10. LATE CRETACEOUS, PALEOGENE AND NEOGENE PLANKTONIC FORAMINIFERA

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INTRODUCTION

Late Cretaceous, Paleogene, and Neogene calcareous deposits containing planktonic foraminifera were recovered in Holes 199, 200, 200A, and 202 near the margin of the Caroline Abyssal Plain. Stratigraphic sections of these holes supplement one another to form a discontinuous composite stratigraphic succession of Cretaceous and Cenozoic deposits. The deposits of the Maastrichtian, late Paleocene, certain zones of the early and middle Eocene, and almost the whole Neogene beginning from the Burdigalian Stage were sampled. Despite stratigraphic incompleteness, these sections are of interest, since the planktonic foraminiferal biostratigraphy of the Late Cretaceous, Paleogene, and Neogene of the tropical area of the Pacific Ocean has been insufficiently studied. Foraminiferal assemblages of Sites 200 and 202 are listed in Tables 1 and 2, and their distribution in the Miocene through Pleistocene at Site 200 is shown in Table 3.

LATE CRETACEOUS

Late Cretaceous limestones were penetrated in Hole 199. The oldest layers (Core 13) are devoid of planktonic foraminifera. The limestones of Core 12 are characterized by extremely sporadic and small *Rugoglobigerina* spp., *Pseudoguembelina* spp., *Heterohelix* spp., placing these deposits within the Campanian-Maastrichtian stages.

More diverse planktonic foraminifera occur in the limestones of Core 11 (Section 2): *Abathomphalus mayaroensis* (Bolli), *Globotruncanella havanensis* (Voorw.), *G. petaloidea* Gand., *Hedbergella monmouthensis* (Olsson), *Rugoglobigerina hexacamerata* Bronn., *R. ordinaria* (Subb.), *Heterohelix striata* (Ehrenb.), *Pseudoguembelina* spp., and *Guembelitria cretacea* Cushm., indicating a late Maastrichtian age (*Abathomphalus mayaroensis* Zone). Tests of foraminifera are rare and possess thin semitransparent walls with traces of dissolution. This association of planktonic foraminifera is certain to be a result of selective dissolution, indicating that the accumulation of the Maastrichtian calcareous sediments (Core 11) was proceeding at depths near the level of carbonate compensation (the limestones consist predominantly of nannofossils).

The above can be supported by the following: In the foraminiferal limestones of the upper Paleocene of Hole 199 Maastrichtian redeposited foraminifers are very common (*Abathomphalus mayaroensis* [Bolli], *Globotruncana stuartiformis stuartiformis* Dalb., *G. stuarti* [Lapp.], *G. contusa* [Cushm.], *G. gansseri* Bolli, *Racemiguembelina fructicosa* [Egger], *Pseudotextularia elegans* [Rzehak], *Pseudoguembelina excolata* [Cushm.], etc.). Tests of these species are characterized by regular size, thick walls, and picturesque ornamentation, and they must be derived from the erosion of Maastrichtian calcareous oozes on the slopes of adjacent guyots during the Paleocene. This indicates that standard assemblages of planktonic foraminifera were living in the area during the Maastrichtian and that the ocean floor in the area of Hole 199 in Maastrichtian time was situated at depths near the level of carbonate compensation.

LAYERS TRANSITIONAL FROM CRETACEOUS TO PALEOGENE

Late Maastrichtian limestones (the *Abathomphalus mayaroensis* Zone) are conformably overlain by limestones of similar lithology with extremely peculiar assemblages of planktonic foraminifera (Hole 199; Core 11, Section 1; Core 10, Section 2, 58-145 cm). They consist of minute "*Globigerina*" *eugubina* Lut. and Premoli Silva, "*G.*" *minutula* Lut. and Premoli Silva, "*G.*" *fringa* Subb., "*G.*" *sabina* Lut. and Premoli Silva, "*G.*" *anconitana* Lut. and Premoli Silva, *Chiloguembelina taurica* Moroz., and *Guembelitria irregularis* Moroz. Planktonic foraminiferal tests are sporadic in these rocks; this probably indicates accumulation of calcareous sediments near the level of carbonate compensation.

The above species of "*Globigerina*" are accompanied by sporadic small and thin-walled *Rugoglobigerina ordinaria* Subb., *Rugoglobigerina* sp., *Heterohelix* sp., *Pseudoguembelina* spp., *Hedbergella monmouthensis* (Olsson), *Globotruncanella petaloidea* Gand., and *Abathomphalus mayaroensis* (Bolli). It is not certain whether the tests of these foraminifera are in situ or redeposited.

These deposits, with minute "*Globigerina,*" belong to the *Globigerina eugubina* Zone established by H. Luterbacher and I. Premoli Silva (1964) in continuous sections of Cretaceous-Tertiary deposits of the central Apennines (Italy, Gubbio, Perugia). The limestones of the *Globigerina eugubina* Zone are of insignificant thickness (not over 0.5 m) and in this region separate limestones with typical late Maastrichtian species *Abathomphalus, Globotruncana, Rugoglobigerina, Trinitella, Racemigumbelina, Pseudotextularia, Omphalocyclus* and *Lepidorbitoides* from limestones of the *Globorotalia pseudobulloides-Globigerina daubjergensis* Zone with a standard microfauna of the Danian Stage (Paleocene).

