncana concava</i> [Bellot]											
						<i>Globotruncana wilsoni</i> , new species											
						<i>Globotruncana fanticula</i> Plummer											
						<i>Globotruncana lappensis</i> Lappenski											
						<i>Globotruncana lappensis</i> Bellot											
						<i>Globotruncana regunda</i> , new species											
						<i>Globotruncana globigerinoides</i> Bellot											
						<i>Globotruncana carica</i> White											
						<i>Globotruncana cunea</i> [Cushman]											
						<i>Globotruncana stellata</i> [de la Pippert]											
						<i>Globotruncana cf. conica</i> White											
						<i>Praeglobotruncana cunea</i> [Bellot]											
						<i>Praeglobotruncana concava</i> , new species											
						<i>Globotruncana crinita</i> White											
						<i>Globotruncana lappensis</i> [Chaveau]											
						<i>Globotruncana austriaca</i> Kluss											
						<i>Globotruncana californica</i> [de Lapparent]											
						<i>Globotruncana geniculata</i> Belli											
						<i>Globotruncana costata</i> [Cushman]											
						<i>Globotruncana segnibasis</i> Tilg											
						<i>Abathomphalus intermedius</i> [Bellot]											
						<i>Abathomphalus appenninica</i> [Bellot]											

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

Distribution of planktonic Foraminifera
in the Cretaceous of Trinidad, B. W. I.
(from Bölli, 1959)

AGE	TENTATIVE CORRELATION WITH STAGES OF:		FORMATION	ZONE		
	GULF COAST	EUROPE				
UPPER CRETACEOUS	MENDEZ	MAESTRICH-TIAN	GUAYAHAYARE	<i>Abathomphalus mayaroensis</i>	<i>Globigerina kugleri</i>	
	NAVARRO			<i>Globotruncana ganesseri</i>	<i>Globigerina graysonensis</i>	
	TAYLOR	CAMPANIAN		<i>Globotruncana lapparenti-tricarinata</i>	<i>Praeglobotruncana infracretacea</i>	
	AUSTIN	MARIAMA HILL	<i>Globotruncana stuarti</i>	<i>Schackenia reicheli</i>		
	BAGLEFORD		CONIACIAN		<i>Globotruncana fornicata</i>	<i>Hastigerinella aff. subcretacea</i>
	WASHITA				<i>Globotruncana concavata</i>	<i>Leupoldina protuberans</i>
	FREDERICKSBURG		CENOMANIAN		<i>Globotruncana renzi</i>	<i>Schackoina pustulans pustulans</i>
	TRINITY				<i>Globotruncana inornata</i>	<i>Schackoina pustulans quinquecamerata</i>
	NUEVO LEON	ALBIAN	GAUTIER	<i>Rotalipora appenninica appenninica</i>	<i>Planomalina mariadolensis</i>	
	<i>Globigerina washitensis</i>			<i>Planomalina saundersi</i>		
LOWER CRETACEOUS	TOGO CUCHE	MARIADE		<i>Rotalipora ticiensis ticiensis</i>	<i>Biglobigerinella barri</i>	
				<i>Praeglobotruncana rohri</i>	<i>Praeglobotruncana modesta</i>	
	APTIAN	BARRENTIAN	GAUTIER	<i>Biglobigerinella barri</i>	<i>Praeglobotruncana gautierensis</i>	
				<i>Leupoldina protuberans</i>	<i>Planomalina escheri s.l.</i>	
	TUCANO	CUCHE	GAUTIER	<i>Lenticulina (l.) quechensis cunchenensis</i>	<i>Praeglobotruncana cf. gautierensis</i>	
				<i>Lenticulina (l.) barri</i>	<i>Globigerina cretacea</i>	
					<i>Schackoina gandolfii</i>	
					<i>Praeglobotruncana crassa</i>	
					<i>Praeglobotruncana Planispira</i>	
					<i>Rugoglobigerina rugosa s.l.</i>	
					<i>Rugoglobigerina macrocephala s.l.</i>	
					<i>Hastigerinoides alexanderi</i>	
					<i>Planomalina messinae messinae</i>	
					<i>Rugoglobigerina reicheli s.l.</i>	
					<i>Rugoglobigerina hantkenioides s.l.</i>	
					<i>Rugoglobigerina scotti</i>	
					<i>Planomalina messinae subcarinata</i>	
					<i>Schackoina multispinata</i>	

CENOMANIAN	TURONIAN- SENONIAN	MAESTRICHTIAN		PALEOCENE	
Globotruncana apenninica Zone	Globotruncana lapparenti s.l. Zone	Globotruncana gansseri Zone	Globotruncana mayaroensis Zone		<ul style="list-style-type: none"> ===== Localities 1-4 ===== Additional unspecified localities * Common - abundant * Rare
					<i>Globigerina gautierensis</i>
					" <i>cretacea</i>
					<i>Rugoglobigerina reicheli reicheli</i>
					" " <i>pustulata</i>
		?			" " <i>hexacamerata</i>
					" <i>macrocephala macrocephala</i>
					" " <i>ornata</i>
					" <i>rugosa rugosa</i>
					" " <i>pennyi</i>
					" " <i>rotundata</i>
					<i>Plummerella hantkenioides hantkenioides</i>
					" " <i>costata</i>
					" " <i>inflata</i>
					<i>Globigerinella messinae messinae</i>
					" " <i>subcarinata</i>
					" <i>escheri escheri</i>
					" " <i>clavata</i>
					" <i>tururensis</i>
					<i>Hastigerinoides alexanderi</i>
					" <i>rohri</i>
		?			<i>Trinitella scotti</i>
*	*	?	?		<i>Globigerina s.s.</i>
*	*	*	*		<i>Rugoglobigerina s.s.</i>
*	*	*	*		<i>Plummerella</i>
*	*	*	*		<i>Globigerinella</i>
*	*	*	*		<i>Hastigerinoides</i>
*	*	*	*		<i>Trinitella</i>

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

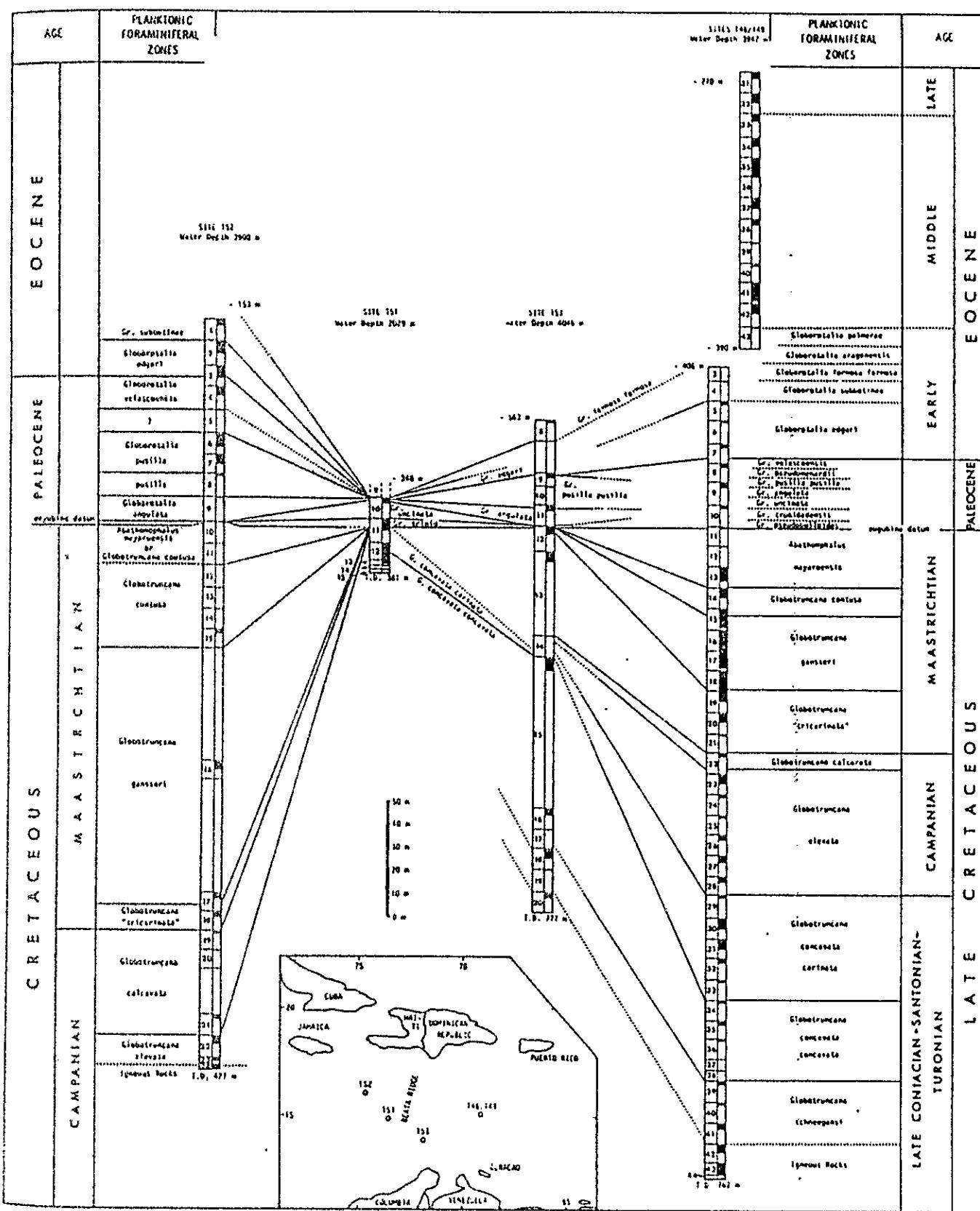


Figure 7. West-east stratigraphic correlation of the Eocene-Cretaceous cores in Sites 152, 151, 153, and 146-149.

	Caron 1985 general	Premoli Silva & Bolli, 1973 Caribbean (Leg 15)	Guilloume, Bolli & Beckmann, 1972 Eastern Venezuela	Bolli 1959 Trinidad	Bolli 1957 Trinidad	Bolli 1966 general	
Maastrichtian	<i>A. mayaroensis</i>	mayaroensis		mayaroensis	mayaroensis	mayaroensis	
	<i>G. ganzeri</i>	confusa ganzeri		ganzeri	ganzeri	ganzeri	
	<i>G. segyptiaca</i>	"tricarinata"		lapparenti tricarinata	lapparenti tricarinata	lapparenti tricarinata	
	<i>G. huavencis</i>					calcarata	
Campanian	<i>G. calcarea</i>	calcarata		stuarti	stuarti	stuarti	
	<i>G. venustissima</i>	elevata		fornicata	fornicata	fornicata	
	<i>G. elevata</i>			concavata	concavata	concavata	
Santonian	<i>D. assymetrica</i>	concavata carinata		renzi	renzi	schnegansi	
Coniacian	<i>D. concavata</i>	concavata concav.		inornata	inornata	helvetica	
	<i>D. primitiva</i>	schneegansi				. gigantea	
Turonian	<i>H. sigilli</i>				cushmani		
	<i>H. helvetica</i>						reicheli
	<i>W. archaeoceratites</i>						brotzeni
Cenomanian	<i>R. cushmani</i>			appenninica/ ticinensis	appenninica	appenninica	
	<i>R. reicheli</i>			washitensis	washitensis		
	<i>R. brotzeni</i>			ticinensis ticinensis	ticinensis ticinensis	ticinensis ticinensis	
Albian	<i>R. appenninica</i>					roberti	
	<i>R. ticinensis</i>					roberti	
	<i>R. subticinensis</i>						
	<i>B. breggientis</i>						
	<i>T. primula</i>						
Aptian	<i>T. bejaouensis</i>			rohri	rohri		
	<i>H. garbachiakae</i>			infracretacea			
	<i>G. algeriana</i>			barri	barri	barri	
	<i>S. cabri</i>			cf. barri	protuberans	protuberans	
Berriasian	<i>G. alowii</i>				Lent. ouachensis		
	<i>H. sigilli</i>				Lent. barri		
	<i>G. heteromorphus</i>						
Hauterivian							