The planktonic foraminiferal assemblage of the *Globigerina eugubina* Zone of Italy consists of numerous and minute (usually less than 0.1 mm) *Globigerina eugubina, G. umbrica, G. anconitana, G. sabina, G. minutula*, and *G. fringa*. H. Luterbacher and I. Premoli Silva believe that the deposits of this zone can be attributed to the lowermost Danian Stage (Paleocene) missing in type-sections of the Danian Stage of Denmark and Sweden. Primitive "*Globigerina*" of the *Globigerina eugubina* Zone are

TABLE 1
Foraminiferal Assemblages, Site 200 Cores

200-1	200-2	200-3	200-4
Abundant planktonic foraminifera: *Globorotalia truncatulinoides, G. tumida, G. humerosa, G. cultrata, G. inflata, G. crassaformis, Sphaeroidinella dehiscens, Pullenia tina obliquiloculata, Globigerinoides conglobatus, G. fistulosus, G. ruber, G. sacculifera, Orbulina universa, Candeina nitida, Hastigerina siphonifera.* Pleistocene; Zone N.22.	Abundant and diverse planktonic foraminifera; *Sphaeroidinella dehiscens, Pulleniatina obliquiloculata, Globorotalia tumida, G. ungulata, G. humerosa, G. cultrata, G. inflata, Globigerinoides fistulosus, G. conglobatus, Candeina nitida* together with rare specimens of *Globorotalia tosaensis* and *G. multicamerata.* Late Pliocene; Zone N.21 (basal part, or transition to Zone N.20).	Assemblages of abundant and very diverse planktonic foraminifera: *Sphaeroidinella dehiscens, Sphaeroidinellopsis subdehiscens, Sph. seminulina, Globorotalia tumida tumida, G. humerosa, G. crassaformis, G. hirsuta, G. multicamerata, Globigerinoides conglobatus, Globigerina nepenthes, Candeina nitida, Globoquadrina altispira, G. dehiscens, Pulleniatina obliquiloculata.* Early Pliocene; Zone N.19. In Sections 1 and 2 *Sphaeroidinellopsis* spp., *Globigerina nepenthes, Globoquadrina altispira* are very rare. Evidently, transition to Zone N.20.	Assemblages of abundant planktonic foraminifera include *Globorotalia tumida tumida, G. menardii, G. multicamerata, G. miocenica, G. margaritae, Globigerina nepenthes, Sphaeroidinellopsis seminulina, Sph. subdehiscens, Orbulina universa, Globoquadrina altispira, Globigerinoides obliquus extremus, Candeina nitida, Pulleniatina primalis,* very rare *Globorotalia tumida plesiotumida.* Upper Miocene; Messinian Stage; Zone N.18.
200-5	200-6	200-7	200-8
Abundant planktonic foraminifera represented by *Sphaeroidinellopsis seminulina, Sph. subdehiscens, Globorotalia tumida plesiotumida, G. miocenica, G. menardii, G. margaritae, G. multicamerata, G. acostaensis, Orbulina universa, Globigerina nepenthes, Globigerinoides obliquus extremus, G. bollii, Candeina nitida, Pulleniatina primalis.* Upper Miocene; Messinian Stage; Zone N.17.	Planktonic foraminifers of the core catcher and Section 2 are represented by numerous *Sphaeroidinellopsis seminulina, Sph. subdehiscens, Globorotalia cultrata, G. menardii, Globigerina nepenthes, Orbulina universa, Globoquadrina dehiscens, G. altispira,* common *Globigerinoides obliquus extremus, Globorotalia merotumida,* rare *G. lenguaensis, G. acostaensis, Candeina nitida.* Upper Miocene; Tortonian Stage; Zone N.16. Rare specimens of *Globorotalia plesiotumida* were found in Section 1. The age of these sediments–Messinian Stage, Zone N.17 (but uphole contamination may take place on account of the soupy character of the oozes).	The following species of planktonic foraminifera are present in the core catcher: abundant *Sphaeroidinellopsis subdehiscens, Sph. seminulina, Globigerina nepenthes, Globoquadrina altispira, G. dehiscens,* common *Globorotalia menardii, G. cultrata, G. obesa, Orbulina universa, Globigerina bulloides, Globigerinoides obliquus, G. bollii,* rare *Globorotalia merotumida, G. acostaensis, G. lenguaensis, Candeina nitida praenitida, Globigerina bulbosa.* Upper Miocene; Tortonian Stage, Zone N.15 (top) or N.16 (base).	None. (Mixture of Pliocene, upper and middle Miocene planktonic foraminifera. Uphole contamination.)
200-9	200-10	200A-1	200A-2
The assemblage of planktonic foraminifera of Section 1 consists of *Obulinra suturalis, Globorotalia praemenardii, G. obesa, G. siakensis,' G. peripheroronda, G. (Clavatorella) bermudezi, Sphaeroidinellopsis seminulina, Hastigerina siphonifera.* Middle Miocene; Zone N.9 (lower part). All other sections (2-6) contain *Praeorbulina transitoria, P. glomerosa, Globigerinoides sicanus, G. diminuta, G. mitra, G. trilobus, Globoquadrina dehiscens, G. altispira, G. langhiana, G. baroemoenensis, Globigerinatella insueta.* Lower Miocene; Burdigalian Stage; Zone N.8.	Core catcher includes sediments of two different types with foraminifera of different age. Soft calcareous oozes are characterized by numerous *Globigerinoides sicanus, G. trilobus, G. subquadratus, Globoquadrina dehiscens, G. altispira* together with less abundant *Praeorbulina glomerosa, Globigerinoides, diminuta, Globoquadrina langhiana.* Lower Miocene; Burdigalian Stage; Zone N.8. Pieces of hard limestone contain numerous *Globigerina bradyi, G. juvenilis, G. binaiensis, G. falconensis, Globigerinoides trilobus,* common *Globoquadrina baroemoenensis, G. altispira,* rare *Globigerinita stainforthi, Globoquadrina praedehiscens.* Lower Miocene; transition from Aquitanian Stage to Burdigalian Stage; Zone N.6 (upper part).	Abundant *Sphaeroidinella dehiscens, Sphaeroidinellopsis subdehiscens, Sph. seminulina, Pulleniatina obliquiloculata, Candeina nitida, Globorotalia tumida, G. crassaformis, G. humerosa, G. hirsuta, Globigerina nepenthes, Globoquadrina dehiscens, G. altispira, Globigerinoides conglobatus, G. ruber.* Lower Pliocene (with reworked lower Eocene species–*Globorotalia aragonensis, G. caucasica, Acarinina pentacamerata* and uphole contamination–Pleistocene *Globorotalia truncatulinoides*).	Very rich assemblages of planktonic foraminifera consisting of numerous *Globorotalia formosa, G. marginodentata, G. quetra, G. troelseni, G. wilcoxensis, G. apanthesma, G. lensiformis, Acarinina triplex, A. pseudotopilensis, A. soldadoensis, A. gravelli, A. decepta, A. broedermanni* together with rare *Globorotalia aragonensis, G. caucasica, G. marksi, G. naussi, Globigerina prolata, Chilogumbelina wilcoxensis.* Lower Eocene; the *Globorotalia formosa formosa* Zone (uppermost part).

TABLE 2
Foraminiferal Assemblages, Site 202 Cores

202-1	202-2	202-3 through 6
Abundant *Sphaeroidinella dehiscens, Globorotalia tumida, G. multicamerata, G. humerosa, G. crassaformis, Pulleniatina obliquiloculata, Globigerinoides conglobatus, G. ruber, G. sacculifera, Sphaeroidinellopsis seminulina, Sph. subdehiscens, Globoquadrina dehiscens, G. altispira, Globigerina nepenthes.* Lower Pliocene; the *Sphaeroidinella dehiscens–Globoquadrina altispira* Zone (N.19). Uphole contamination of rare Pleistocene foraminifera–*Globorotalia truncatulinoides.*	Abundant planktonic foraminifera–*Orbulinoides beckmanni, Hantkenina alabamensis, Globigerinatheca barri, Globigerapsis index, G. kugleri, Globorotalia spinulosa, G. centralis, G. lehneri, Acarinina bullbrooki, Truncorotaloides topilensis, T. rohri, Globigerina pseudovenezuelana, G. galavisi, G. pseudoeocaena.* Middle Eocene; the *Orbulinoides beckmanni* Zone (P.13).	No foraminifera

regarded by H. Luterbacher and I. Premoli Silva as a stock from which all Tertiary Globigerinacea have originated (they appear in sediments of the above-lying *Globorotalia pseudobulloides-Globigerina daubjergensis* Zone).

At present, the deposits of the *Globigerina eugubina* Zone have been recognized in a limited number of regions of the world; i.e., Italy, the USSR, North Africa, and the Caribbean Sea. In the Soviet Union, the presence of the *Globigerina eugubina* Zone was established by Nevzorova (1971) eastward of the Caspian Sea in the area of the West Kopet-Dag Ridge (lower part of the Sumbar Horizon). The thickness of deposits of the zone is not great, since that of the whole Sumbar Horizon is not over 27 meters. The *Globigerina eugubina* Zone is characterized here by small low trochospiral "*G.*" *eugubina,* "*G.*" *anconitana,* "*G.*" *minutula,* "*G.*" *umbrica,* and "*G.*" *sabina*; no common planktonic and benthonic species of the Maastrichtian Stage have been recognized. Some of the enumerated "*Globigerina*" species pass into the deposits of the above-lying *Globigerina taurica* Zone, where *G. taurica* Moroz., *G. eobulloides* Moroz., *G. tetragona* Moroz., *G. pentagona* Moroz., etc., occur in abundance. The presence of the *Globigerina taurica* Zone has been established in many regions of the USSR (Crimea, Caucasus, Trans-Caspian area), in Syria and Egypt (Krasheninnikov, 1964, 1965; Krasheninnikov, Abd el Razik, 1969; Fahmy, Krasheninnikov et al., 1969), and on the Shatsky Rise in the Pacific Ocean (Fisher et al., 1971; Krasheninnikov, 1971). We believe that it corresponds to the *Globorotalia pseudobulloides-Globigerina daubjergensis* Zone in Italy according to the interpretation by H. Luterbacher and I. Premoli Silva (1964).

Blow (*in* Fisher et al., 1971, p. 1021), while speaking of transitional layers from the Maastrichtian to the Danian Stage, writes: "In parts of the North African area, the extinction of *Globotruncana* spp. is followed by an interval with small *Rugoglobigerina* spp. and *Pseudoguembelina* spp., which the writer considers as equivalent to the '*Globigerina*' *eugubina* zone of Luterbacher and Silva." According to Blow, the age of this interval is sure to be late Maastrichtian, somewhat older than the *Globigerina* (*Eoglobigerina*) *taurica* Zone established by the Soviet micropaleontologists. Blow puts the generic name of *Globigerina eugubina* in quotation marks as he evidently doubts whether it is correct to assign *G. eugubina, G. sabina, G. minutula, G. umbrica,* and *G. fringa* to the genus *Globigerina.*

Deposits of the *Globigerina eugubina* Zone were also recognized by H. Bolli and I. Premoli Silva during Deep Sea Drilling Leg 15 in the Caribbean Sea (Edgar et al., 1971). They were penetrated in Holes 152 (the Nicaragua Rise) and 153 (the southern end of the Beata Ridge near Aruba Gap). The assemblage of planktonic foraminifera of the *Globigerina eugubina* Zone in the Caribbean basin consists of the same species of small *Globigerina* as those in Italy. Some of these species (*Globigerina eugubina, G. sabina*) also pass into the deposits of the overlying *Globorotalia pseudobulloides* Zone (Hole 146, Venezuelan Basin).