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

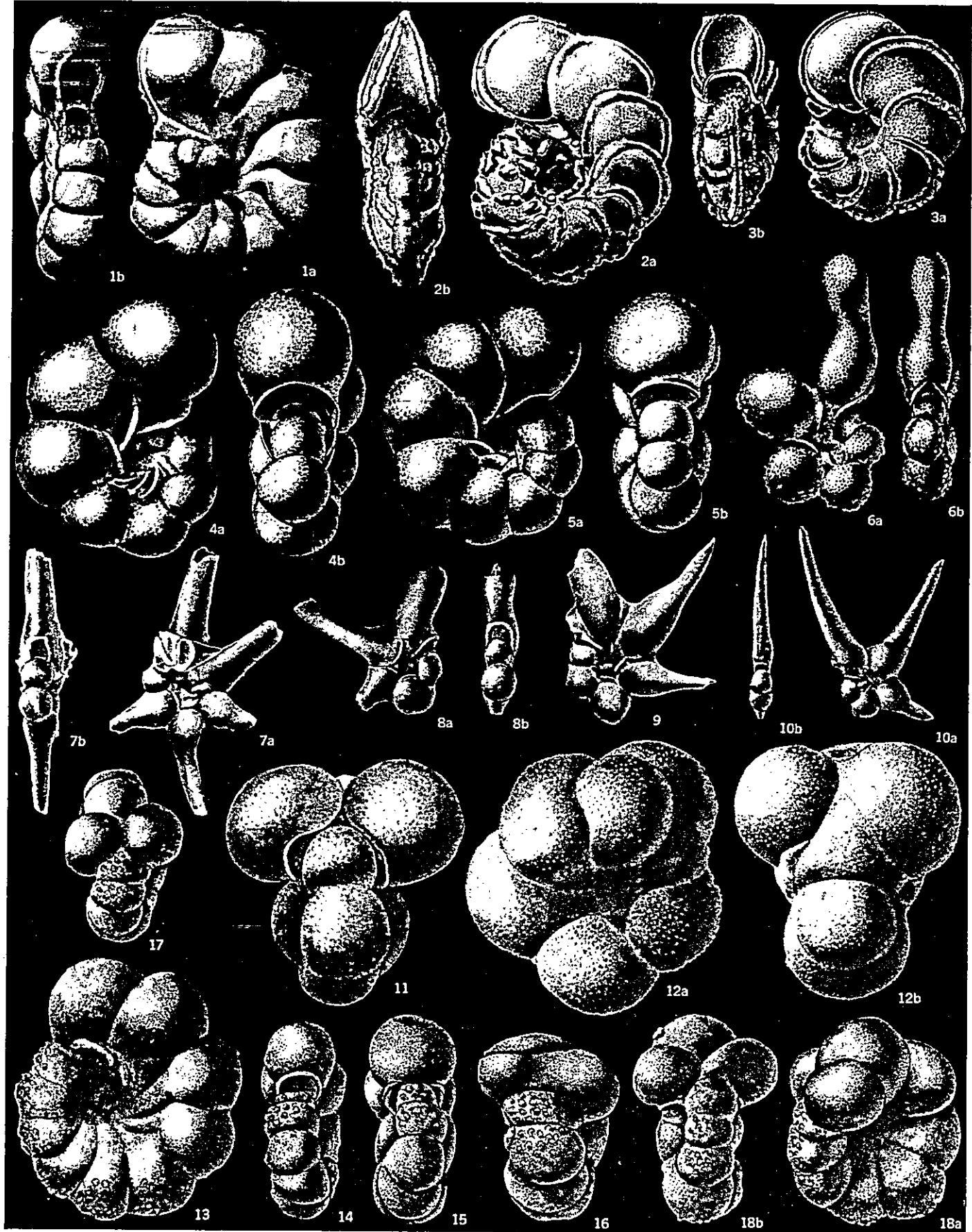
MAGNETIC POLARITY (1)	MILLION YEARS (2)		AGE (3)	STAGE	PLANKTIC FORAMINIFERA (4)	CALCAREOUS NANNOFOSSILS (5)	RADIOLARIA (6)	DINOFLAGELLATES (7)	CALPIONELLIDS (8)
30	65	65			<i>Abathomphalus mayaroensis</i>	CC26 <i>Nephrolithus frequens</i>			
31					<i>Gansserina gansteri</i>	CC25 <i>Arkhangelskiella cymbiformis</i>			<i>Dinogymnum euclideanum</i>
32	70				<i>Globotruncana aegyptiaca</i>	CC24 <i>Reinhardtites levis</i>			
					<i>Globotruncanella tivanaensis</i>	CC23 <i>Tranolithus phaeolosus</i>			
	73	70				CC22 <i>Quadrum trilidum</i>			
33	75					CC21 <i>Quadrum sissinghii</i>			
	80					CC20 <i>Ceratolithoides aculeus</i>			
	85					CC19 <i>Calculites ovalis</i>			
	90					CC18 <i>Aspidolithus parcus</i>			
	95					CC17 <i>Calculites obscurus</i>			
	100								
34	100				<i>Dicerinella asymmetrica</i>	CC16 <i>Lucianorhabdus cayeuxii</i>			<i>Cordosphaeridium truncigerum</i>
	105					CC15 <i>Reinhardtites anthophorus</i>			
	110				<i>Dicerinella concavata</i>	CC14 <i>Micula decussata</i>			<i>Celliosphaeridium asymmetricum</i> – <i>Oligosphaeridium pulcherrimum</i>
	115				<i>Dicerinella primitiva</i>	CC13 <i>Marthasterites furcatus</i>			
	120				<i>Marginotruncana sigali</i>	CC12 <i>Lucianorhabdus maleformis</i>			
M0					<i>Helvetotruncana helvetica</i>	CC11 <i>Quadrum gartneri</i>			<i>Surculosphaeridium longifurcatum</i>
M1	113	108			<i>Whiteinella archeocretacea</i>				<i>Bacchidinium polypes</i>
M2					<i>Rotalipora cushmani</i>	CC10 <i>Microrhedulus decoratus</i>			
M3					<i>Rotalipora reicheli</i>	CC9 <i>Eiffellithus turrisellofelli</i>			
M4					<i>Rotalipora brotzeni</i>				
M5					<i>Rotalipora appenninica</i>				
M6					<i>Rotalipora ticinensis</i>	CC8 <i>Prediscosphaera columnata</i>			
M7					<i>Rotalipora subticinensis</i>				
M8					<i>Biticinella breggiensis</i>				
M9	119	115			<i>Ticinella primula</i>				
M10					<i>Ticinella bejaouensis</i>				
M11	125	121			<i>Hedbergella gorbachikae</i>	CC7 <i>Chiastozygus litterarius</i>			
M12					<i>Globigerinelloides algeriana</i>				
M13					<i>Schackinella cabri</i>				
M14	131	126			<i>Globigerinelloides blowi</i>				
M15					<i>Hedbergella sigali</i>	CC6 <i>Micrantholithus haschulzii</i>			
M16						CC5 <i>Lithraphidites ballii</i>			
M17	144	141	JUR.	LATE TITHONIAN	<i>Globuligerina hauderivica</i>	CC4 <i>Cretarhabdus toriei</i>			
						CC3 <i>Calcicalathina oblongata</i>			
						CC2 <i>Stradneria crenulata</i>			
						CC1 <i>Nannoconus steinmannii</i>			

PLATE 1. HANTKENINIDAE: PLANOMALININAE

	Page		Page
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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. $\times 75$.		7a, Side view of holotype (Cushman Coll. 15750), showing radial elongate chambers. 7b, Edge view. 8a, 10a, Side views of topotypes (USNM P3920a, b), showing relict apertures around umbilical region, and variation in the shape of the radial elongate chambers. 8b, 10b, Edge views, showing low arched equatorial aperture. 9, Paratype (Cushman Coll. 15754). All from the Austin chalk (Upper Cretaceous) of Texas. $\times 95$.	
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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. $\times 130$.			

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BULLETIN 215, PLATE 1



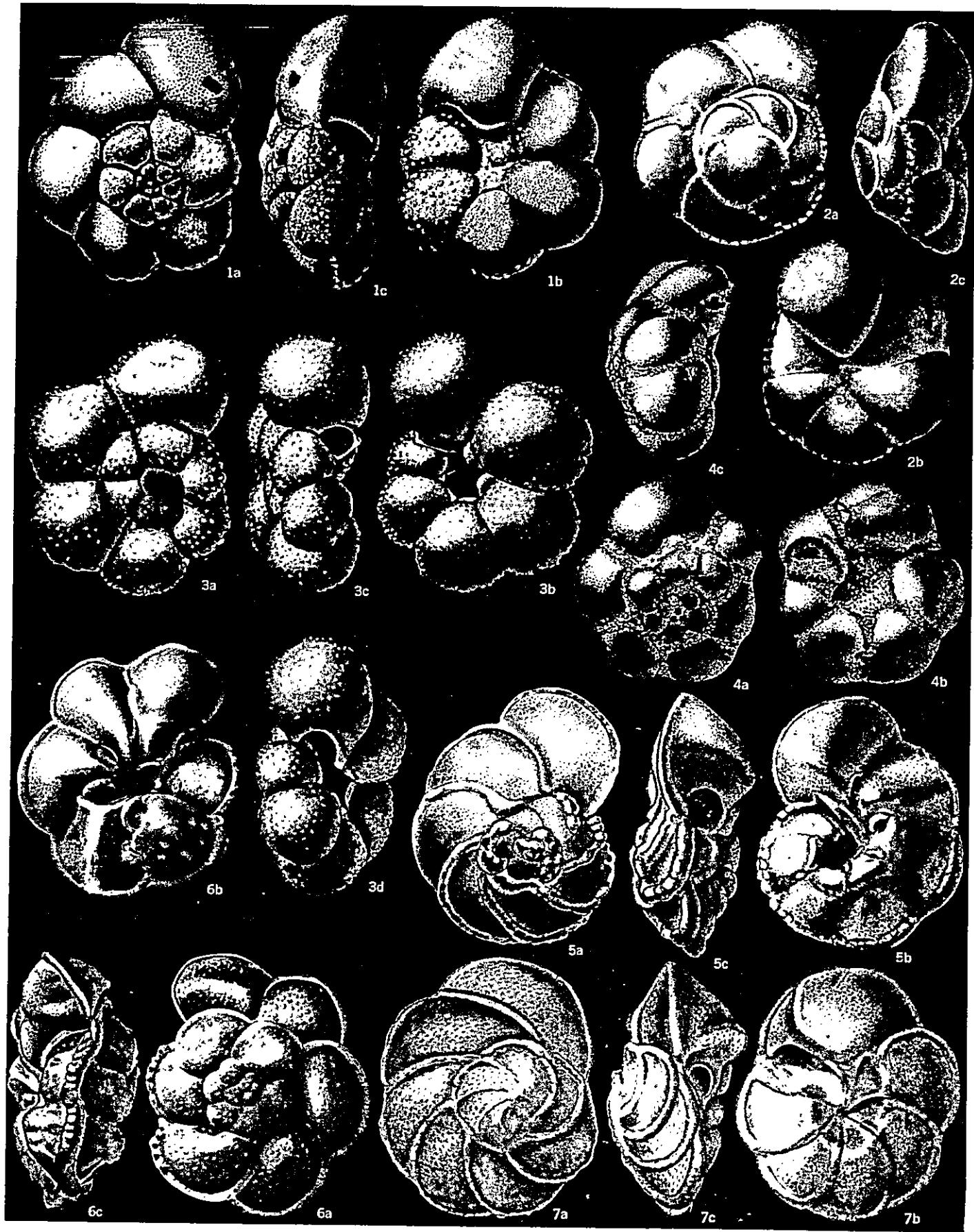
HANTKENINIDAE: PLANOMALININAE

PLATE 9. GLOBOROTALIIDAE

FIGURES	Page
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BULLETIN 215, PLATE 9



GLOBOROTALIIDAE

PLATE II. GLOBOTRUNCANIIDAE

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1c, Edge view.			
From the Maestrichtian Guayaguayare formation of Trinidad, B.W.I. $\times 90$.			
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GLOBOTRUNCANIDAE