In Hole 153, the deposits of the *Globigerina eugubina* Zone occur unconformably (within one core) on limestones with flints of the early Maastrichtian (the *Globotruncana tricarinata* Zone). In Hole 152, they are underlain by the middle Maastrichtian (the *Globotruncana gansseri* Zone). However, the deposits of this age are separated here by an interval (one core) with poor recovery. In the neighboring hole (Hole 146), the Maastrichtian is terminated by sediments of the *Abathomphalus mayaroensis* Zone.

The recognition of the *Globigerina eugubina* Zone on the Caroline Abyssal Plain testifies to the wide geographical distribution of this stratigraphic unit (the Pacific Ocean, Caribbean, Mediterranean, Transcaspian area) occupying the same stratigraphic level everywhere; i.e., above the *Abathomphalus mayaroensis* Zone of the late Maastrichtian and beneath the *Globigerina taurica* Zone (or synchronous *Globorotalia pseudobulloides-Globigerina daubjergensis* Zone) of the lower part of the Danian Stage. There are, however, differing opinions concerning the age of the *Globigerina eugubina* Zone itself; either the top of the Maastrichtian (Blow) or the base of the Paleogene (Luterbacher, Premoli Silva, Bolli, Nevzorova). The solution of this problem is hindered by the poor preservation of material from this zone. Planktonic foraminifera from comparatively hard limestones of the *Globigerina eugubina* Zone of Italy do not appear to be well preserved, and the character and position of the aperture in *Globigerina sabina, G. umbrica, G. minutula, G. eugubina,* and *G. anconitana* still remain obscure (in the paper by H. Luterbacher and I. Premoli Silva, 1964, the aperture is shown schematically). Though tests of *Globigerina minutula, G. sabina, G. anconitana, G. fringa,* and *G. eugubina* in calcareous rocks of the Caroline Abyssal Plain are relatively scarce, they are characterized by excellent preservation. The examination of all specimens showed very convincingly that the aperture does not open into the

TABLE 3
Distribution of Planktonic Foraminifera, Site 200

R = Rare
F = Few
C = Common
A = Abundant

Zone	Sample	*Globorotalia fimbriata*	*Globorotalia dutertrei*	*Globorotalia truncatulinoides*	*Globigerina rubescens*	*Globigerinoides fistulosus*	*Globorotalia tosaensis*	*Globigerinoides pyramidalis*	*Globorotalia inflata*	*Globorotalia ungulata*	*Globorotalia hirsuta*	*Globorotalia humerosa*	*Pulleniatina obliquiloculata*	*Globorotalia crassaformis*	*Sphaeroidinella dehiscens*	*Pulleniatina spectabilis*	*Globigerina praedigitata*	*Globorotalia flexuosa*	*Globorotalia tumida tumida*	*Globigerinoides conglobatus*	*Globorotalia margaritae*	*Globorotalia miocenica*	*Globorotalia multicamerata*	*Hastigerina pelagica*	*Pulleniatina primalis*	*Globorotalia plesiotumida*	*Candeina nitida nitida*	*Globigerinita glutinata*	*Globigerinoides obliquus extremus*	*Sphaeroidinellopsis seminulina kochi*	*Candeina nitida praenitida*
N.22 *Globorotalia truncatulinoides*	1-1	R	C	F	C			C	R	C	R	C	C	C	C		R		C	C							C	F			
	1-2	R	F	F	F			C		F	R	C	C	C	C				C	C							C	F			
	1-3		F	F	R			C	R	C	R	C	C	C	C				C	C							C	F			
	1-4		F	F	–			C	R	C	R	C	C	C	C				C	C							F	F			
	1-5		F	F	–			C	–	C	R	C	C	C	C				C	C							C	R			
	1, CC		F	F	R		R	C	R	C	R	C	C	C	C				C	C							F	R			
N.21 *Globorotalia tosaensis*	2-1				–	F	F	C	R	C	R	C	C	C	C				C	C							F	R			
	2-2				–	C	F	C	–	C	R	F	C	C	C				C	C			R				F	R			
	2, CC				R	F	F	F	F	F	F	F	C	C	C				C	C			R				R	R			
N.20 *Globorotalia multicamerata Pulleniatina obliquiloculata*	3-1							cf	–	C	F	F	C	C	C				C	C			C				F	R	R	R	
	3-2								R	F	R	R	C	C	C			C	C	C			C				F	R	F	R	
N.19 *Sphaeroidinella dehiscens- Globoquadrina altispira*	3-3								–	F	R	–	F	C	C	C		R	C	C	R		C				F	R	C	R	
	3-4								R	R	R	R	R	F	C	C		F	R	C	F		C				F	R	C	R	
	3, CC										F	R	cf	F	F	C	F	R	C	C	R		C		cf		F	R	R	F	
N.18 *Globorotalia tumida- Sphaeroidinellopsis subdehiscens paenedehiscens*	4-1															R	R		C	C	F	R	C		R	R	R	R	C	C	
	4-2																		C	C	–	C	C		C	R	–	R	C	C	
	4-3																		C	C	R	R	F		F	R	R	R	C	C	
	4, CC																		R	C	–	C	C		F	R	F	R	C	C	
N.17 *Globorotalia plesiotumida*	5-1																			R	R	R	F		R	C	F	R	C	F	R
	5, CC																							R	R	C	F	R	C	R	R
N.16 *Globorotalia acostaensis Globorotalia merotumida*	6-1																									A	R	R	R	C	R
	6-2																											R	R	C	R
	6, CC																											R	R	C	R
N.15-N.16	7, CC																														R
Middle Miocene	8, CC																														
N.9 *Orbulina suturalis*	9-1																														
N.8 *Globigerinoides sicanus Globigerinatella insueta*	9-2																														
	9-3																														
	9-4																														
	9-5																														
	9-6																														
Globigerinatella insueta Globigerinita dissmiilis	10, CC																														

TABLE 3 – *Continued*

Globigerina bulbosa	*Globigerina nepenthes*	*Globigerinoides bollii*	*Globigerinoides obliquus obliquus*	*Globigerinoides ruber*	*Globigerinoides sacculifer*	*Globorotalia acostaensis*	*Globorotalia cultrata*	*Globorotalia menardii*	*Sphaeroidinellopsis subdehiscens*	*Biorbulina bilobata*	*Orbulina universa*	*Globorotalia scitula*	*Globorotalia merotumida*	*Orbulina suturalis*	*Globorotalia bermudezi*	*Sphaeroidinellopsis seminulina seminulina*	*Hastigerina siphonifera*	*Globorotalia archeomenardii*	*Globigerinatella insueta*	*Globigerinoides sicanus*	*Globigerinoides diminutus*	*Globigerinoides mitra*	*Globoquadrina dehiscens*	*Globoquadrina langhiana*	*Praeorbulina glomerosa*	*Praeorbulina transitoria*	*Globigerina angustiumbilicata*	*Globigerina bradyi*	*Globigerina juvenilis*	*Globigerina binaiensis*	*Globigerina venezuelana*	*Globigerinita stainforthi*	*Globigerinoides trilobus*	*Globoquadrina altispira*	*Globoquadrina baroemoenensis*	*Globoquadrina praedehiscens*	*Globigerinoides subquadratus*
				C	C		A	A			C	C					F						C										C			
				C	C		C	C			C	C					F						C										C			
				C	C		C	C			C	C					F						C										C			
				C	C		C	C			C	F					F						C										C			
				C	C		C	C		R	C	C					F						C										C			
				C	C		C	C			C	C					F						C										C			
				C	C		C	C			C	F					F						C										C			
				C	C	R	C	C			C	C					F						C	R									C	R		
		R	R	C	C	R	C	C			C	F					F						C	R									C	R		
		R	R	C	C	–	C	C			C	F				R	F						C	R									C	R		
	R	R	R	R	C	R	C	C	F	R	C	F				R	F						C	R							R		C	C		
	R	R	R	F	C	–	C	C	C		C	R				R	F						C	C									C	C		
	R	C	R	R	C	R	C	C	C		C	F				F	F						C	F									C	C		
	C	C	F	R	cf	–	C	C	C		C	R				C	F						C	C							F		C	C		
	C	C	F	R	cf	–	C	C	C	R	C	F				C	F						C	F							F		C	C		
	C	R	F	F	cf	–	C	C	C		C	F				C	F						C	R							F		C	C		
	C	R	F	R	cf	R	C	C	C	R	C	C				C	F						C	R									C	C		
	C	F	F	F	cf	R	C	C	C		C	F	R			C	F						C	F									C	C		
	C	R	F	F	cf	C	C	C	C	F	C	F	R			C	F						C	R									C	C		
F	C	C	F	F	cf	F	C	C	F		C	F	C			C	F						C	C									C	C		
R	A	C	F	C	cf	F	C	C	F		C	F	C			C	F						C	C									C	C		R
C	C	C	F	C	cf	R	C	C	F		C	F	C			C	F						C	C							R		C	C		R
C	F	C	R	C	cf	R	C	C	F	F	C	F	R	–		C	F					cf	C										A	C			R
														–									C														
														C	R	R	F	C		C	–	R	C	R	R	C	–							A	C	R		
																	cf	C	C	C	C	C	R	C	C	C	R	R	R	C	R	R	R	A	C	R		C
																	cf	R	C	C	C	C	R	C	C	C	C	R	R	C	R	R	R	A	C	R		C
																			C	C	C	C	R	C	C	C	C	R	–	R	R	R	A	C	F		C
																			C	C	C	F	C	C	C	C	F	R	–	–	R	R	A	C	F		C
																			R	C	C	R	C	C	R	F	R	–	R	–	–	A	C	R		C
																												R	A	A	C	R	R	R	C	C	R	C

TABLE 4
Numbers of Reworked Foraminifera, Site 200

Sample	Reworked Foraminifera Per 5000 Specimens
1-1	2
1-2	–
1-3	2
1-4	2
1-5	–
1, CC	–
2-1	–
2-2	2
2, CC	4
3-1	4
3-2	10
3-3	11
3-4	6
3, CC	13
4-1	27
4-2	23
4-3	67
4, CC	120
5-1	241
5, CC	260
6-1	192
6-2	171
6, CC	192
7, CC	111
8, CC	4
9-1	–
9-2	–
9-3	–
9-4	–
9-5	–
9-6	–
9, CC	–
10, CC	–

umbilical area, as it does in typical representatives of the genus *Globigerina*. The aperture has the shape of a small round opening at the base of the apertural surface (interio-marginal, extra-umbilical). As to the structure of the aperture, the above species of "*Globigerina*" are closer to the genus *Hedbergella*, differing in the absence of a narrow lip or spatulate around the umbilical arch.

Thus, it is difficult ot draw any conclusion about the generic affinities of the species of planktonic foraminifera in question; whether they are the last dwarfed representatives of the genus *Hedbergella* or the first primitive representatives of the genus *Globigerina*. This is very closely related to the problem of the age of the deposits of the *Globigerina eugubina* Zone. In the first case, it would be preferable to assign this zone to the top of the Maastrichtian Stage; in the second, to the base of the Danian Stage.

In any case, one may suggest the existence of an extremely brief time interval in geological history (at the Creatceous-Tertiary boundary) when the main mass of Late Cretaceous planktonic foraminifera had already become extinct but when typical Tertiary globigerinids and globorotaliids had not yet appeared. This interval is characterized by rather peculiar assemblages of planktonic foraminifera; small heterohelicids and forms transitional from *Hedbergella* to *Globigerina* (?) prevail among them.