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PLATE 13. GLOBOTRUNCANA

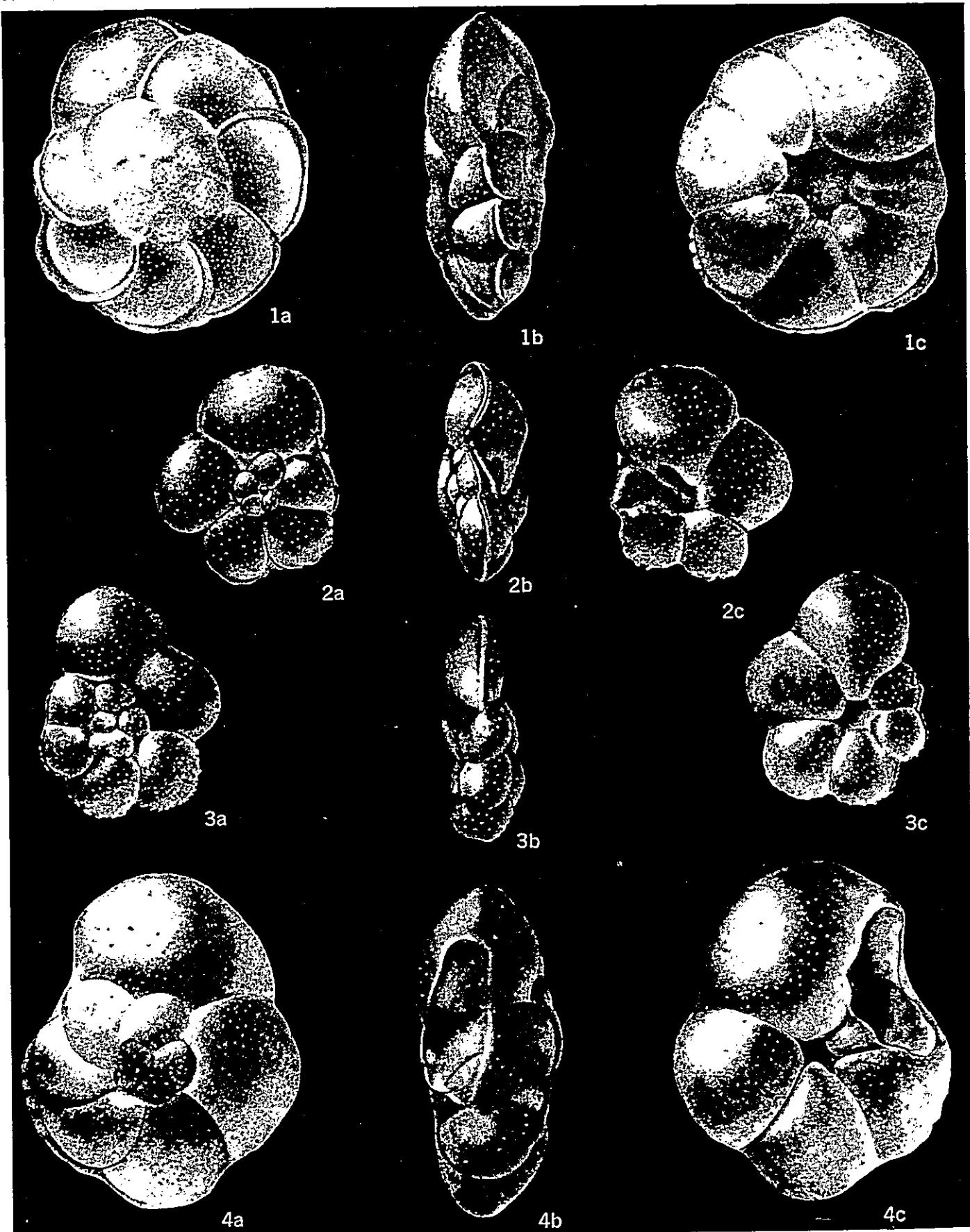
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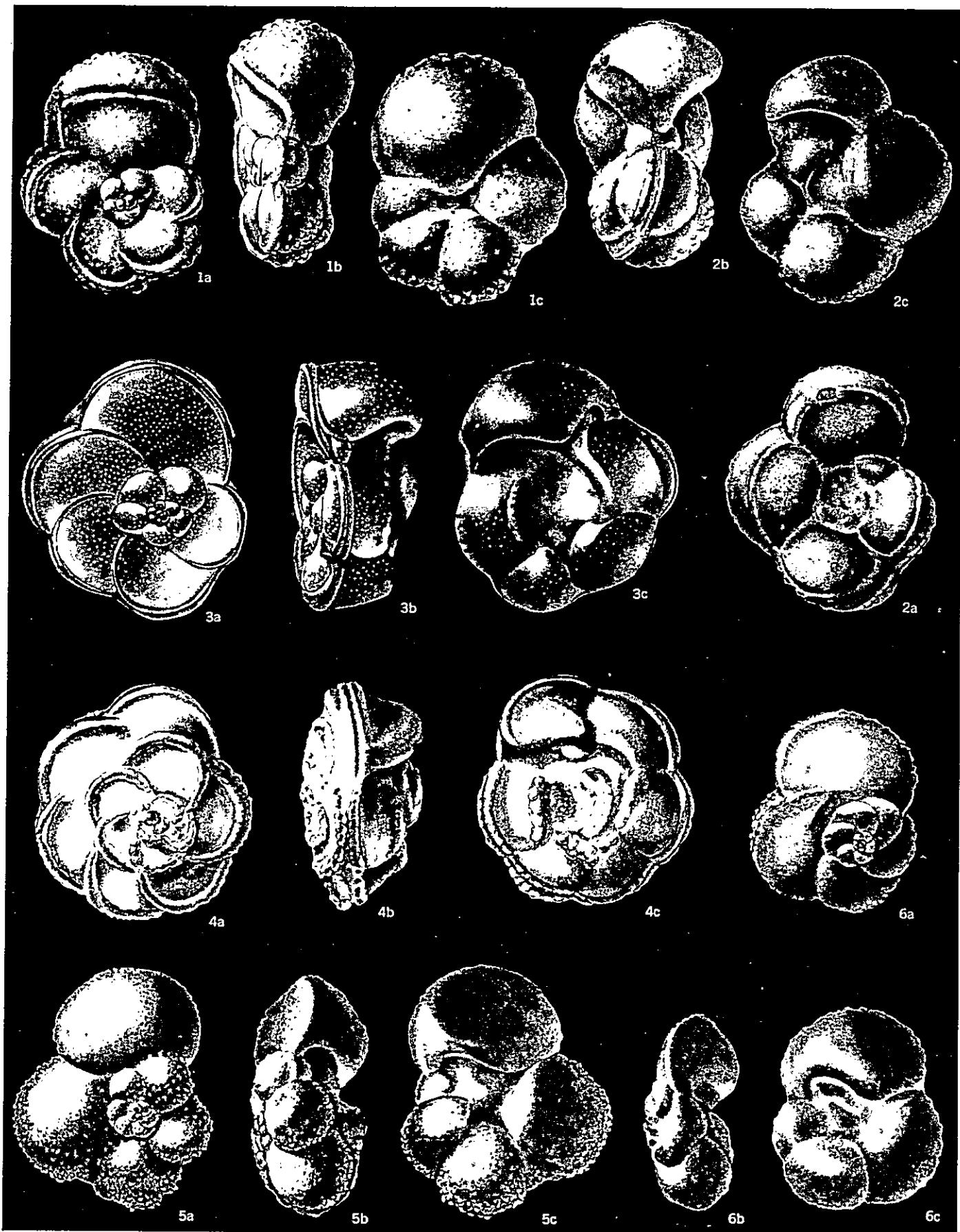
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ROTALIPORA, PRAEGLOBOTRUNCANA

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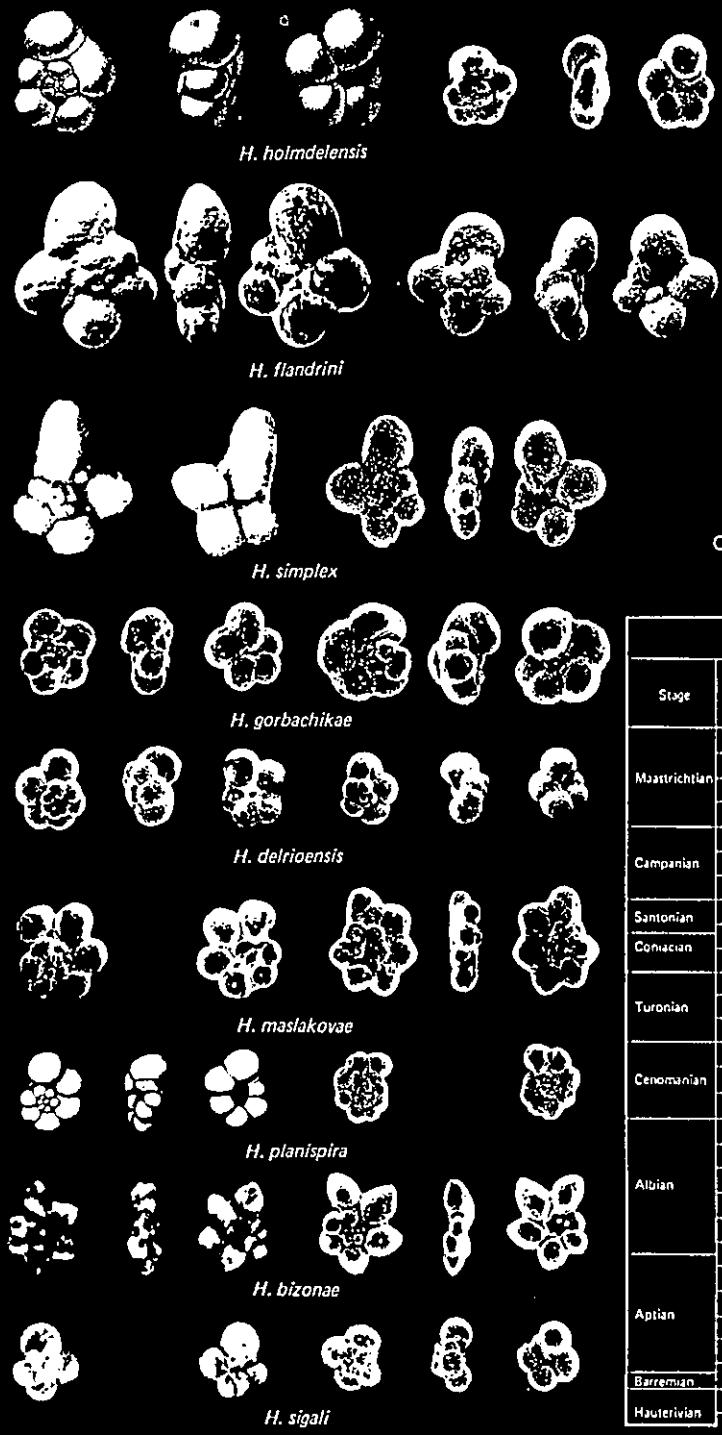
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GLOBOTRUNCANA