It is necessary to prove the existence of the "*Globigerina*" *eugubina* Zone in various parts of the world and to study in detail the groups of microfossils characteristic of it so that we may draw a final conclusion about the age of deposits of the *Globigerina eugubina* Zone and the position of the boundary between the Mesozoic and Cenozoic. In this connection, it is interesting to note that in the *Globigerina eugubina* Zone of the Caroline Abyssal Plain, Tertiary nannofossils (*Coccolithus cavus, Cruciplacolithus tenuis*) are already present.

When sediments of the *Globigerina eugubina* Zone are studied in many regions of the world, it should be possible to determine the true species composition of this zone and whether the rare specimens of *Abathomphalus mayarensis, Globotruncanella petaloidea,* etc., in the *Globigerina eugubina* Zone of the Caroline Abyssal Plain are in situ or redeposited. Thus, it may be possible to draw some conclusion as to the age of this zone.

PALEOGENE

Drilling on the Caroline Abyssal Plain penetrated deposits of the late Paleocene and the early and middle Eocene.

Late Paleocene

Late Paleocene limestones were recognized in Hole 199 (Cores 7, 8, 9, 10), where their thickness reaches 86 meters. They rest unconformably on the limestones of the *Globigerina eugubina* Zone. The stratigraphic gap is marked by a bed of reddish-brown and greenish silicified limestones and grayish-red-brown tuffs (Core 10, Section 2, 50 cm). Two zones were distinguished–the *Globorotalia pseudomenardii* and *Globorotalia velascoensis* zones. The Danian Stage and the early Paleocene (*Globorotalia angulata* Zone) are not represented in the section.

The *Globorotalia pseudomenardii* Zone (Core 10, Section 2, 0.38 cm) is characterized by numerous *Globorotalia occlusa* Loebl. and Tapp., together with less abundant *G. laevigata* Bolli, *G. pseudomenardii* Bolli, *G. velascoensis parva* Rey, *G. imitata* Subb., and *G. convexa* Subb. The assemblage of planktonic foraminifera is here more diverse, but their tests are poorly preserved, being difficult to extract from the indurated limestones.

The next core, Core 9, already contains a microfauna of the *Globorotalia velascoensis* Zone, but is is separated from Core 10 by a 57-meter interval. The planktonic foraminifera of this zone (Cores 9 and 8) include *Globorotalia velascoensis* (Cushm.), *G. occlusa* Loebl. and Tapp., *G. acuta* Toulm., *G. laevigata* Bolli, *G. apanthesma* Loebl. and Tapp., *G. hispidicidaris* Loebl. and Tapp., *G. imitata* Subb., *G. trichotrocha* Loebl. and Tapp., *G. aequa* Cushm. and Renz, *Acarinina acarinata* Subb., *A. mckannai* (White), *A. primitiva* (Finl.), *A. strabocella* (Loebl. and Tapp.), *A. soldadoensis, A. esnaensis* (LeRoy), *A. intermedia* Subb. *Globigerina nana* Khalil., *G. compressaformis* Khalil., and *G. velascoensis* Cushm.

Late Paleocene planktonic foraminiferal assemblages of the Caroline Abyssal Plain are rather peculiar. Representatives of genus *Globorotalia* are markedly predominant in them, those of genus *Acarinina* are in a subordinate position, and *Globigerina* species are sporadic. Considering

only the species of planktonic foraminifera occurring in great numbers (*Globorotalia* and to a certain extent *Acarinina*), the upper Paleocene microfauna of the Caroline Abyssal Plain is characterized by low specific diversity.

Early Eocene

Early Eocene limestones (the *Globorotalia formosa formosa* Zone) were recovered on Ita Mai Tai Guyot (Hole 200A, Core 2). Planktonic foraminiferal assemblages contain numerous *Globorotalia formosa formosa* Bolli, *G. formosa gracilis* Bolli, *G. marginodentata* Subb., *G. quetra* Bolli, *G. wilcoxensis* Cushm. and Pont., *G. troelseni* Loebl. and Tapp., *G. apanthesma* Loebl. and Tapp., *Acarinina triplex* Subb., *A. pseudotopilensis* Subb., *A. soldadoensis* (Bronn.), *A. gravelli* (Bronn.), and *A. decepta* (Mart.) together with less common *Globorotalia lensiformis* Subb., *G. pseudoscitula* Glaessn., *Acarinina broedermanni* (Cushm. and Berm), *A. pentacamerata camerata* Khalil., *Chiloguembelina wilcoxensis* (Cushm. and Pont.), *Ch. parallela* Beckm., and sporadic *Globorotalia aragonensis* Nutt., *G. caucasica* Glaessn., *G. marksi* Mart., *G. aequa* Cushm. and Renz. *G. naussi* Mart., *G. subbotinae* Moroz., *G. aff. collactea* (Finl.), *Acarinina esnaensis* (LeRoy), *A. mckannai* (White), *A. acarinata* Subb., *A. pentacamerata pentacamerata* (Subb.), *Globigerina taroubaensis* Bronn., and *G. prolata* Bolli.

Sporadic specimens of *Globorotalia aragonensis, G. caucasica, G. marksi,* and *Acarinina pentacamerata pentacamerata* indicate that the deposits belong to the uppermost part of the *Globorotalia formosa formosa* Zone and may prove to be transitional to the deposits of the *Globorotalia aragonensis* Zone.

Early Eocene planktonic foraminifera of Ita Mai Tai Guyot show two peculiarities:

1) Their assemblages are somewhat more diverse compared with early Paleocene assemblages of the Caroline Abyssal Plain, but, as in the case of the Paleocene assemblages, representatives of genus *Globorotalia* (in number of species and specimens) are markedly predominant; *Acarinina* representatives are in a subordinate position and *Globigerina* species are of sporadic occurrence.

2) Frequently, but not always, specimens of various *Acarinina* species (*A. triplex, A. pseudotopilensis, A. soldadoensis, A. pentacamerata*) are furnished on the spiral side of the test with secondary sutural apertures that occur on the intersection of the intercameral and spiral sutures. Technically, these specimens of *Acarinina* should be included in the genus *Truncorotaloides*. There is no doubt, however, that in this case we are dealing with intraspecific variability, and that the appearance of supplementary apertural openings on the spiral side of the shell is of no taxonomic importance at the genus level. The species *Acarinina triplex* Subb., *A. pentacamerata* (Subb.), and *A. pseudotopilensis* Subb. were originally described from Eocene deposits of the North Caucasus (USSR), where, however, supplementary apertures on the spiral side were not observed.

Secondary sutural apertures on the spiral side of the shell are considerably less frequent in *Globorotalia formosa, G. marginodentata, G. quetra*, and *G. apanthesma* from early Eocene deposits of the Caroline Abyssal Plain. Specimens of the same species from coeval deposits of the North Caucasus have no secondary apertures. Variations in the structure of the spiral side in the above species of *Acarinina* and *Globorotalia* are very likely to be regarded as geographical intraspecific variability of planktonic foraminifera.

The appearance of secondary apertural openings in some species of *Acarinina* and *Globorotalia* from the Caroline Abyssal Plain is probably indicative of tropical conditions in the Eocene ocean.

Faunal makeup, a numerical dominance of species and specimens of *Globorotalia*, and a low abundance of *Globigerina* also indicate tropical conditions during deposition of the late Paleocene and early Eocene sediments of the Caroline Abyssal Plain. It is known that these features characterize the distribution of globorotaliidae and *Globigerinidae* in the present-day ocean. It is quite possible that the low faunal diversity (taking into account only those species represented by a great number of specimens) was typical for low and high latitudes, and the belt of middle latitudes was characterized by the greatest diversity of planktonic foraminifera. But today, in the area of high latitudes, *Globigerinidae* strongly prevail, and in the area of low latitudes, *Globorotaliidae.*

The high rate of accumulation of calcareous biogenic oozes of the late Paleocene, peculiarity of assemblages of planktonic foraminifera of the late Paleocene and early Eocene, and morphological features of planktonic foraminifera of the early Eocene serve as evidence of formation of the biogenic limestones of the late Paleocene and early Eocene under tropical conditions.

Middle Eocene

Middle Eocene foraminiferal limestones (the *Orbulinoides beckmanni* Zone) were found at Site 202 in Ita Mai Tai Guyot where they are underlain by oolitic limestones of unknown age. The abundant planktonic foraminifera include *Orbulinoides beckmanni* Saito, *Hantkenina alabamensis* Cushm., *Globigerinatheka barri* Bronn., *Globigerapsis index* (Finl.), *G. kugleri* Bolli, Loebl. and Tapp., *Globorotalia spinulosa* Cushm., *G. centralis* Cushm. and Berm., *G. lehneri* Cushm. and Jarv., *Acarinina bullbrooki* (Bolli), *Truncorotaloides topilensis* (Cushm), *T. rohri* Bronn. and Berm., *Globigerina pseudovenezuelana* Bann. and Blow, *G. galavisi* Berm., and *G.pseudoeocaena* Subb.

Despite the relatively poor preservation of the microfauna (the foraminiferal limestones are rather indurated), the spiral side of shells of *Truncorotaloides topilensis* and *T. rohri* clearly show secondary apertural openings. The latter are absent in specimens of *Truncorotaloides topilensis* from Eocene deposits of the southern USSR (Armenia, North Caucasus) where this species is usually attributed to the genus *Acarinina. Truncorotaloides rohri* is not known from the upper part of the Eocene deposits of the south of the USSR. At this stratigraphic level, *Acarininas*, morphologically similar to *Truncorotaloides rohri* but devoid of additional apertural openings on the spiral side, can be seen.

The above data indicate the need for a thorough study of the morphology of both *Truncorotaloides* and *Acarinina*

to evaluate their taxonomic independence. The appearance of additional apertural openings on the spiral side of the shell of some globorotaliids apparently represents geographic intraspecific variation.

Present in the Neogene turbidites of Hole 199 are redeposited *Globorotalia cerroazulensis* (Cole), *G. opima opima* Bolli, *G. pseudokugleri* Blow, *Globigerina praebulloides* Blow, *G. angulisuturalis* Bolli, *G. ouachitaensis* Howe and Wall., *G. prasaepis* Blow, *Cassigerinella chipolensis* (Cushm. and Pont.), *Pseudohastigerina barbadoensis* Blow, *Chilogümbelina cubensis* Palm., and others. These foraminifers testify to the presence of calcareous deposits of the late Eocene and Oligocene on guyots of the Caroline Abyssal Plain, though they were not sampled during Leg 20.

NEOGENE

Neogene calcareous deposits were recovered on Ita Mai Tai Guyot in Holes 200, 200A, and 202. The oldest Miocene layers (Aquitanian Stage, the *Globorotalia kugleri* and *Globigerinita dissimilis* Zones of Bolli's, 1957, zonation) remained unsampled, as Hole 200 did not pass beyond deposits which correspond approximately to the *Globigerinita stainforthi* Zone.

Early Miocene

Upper lower Miocene sediments were recovered in Hole 200. The section is incomplete, however, owing to poor recovery.

The lowermost core (Core 10) was empty except for the core catcher sample which includes fragments of deposits of diverse lithology—relatively hard limestones and soft calcareous oozes. These deposits are characterized by planktonic foraminifera of various ages.