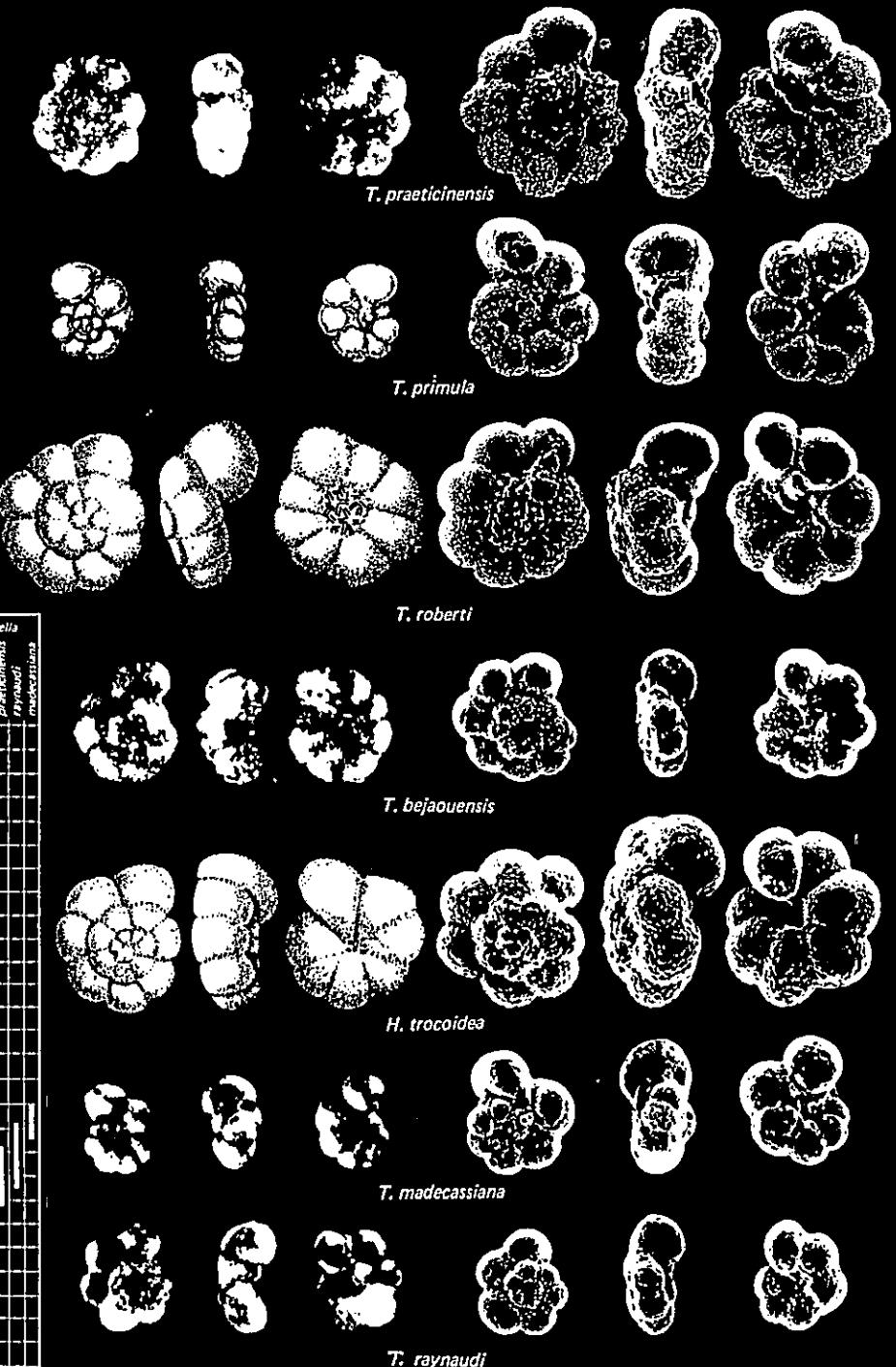


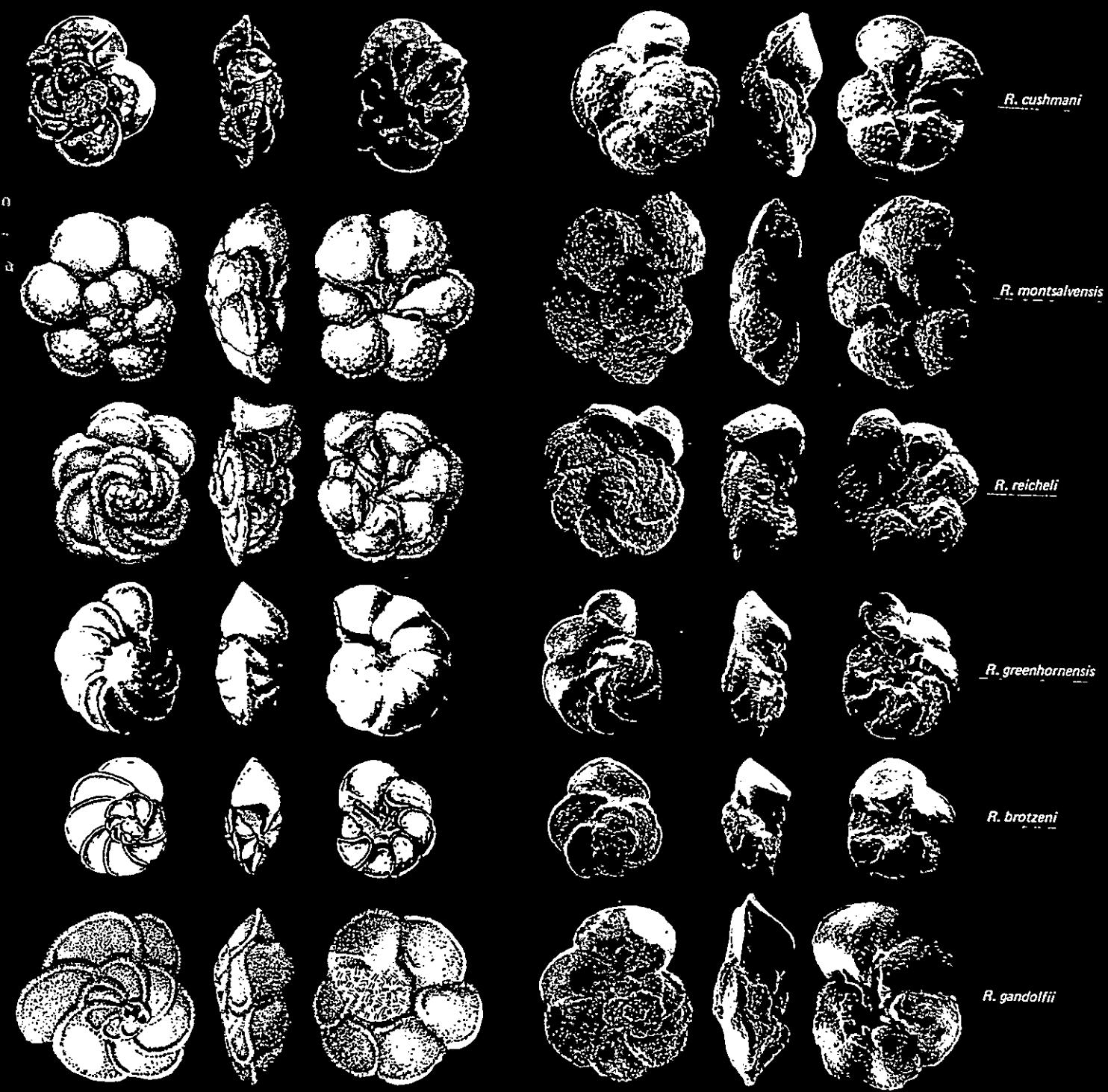
GLOBOTRUNCANA



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

Stage	Planktic Foraminiferal Zones	Hedbergella				Ticinella								
		salsi	bizone	plana	multistake	delicatula	stroboides	gorbachikae	simplex	flabellata	roberti	primula	praeconcinensis	raynaudi
Maastrichtian	A. mayaroensis													
	G. ganzeri													
	G. aggyptica													
	G. havanensis													
Campanian	G. calcarea													
	G. ventricosa													
	G. elevata													
	D. asymmetrica													
Santonian	D. concavata													
	D. primitive													
	M. sigali													
	H. helvetica													
Coniacian	W. archaeocretacea													
	R. cushmani													
	R. reichei													
	R. brotzeni													
Turonian	R. appenninica													
	R. ticinensis													
	R. subticinensis													
	B. bregiensis													
Cenomanian	T. primula													
	T. bejaouensis													
	H. gorbachikae													
	G. algeriana													
Albian	S. cabri													
	G. blowi													
	H. sigali													
	G. heterivira													
Aptian														
Barremian														
Hauterivian														

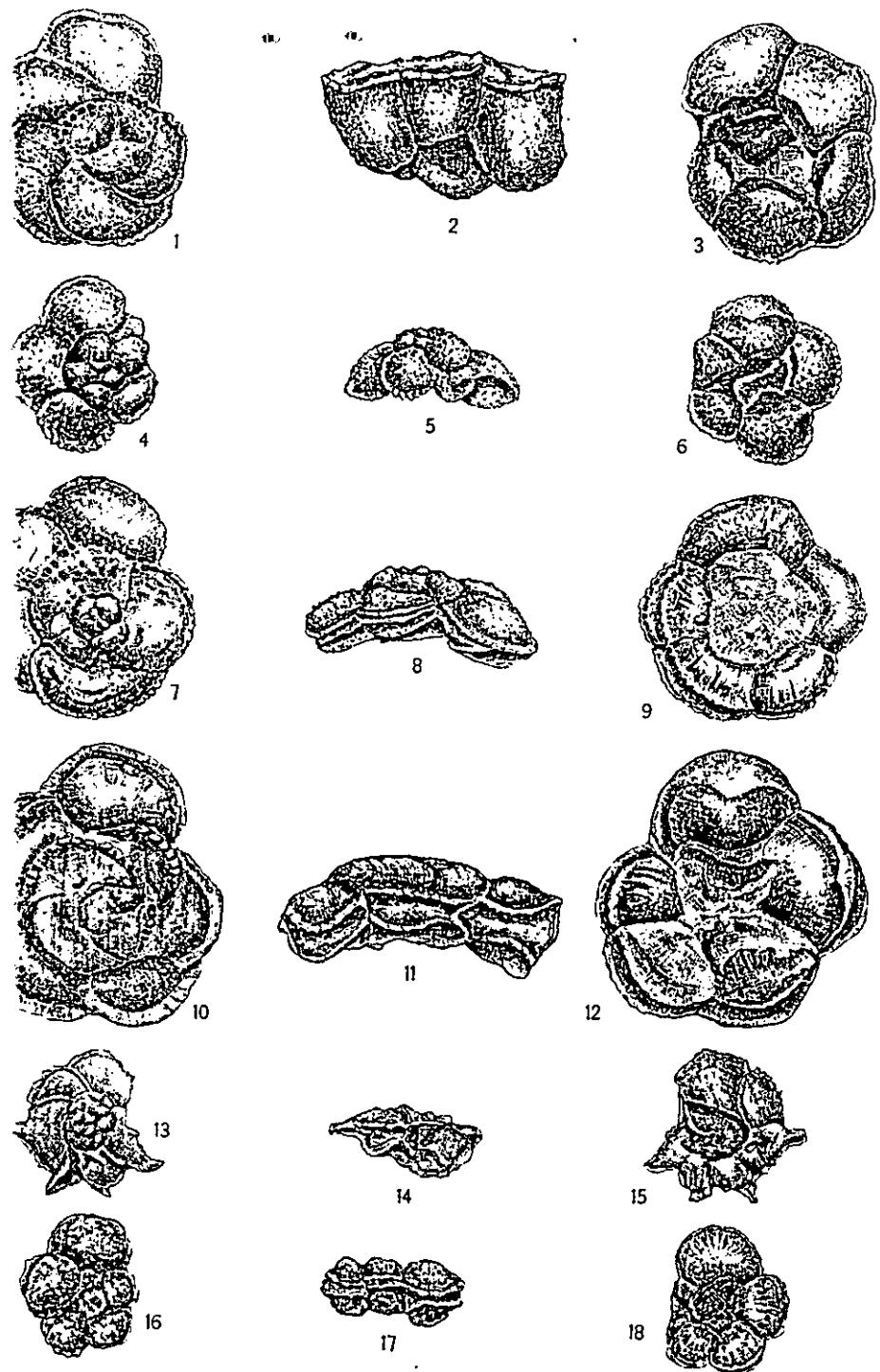




Characteristic *Rotalipora* species
(Primary types on left side)

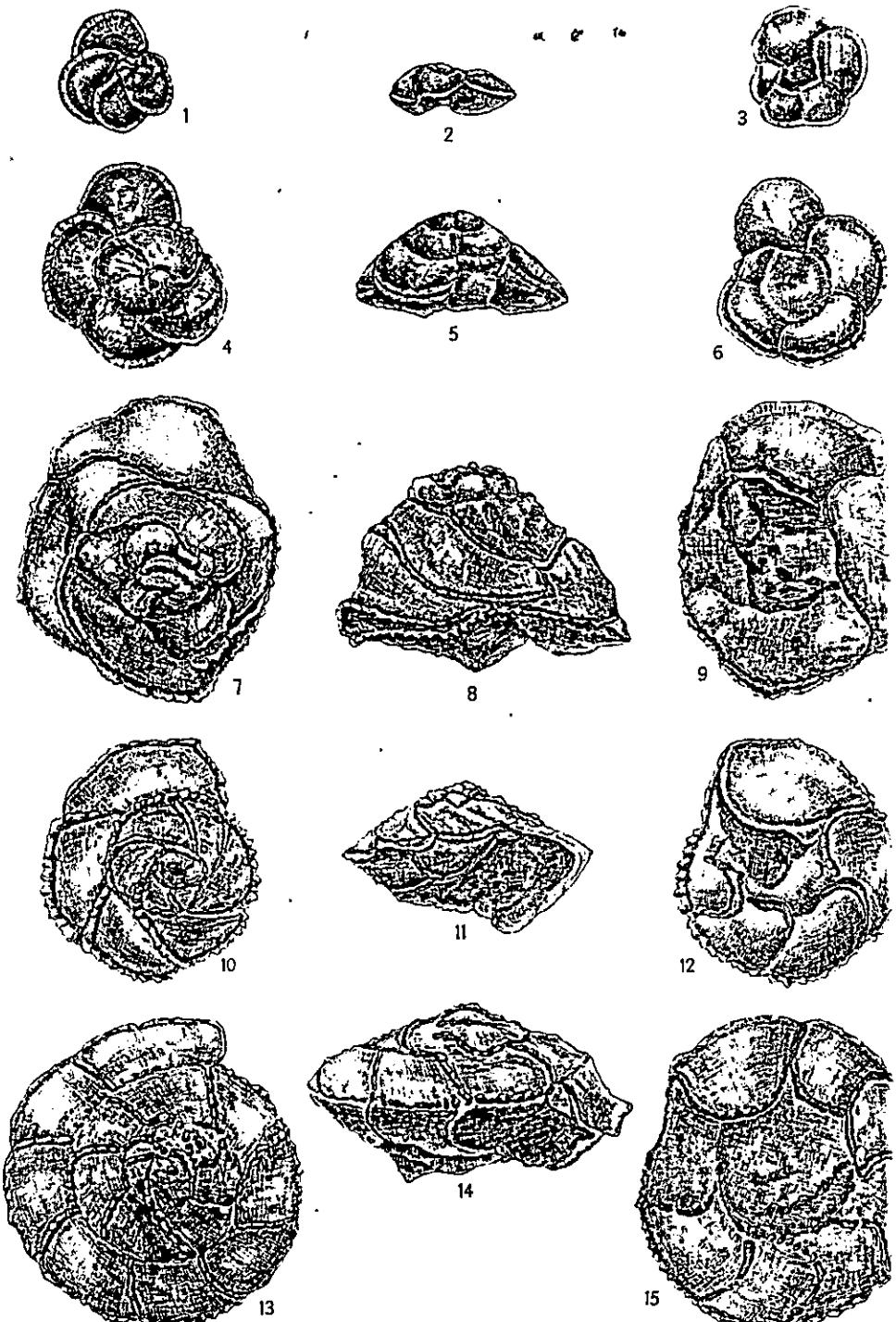
Stage	Planktic Foraminiferal Zones	<i>Rotalipora</i>								
		<i>rotalicinus</i>	<i>leptoceras</i>	<i>spinosus</i>	<i>gandolfii</i>	<i>brotzeni</i>	<i>montsalvensis</i>	<i>reicheli</i>	<i>greenhornensis</i>	<i>cushmani</i>
Cenomanian	<i>R. cushmani</i>									
	<i>R. reicheli</i>									
	<i>R. brotzeni</i>									
Albian	<i>R. appenninica</i>									
	<i>R. ticinensis</i>									
	<i>R. subticinensis</i>									
Aptian	<i>B. breggensis</i>									
	<i>T. primula</i>									
	<i>T. bejaouensis</i>									
Barremian	<i>H. porosiphilus</i>									
	<i>G. algeriana</i>									
	<i>S. cabri</i>									
Maastrichtian	<i>G. bland</i>									
	<i>H. sigilli</i>									
	<i>G. heteromixta</i>									



Bolli, Trinidad *Globotruncanae*

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All figures $\times 65$

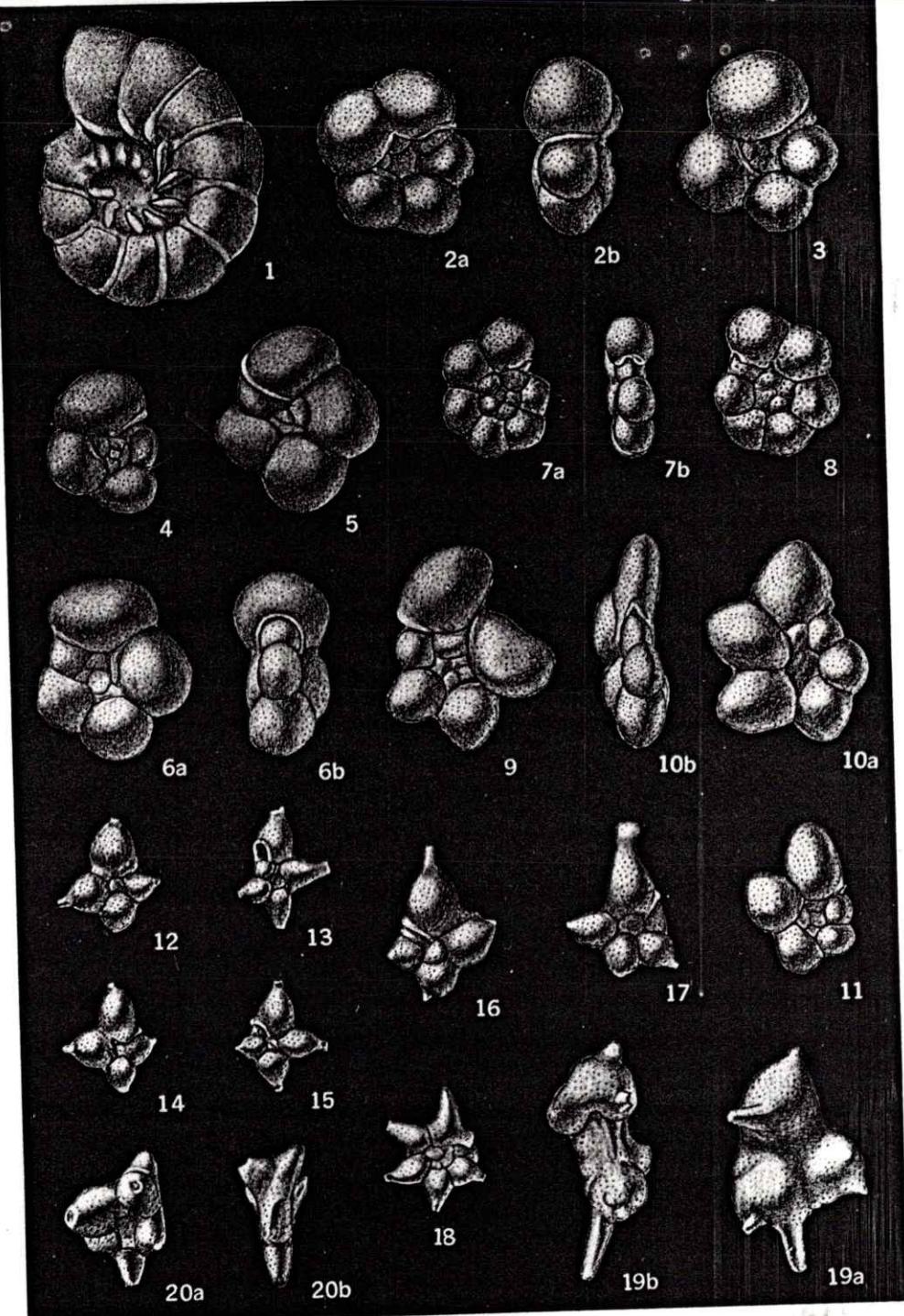
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Bolli, Trinidad *Globotruncanae*

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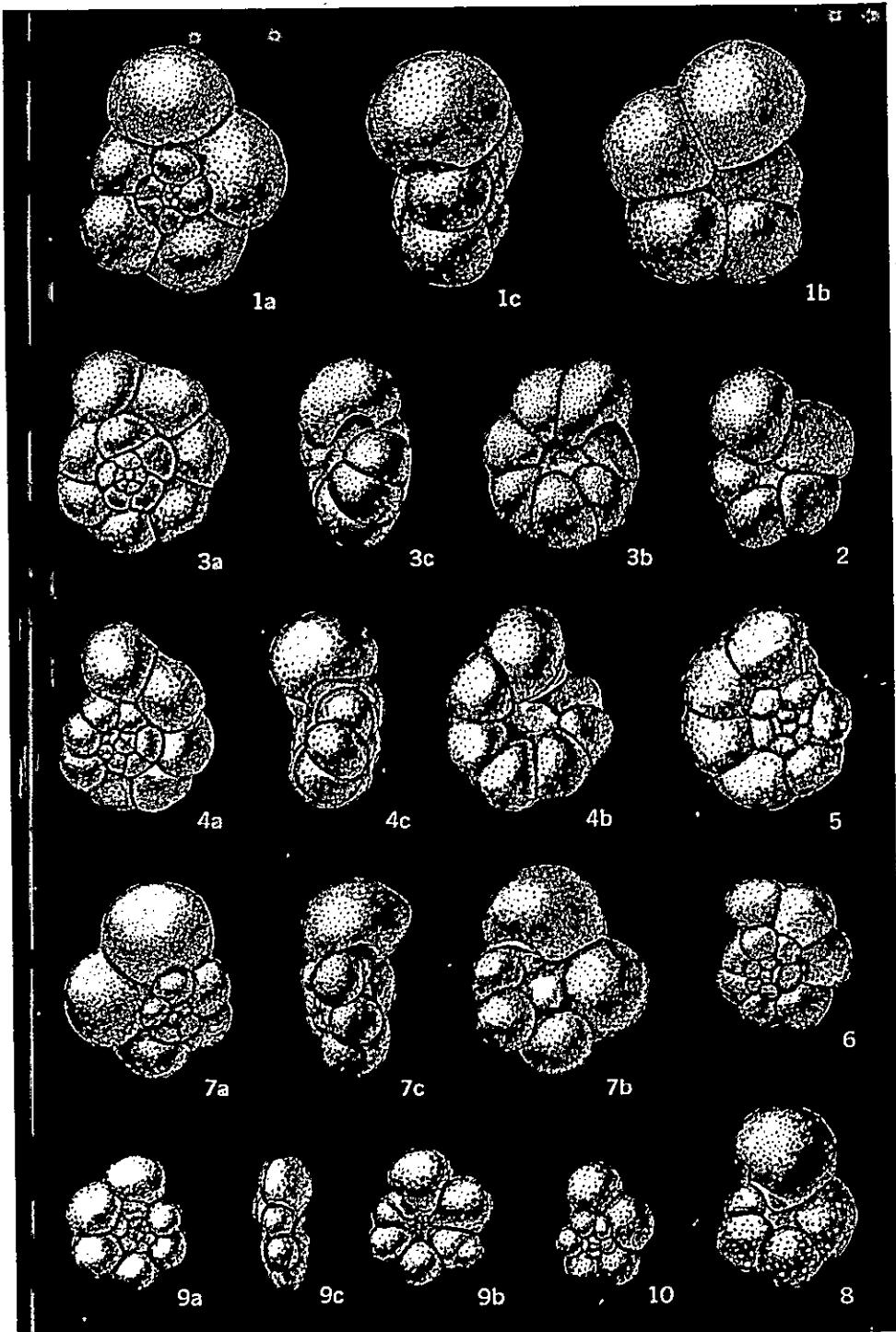
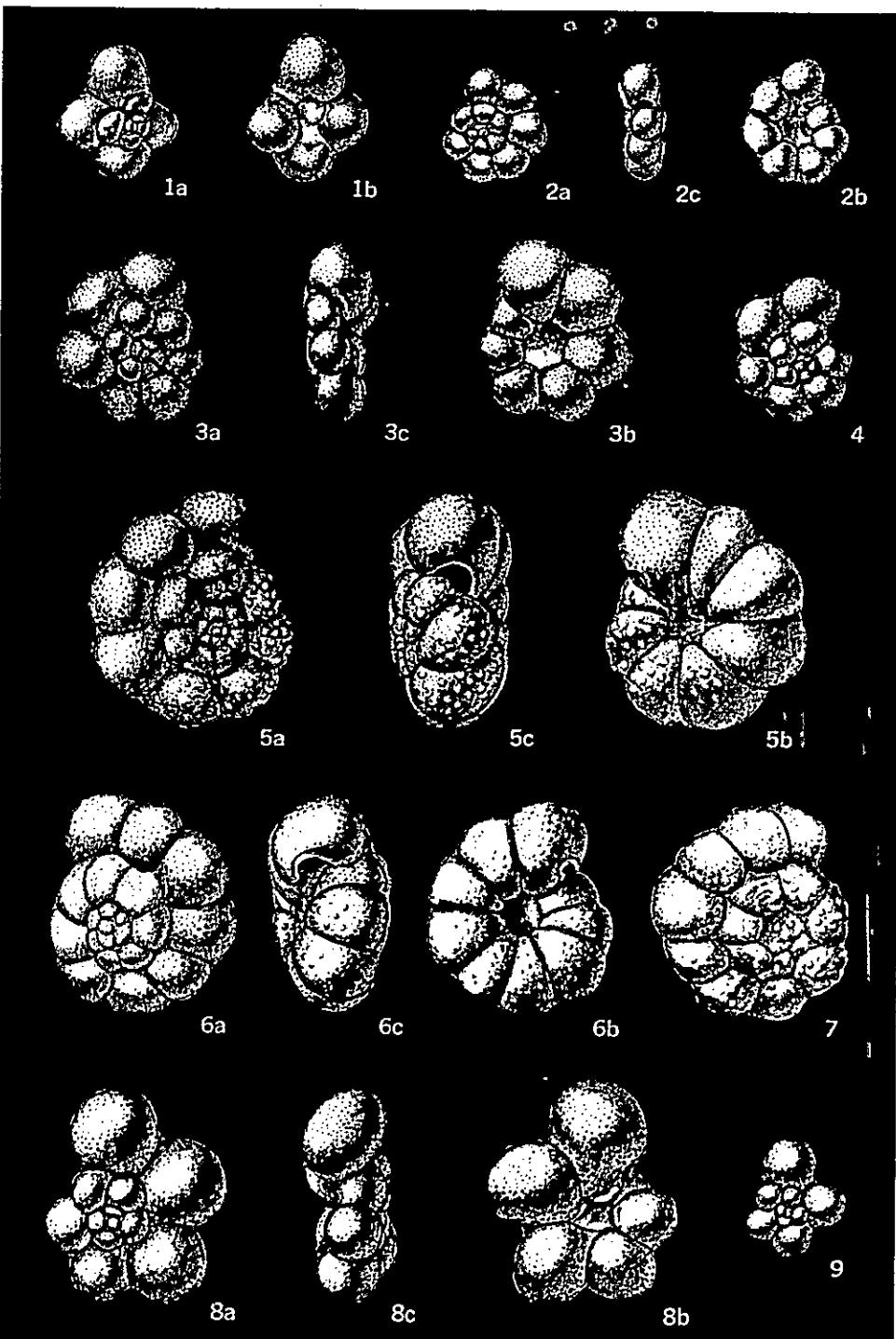


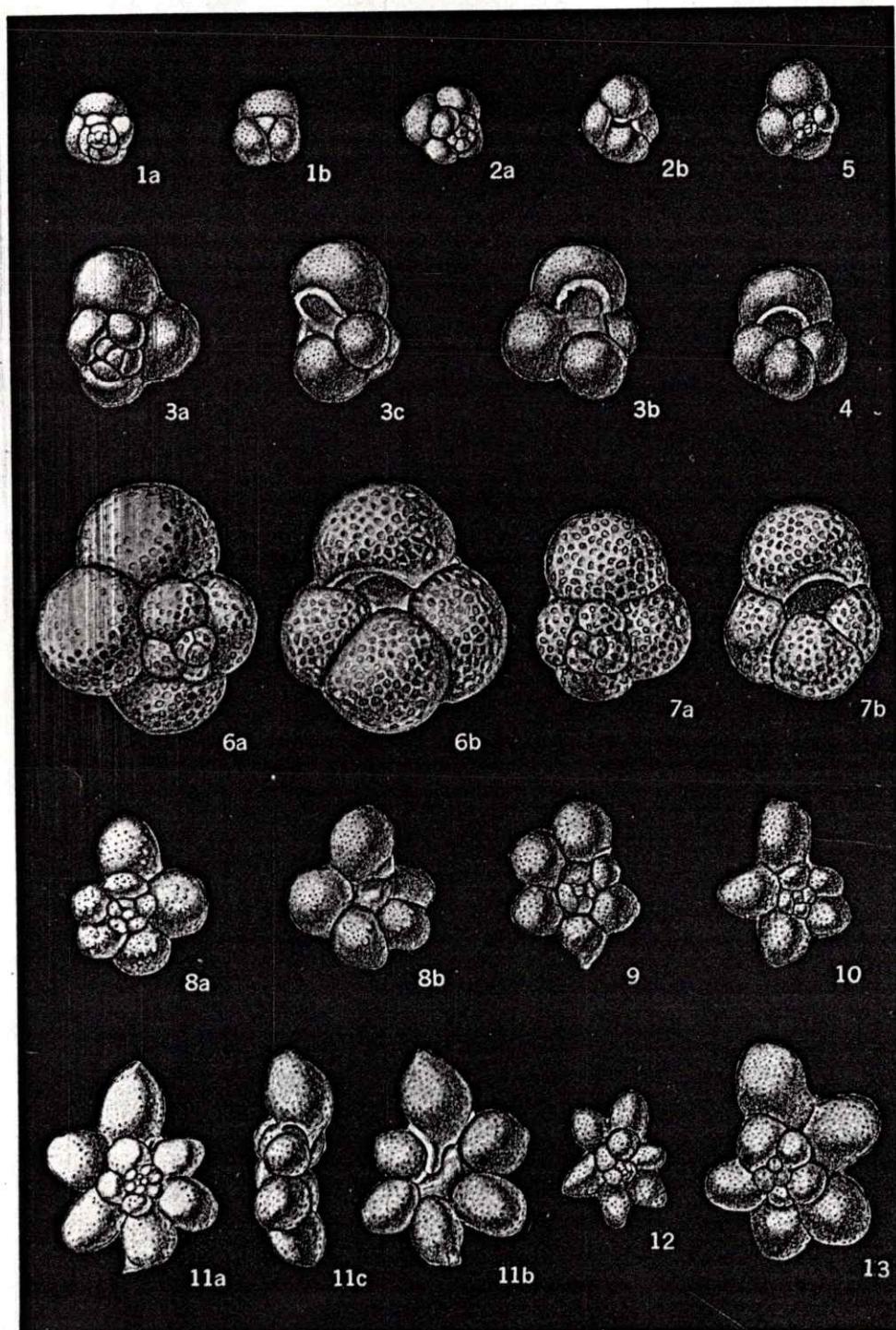
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Plate I. Schackoina

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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 excentrical aperture. 4, Side view of fully preserved paratype.

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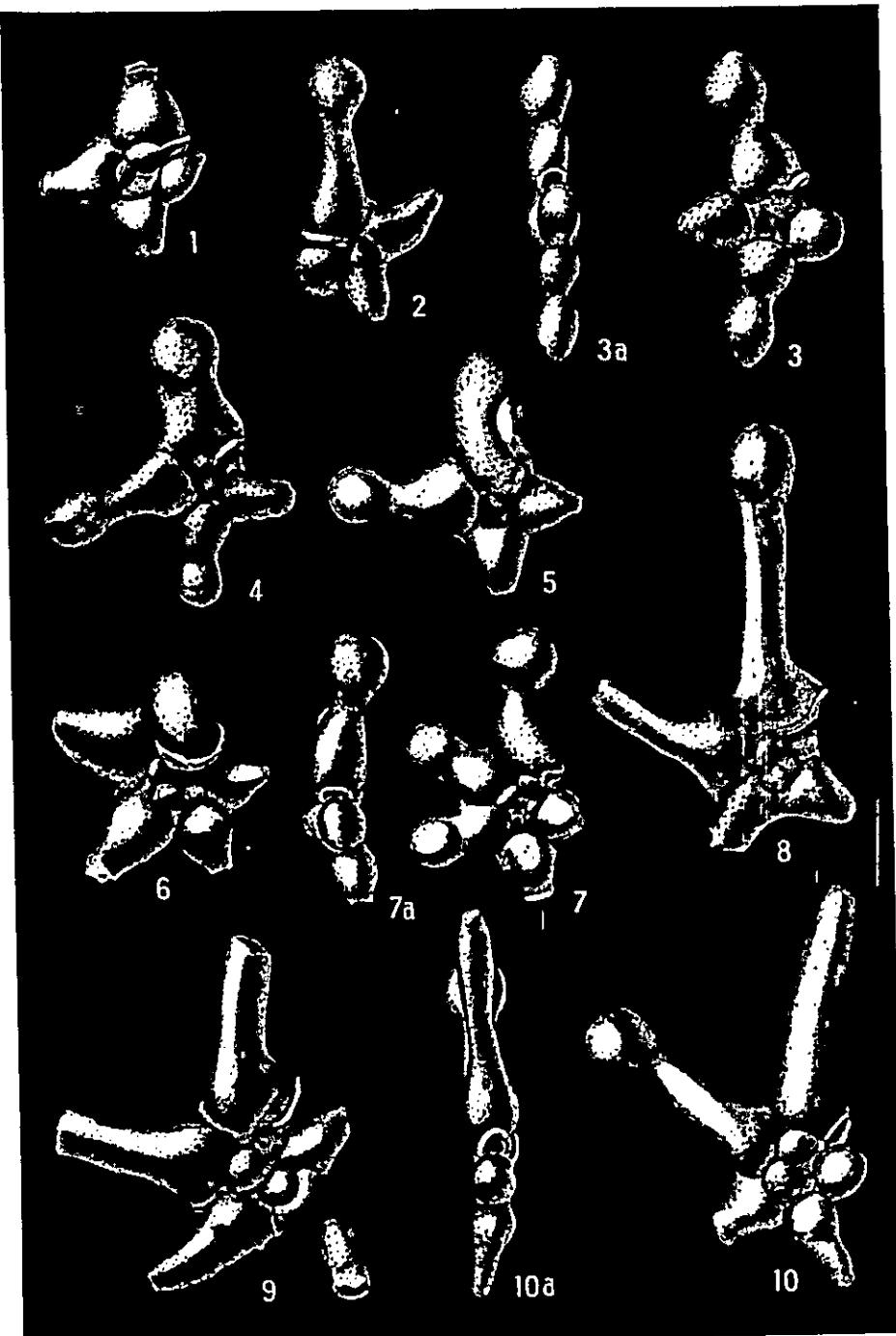


Plate II. *Leupoldina* n. gen.

All figures $\times 110$

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 *Schuckoina*-like aperture in a slightly excentrical 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 extraumbilical 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.

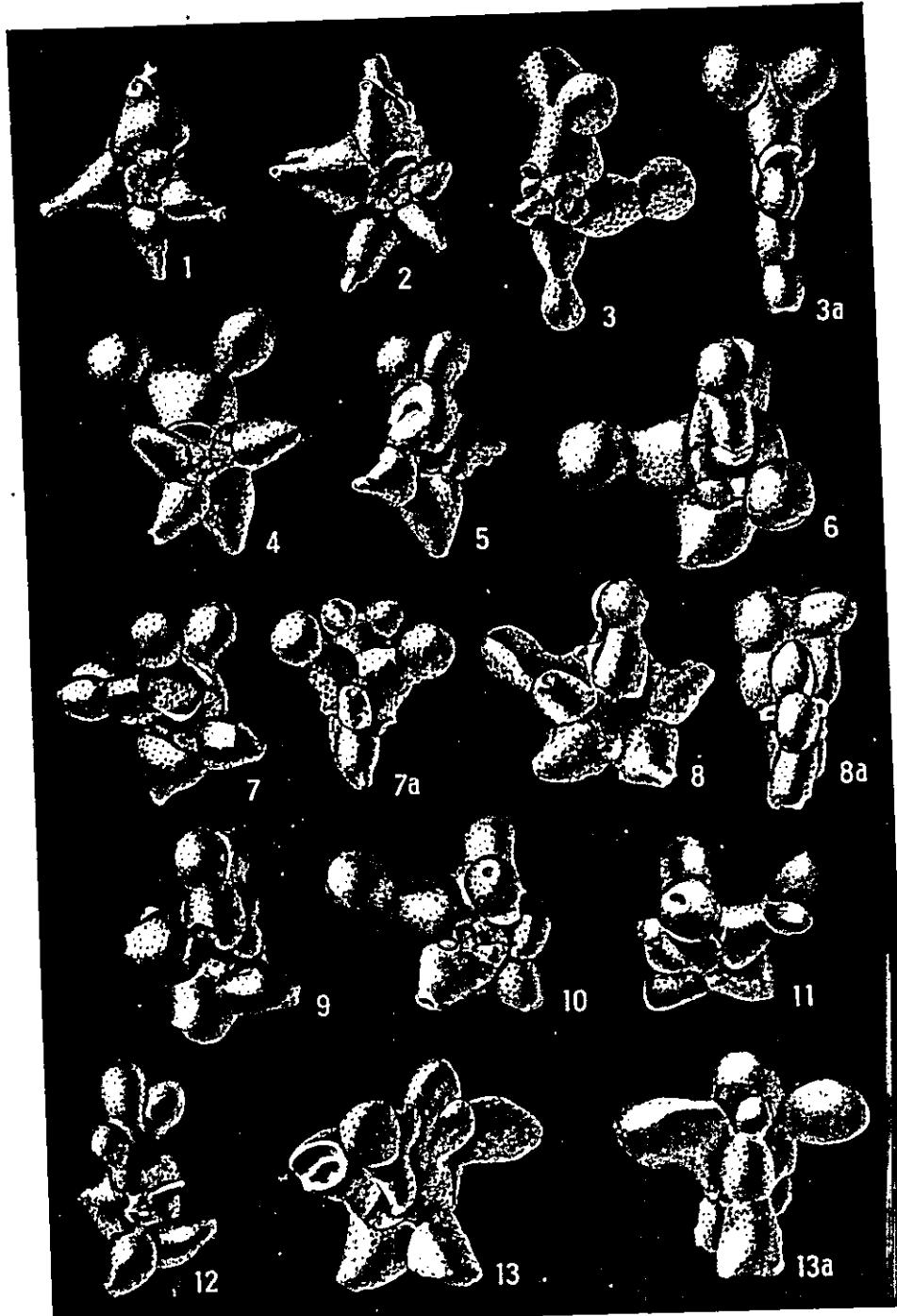


Plate I. *Grimsdaleinella*, n. gen.All figures $\times 75$ Figs. 1-11. *Grimsdaleinella spinosa*, n. gen., n. sp.

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.

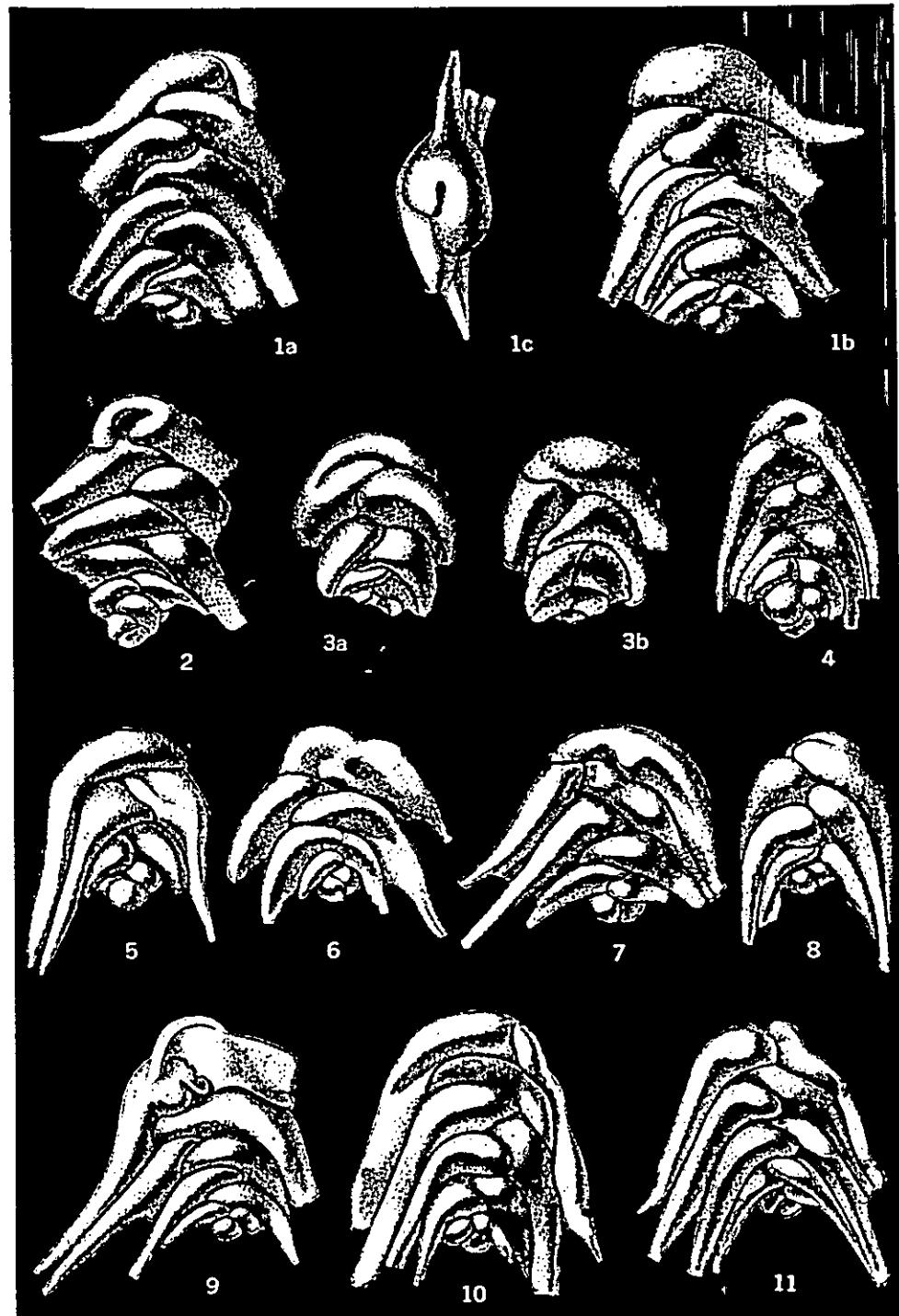
3b. View of opposite side.

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])



GANSSERINA Robaszynski, Caron, Gonzalez & Wonders, 1984

Discussion of genera

ABATHOMPHALUS Bolli, Loeblich & Tappan, 1957

Type species: *Globotruncana mayaroensis* Bolli, 1951.

The genus differs from *Globotruncana* in the umbilical-extrumbilical 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*.

ARCHAEGLOBIGERINA 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. archaeocretacea* - *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. asymmetrica* lineage, the genus shows a trend towards curved umbilical sutures, a tendency already present in certain specimens of the ancestral *D. ulgeriana*.

FALSTRUNCANA Caron, 1981

Type species: *Falsotruncana maslakavae* 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-extrumbilical. It differs from *Hedbergella* in the reticulate sculpture.

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 ulgeriana* 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: *Polkskanella* 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: *Guembelitria cretacea* Cushman, 1933.

The very small (150–200 µm), 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 *Schuckinina* 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 infralaminal 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 Hoiker, 1956

Type species: *Rosalina 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 *Rosalia*, 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 *singuosa*, or a single one as in *sigilli* and *mariannosi*.

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.

PSEUDOQUEMBELINA 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 Heterohelicidae 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 fructicosa* Egger, 1899.

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

ROSITA Robaszynski, Caron, Gonzalez & Wonders, 1984

Type species: *Globotruncana fornicate* Plummer, 1931.

The spiral side of the test can be moderately high as in *R. fornicate* 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: *Rotalipora turonica* Brotzen, 1942. (Now junior synonym of *Rotalipora cushmani* (Morrow), 1934.)

Synonyms: *Thalmanninella* Sigal, 1948.

Anaticinella Eicher, 1972.

Pseudoteticinella Longoria, 1973.

Emendations: Reichel, 1950. Sigal, 1958.

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

RUGOGLOBIGERINA Brönnimann, 1952

Type species: *Globigerina rugosa* Plummer, 1927.

Synonyms: *Trinitella* Brönnimann, 1952.

Plummerita 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 subcircumnodifer* 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 crenulata* Schacko, 1897.

Synonym: *Leupoldina* Bolli, 1957.

Schackoina differs from *Hastigerinoides* in its tubulospines or bulbous extensions 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 *Rotalipora* in the lack of a peripheral keel.

WHITEINELLA Pessagno, 1967

Type species: *Whiteinella archaeocretacea* Pessagno, 1967.

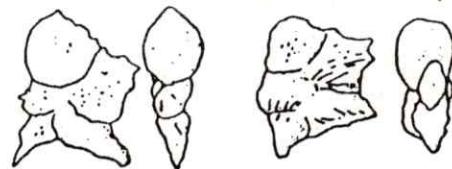
Whiteinella differs from *Heubergella* in the presence of portici; from *Archaeoglobigerina* in the absence of tegilla and absence of the wide imperforate peripheral band; from *Praeglobotruncana* in the absence of imbricated pustules along the peripheral margin. *Whiteinella* is a homeomorph of *Globotruncanella*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

References

- Bartenstein, H., Bettenstaedt, F. & Bolli, H.M. (1957): Die Foraminiferen der Unterkreide von Trinidad, B.W.I. Erster Teil: Cuche- und Toco-Formation. Eclogae geol. Helv. 50/1, 5-67.
- Bartenstein, H. (1966): Die Foraminiferen der Unterkreide von Trinidad, W.I. Zweiter Teil: Maridale-Formation (Typlokalität). Eclogae geol. Helv. 59/1, 129-177.
- Bartenstein, H. & Bolli, H.M. (1977): The Foraminifera in the Lower Cretaceous of Trinidad, W.I. Part 4: Cuche Formation, upper Part; Leupoldina Protuberans Zone. Eclogae geol. Helv. 70/2, 543-573.
- Bolli, H.M. (1951): The genus Globotruncana in Trinidad, B.W.I. J. Paleontol. 25, 187-99.
- Bolli, H.M. (1957): The genera Praeglobotruncana, Rotalipora, Globotruncana, and Abathomphalus in the Upper Cretaceous of Trinidad, B.W.I. In: A.R. Loeblich, Jr. Studies in Foraminifera. Bull. U.S. natl. Mus., 215, 51-60.
- Bolli, H.M. (1957): The foraminiferal genera Schackoinea Thalmann, emended and Leupoldina, n.gen. in the Cretaceous of Trinidad, B.W.I. Eclogae geol. Helv. 50/2, 271-278.
- Bolli, H.M. (1959): Grimsdaleinella, a new genus of the foraminiferal family Heterohelicidae. Eclogae geol. Helv. 52/1, 1-4.
- Bolli, H.M. (1959): Planktonic foraminifera from the Cretaceous of Trinidad, B.W.I. Bull. Am. Paleontol. 39, 257-77.
- Bolli, H.M. (1966): Zonation of Cretaceous to Pliocene marine sediments based on planktonic foraminifera. Boletin Informativo Asociacion Venezolana de Geologia, Mineria y Petroleo 9, 3-32.

- Bolli, H.M., Loeblich, A.R. Jr. & Tappan, H. (1957): Planktonic foraminiferal families Hantkeninidae, Orbulinidae, Globorotaliidae and Globotruncanidae. Bull. U.S. Natl. Mus. 215, 3-50.
- Bolli, H.M., Saunders, J.B. & Perch Nielsen, K., Editors (1985): Plankton Stratigraphy. Cambridge University Press.
- Brönnimann, P. (1952): Globigerinidae from the upper Cretaceous (Cenomanian-Maestrichtian) of Trinidad, B.W.I. Bull. Am. Paleontol. 34, 5-71.
- Caron, M. (1985): Cretaceous planktic foraminifera. In: Plankton Stratigraphy (Bolli, H.M., Saunders, J.B. & Perch Nielsen, K. Eds.), Cambridge University Press, 17-86.
- Gandolfi, R. (1955): The genus Globotruncana in Northeastern Colombia. Bull. Amer. Pal. 36/155, 1-118.
- Guillaume, H.A., Bolli, H.M. & Beckmann, J.P. (1972): Estratigrafia del Cretaceo inferior en la Serrania del Interior, Oriente de Venezuela. Memoria IV Congr. Geol. Venez. Tomo III. Bol. de Geol. Publ. Especial 5, 1619-1659.
- Longoria, J.F. (1974): Stratigraphic, morphologic and taxonomic studies of Aptian planktonic foraminifera. Rev. Espanola Micropal., Numero Extraordinario, Diciembre 1974, 1-107.
- Longoria, J.F. (1984): Cretaceous biochronology from the Gulf of Mexico region based on planktonic microfossils. Micropaleontology 30/3, 225-542.
- Longoria, J.F. & Gamper, M.A. (1975): The evolution and classification of Cretaceous planktonic foraminifera. Part I: The superfamily Hedbergelloidea. Rev. Espanola Micropal. Numero Extraordinario. Enero 1975, 61-96.

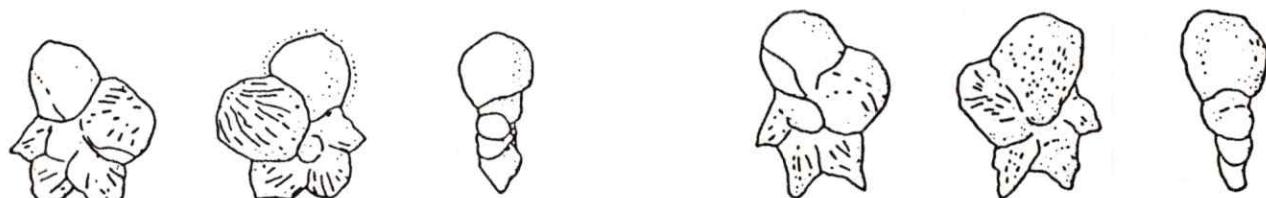
- Masters, B.A. (1977): Mesozoic planktonic foraminifera; a world-wide review and analysis. In: Ramsay, A.T.S. Ed., Oceanic micropaleontology. London: Academic Press, 1, 301-731.
- Pessagno, E.A. Jr. (1967): Upper Cretaceous planktonic foraminifera from the Western Gulf Coastal Plain. *Palaeontographica Amer.* 5, 259-441.
- Postuma, J.A. (1971): Manual of planktonic foraminifera. Elsevier, 395 p.
- Premoli Silva, I. & Bolli, H.M. (1973): Late Cretaceous to Eocene planktonic foraminifera and stratigraphy of Leg 15 sites in the Caribbean Sea. Initial Rep. Deep Sea Drill. Proj. 15, 499-547.
- Robaszynski, F. & Caron, M., Coordinators (1979): Atlas de Foraminifères planctoniques du Crétacé moyen. Parts 1-2. Cah. Micropaleontol. 1 and 2, 1-185 und 1-181.
- Robaszynski, F., Caron, M., Gonzalez, J.M. & Wonders, A. (1984): Atlas of Late Cretaceous planktonic foraminifera. Rev. Micropaleontol. 26, fasc. 3-4, 145-305.
- Rod, E. & Maync, W. (1954): Revision of Lower Cretaceous stratigraphy of Venezuela. *Amer. Assoc. Petrol. Geol. Bull.* 38/2, 193-283.
- Salvador, A. & Stainforth, R.M. (1965): Clues in Venezuela to the geology of Trinidad, and vice versa. 4th Caribbean Geol. Congr., Trinidad, 31-40.



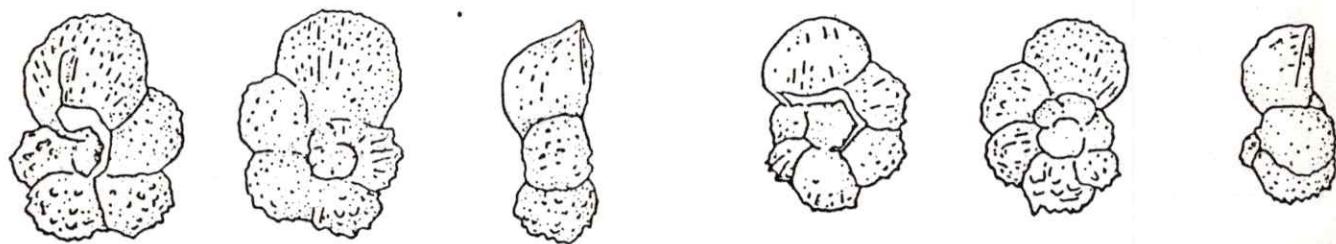
Plummerita hantkeninoides hantkeninoides Brönnimann. Specimen on left: Holotype



Plummerita hantkeninoides costata Brönnimann. Holotype

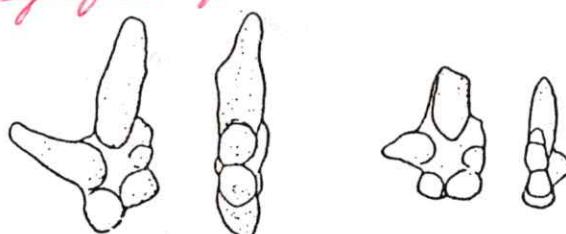


Plummerita hantkeninoides inflata Brönnimann. Specimen on left: Holotype

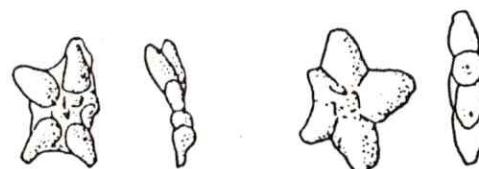


Trinitella scotti Brönnimann. Specimen on left: Holotype

Rugoglochonidea



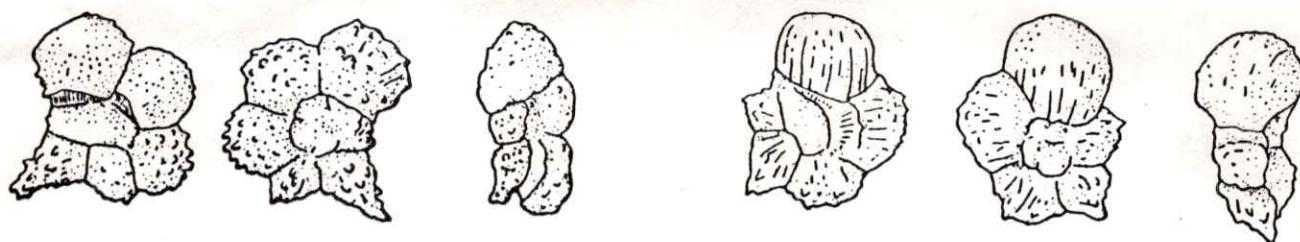
Hastigerinoides alexanderi (Cushman)



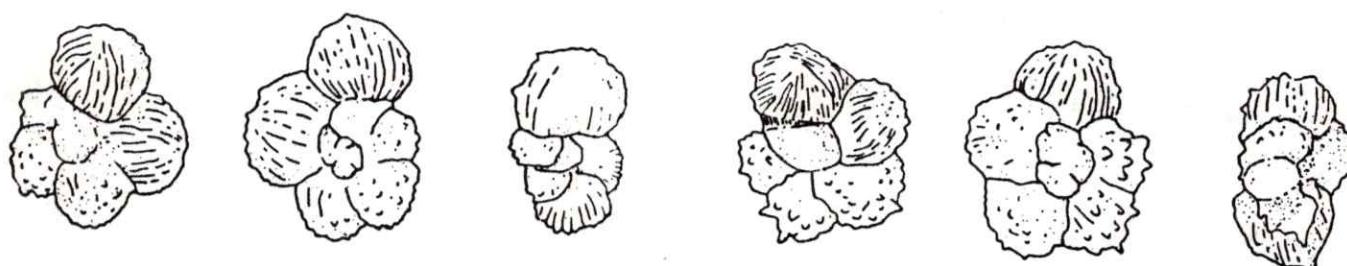
Hastigerinoides rohri Brönnimann

Marcos Castro M.
BIOLOGIA

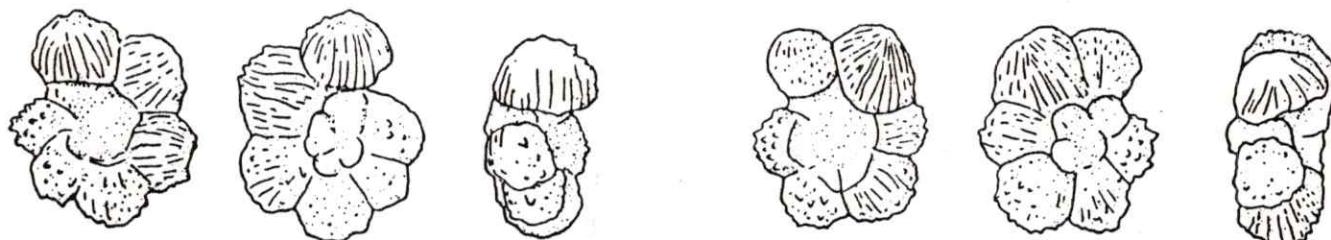
all specimens x 80



Rugoglobigerina reicheli reicheli Brönnimann



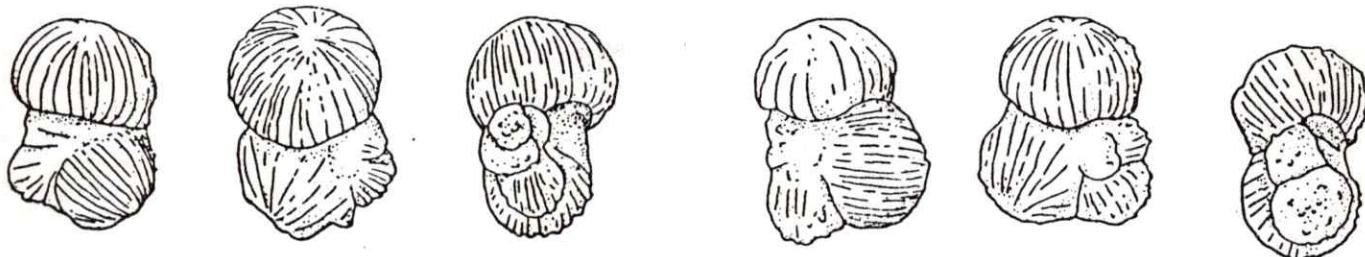
Rugoglobigerina reicheli pustulata Brönnimann



Rugoglobigerina reicheli hexacamerata Brönnimann

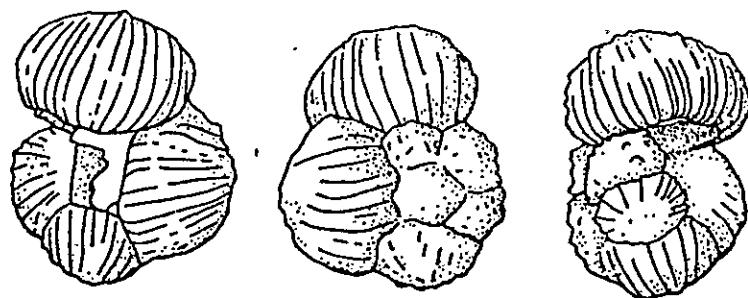


Rugoglobigerina macrocephala macrocephala Brönnimann

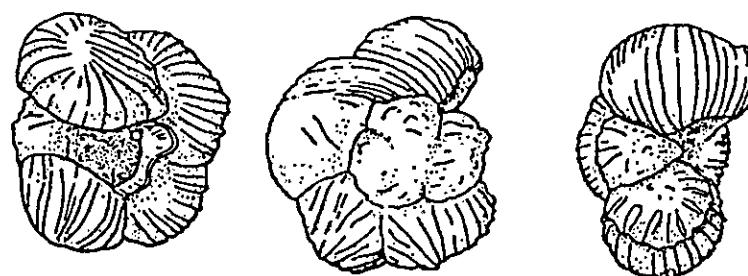


Rugoglobigerina macrocephala ornata Brönnimann

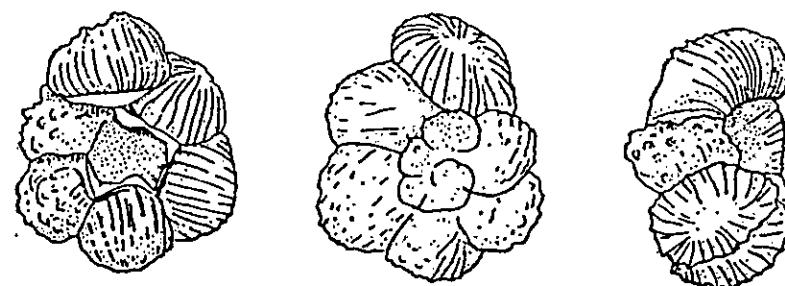
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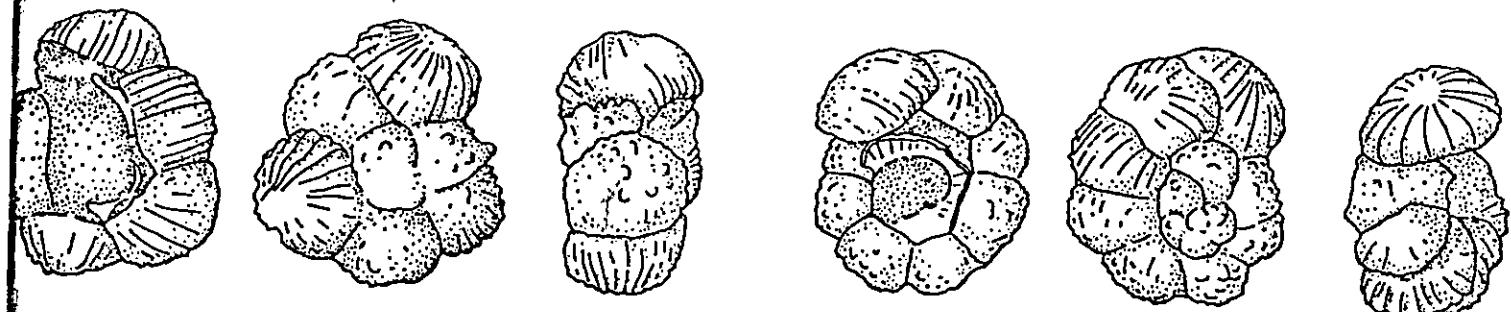
Rugoglobigerina rugosa rugosa (Plummer) 4-chambered specimen



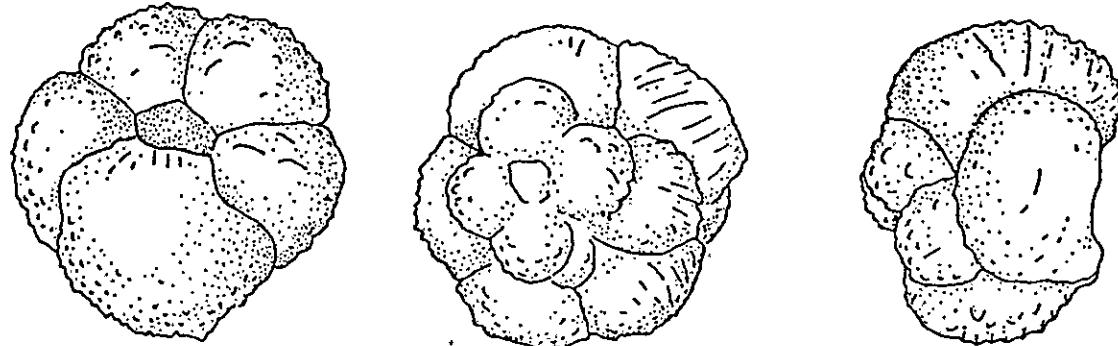
Rugoglobigerina rugosa rugosa (Plummer) 5-chambered specimen



Rugoglobigerina rugosa rugosa (Plummer) 6-chambered specimen



Rugoglobigerina rugosa pennyi Brönnimann



Rugoglobigerina rugosa rotundata Brönnimann

all Specimens x 80

Mariante Castro M.
GEOLOGIA