The planktonic foraminiferal assemblage from the hard limestones consists of numerous *Globigerina bradyi* Wiesn., *G. juvenilis* Bolli, *G. binaiensis* Koch, *Globigerinoides trilobus* (Reuss), *Globoquadrina baroemoenensis* Le Roy, together with less frequent *Globoquadrina altispira* (Cushm. et Jarv.), *Globigerinoides subquadratus* Bronn., *Globigerina falconensis* Blow, *G. foliata* Bolli, *G. praebulloides* Blow, *Globorotalia siakensis* (Le Roy) and sporadic *Globoquadrina praedehiscens* Bann. and Blow, *G. dehiscens* (Chapm., Parr, and Coll.), *Globigerinita unicava* (Bolli, Loebl., and Tapp.), *G. stainforthi* (Bolli, Loebl., and Tapp.), *G. incrusta* Akers, *Cassigerinella chipolensis* (Cushm. and Pont.), *Globorotalia obesa* Bolli, *Globigerina venezuelana* Hedb., *G. angustiumbilicata* Bolli, and *G. bolli*, Cita and Premoli Silva.

These limestones most probably belong to the upper part of the *Globigerinita stainforthi* Zone of Bolli's zonal scheme (or to Zone N.6 of Blow's scheme). The age of these beds is transitional from Aquitanian to Burdigalian.

In the soft calcareous oozes, *Globigerinoides sicanus* De stefani, *G. trilobus* (Reuss), *G. diminutus* Bolli, *G. subquadratus* Bronn., *Globoquadrina dehiscens* (Chapm., Parr, and Coll.), and *G. altispira* (Cushm. and Jarv.) are dominant and are accompanied by less common *Globoquadrina langhiana* Cita and Gel., *Globorotalia siakensis* (Le Roy), *G. continuosa* Blow, *G. peripheroronda* Bann. and Blow, *G. obesa* Bolli, *G. minutissima* Bolli, *Globigerinoides mitra* Todd, *Globigerina foliata* Bolli, *G. falconensis* Blow, *G. praebulloides* Blow, *Praeorbulina glomerosa* (Blow), and *P. transitoria* (Blow).

Soft calcareous oozes with the above species of foraminifera belong to the upper part of the Burdigalian Stage which in the zonal schemes of various authors is either the *Globigerinoides sicanus* Zone, *Praeorbulina glomerosa* Zone, or Zone N.8. Poorly developed representatives of the genus *Praeorbulina*, and primitive *P. glomerosa* show that the deposits belong to the lower part of Zone N.8. The lower part of the Burdigalian Stage (Zone N.7) could not be recognized owing to poor core recovery.

The overlying calcareous oozes of Core 9 (Section 6-2) contain a typical microfauna of Zone N.8—*abundant Praeorbulina glomerosa, P. transitoria, Globigerinoides sicanus, G. diminutus, G. mitra, G. trilobus, G. subquadratus, Globoquadrina dehiscens, G. altispira, Globorotalia siakensis, G. continuosa, Globigerinatella insueta* Cushm. and Stainf., and rare *Globorotalia archaeomenardii* Bolli.

The first sporadic specimens of *Orbulina suturalis* Bronn. occur in Section 2 of Core 9, marking the transition to the middle Miocene.

Middle Miocene

Middle Miocene deposits are represented by their basal beds (the *Globorotalia peripheroronda* Zone, or Zone N.9). Of considerable importance is the appearance of *Orbulina suturalis* Bronn., *Hastigerina siphonifera* (d'Orb.), *Sphaeroidinellopsis seminulina* (Schw.), *Globorotalia praemenardii* Cushm. and Stainf., and *G. (Clavatorella) bermudezi* (Bolli), though they are not abundant. Also present are *Globorotalia peripheroronda* Bann. and Blow, *G. siakensis* (Le Roy), *G. obesa* Bolli, *G. continuosa* Blow, *Globigerinoides trilobus* (Reuss), *G. subquadratus* Bronn., *Globoquadrina altispira* (Cushm. and Jarv.), *G. dehiscens* (Chapm., Parr, and Coll.), *Globigerina concinna* Reuss, and sporadic *Praeorbulina glomerosa* (Blow) and *Globigerinoides sicanus* De Stefani.

The above foraminiferal assemblages were seen in Hole 200 (Core 9, Section 1). One could suppose that in Core 8 of this hole the main part of the middle Miocene would be present (Zones N.10-N.13). However, Core 8 proved to be a mixture of sediments with planktonic foraminifera of the Pleistocene, Pliocene, late and middle Miocene. As *Globorotalia peripheroacuta* Bann. and Blow, *G. fohsi* Cushm. and Ell., and *Biorbulina bilobata* (d'Orb.) were found in Core 8, the presence of middle Miocene deposits on the Ita Mai Tai Guyot is confirmed.

Late Miocene

The late Miocene is regarded here in the scope of the Tortonian and Messinian stages (in accordance with the recommendation given in the Deep Sea Drilling Project Core Description Manual, Part VII: Biostratigraphy), though in many countries the Tortonian Stage crowns the late Miocene.

In Hole 200, the late Miocene is completely represented. However, poor core recovery, the soupy consistency of calcareous oozes, and related uphole contamination make it difficult to draw precise stratigraphic boundaries.

The Tortonian Stage begins with calcareous ooze (the core catcher of Core 7) with abundant *Sphaeroidinellopsis subdehiscens* Blow, *Sph. seminulina* (Schw.), *Globigerina nepenthes* Todd, *Globoquadrina dehiscens* (Chapm., Parr, and Coll.) and *G. altispira* (Cushm. and Jarv.) that are accompanied by less frequent *Globorotalia menardii* (d'Orb.), *G. cultrata* (d'Orb.), *G. lenguaensis* Bolli, *G. obesa* Bolli, *Orbulina universa* d'Orb., *Globigerina bulloides* d'Orb., *Globigerinoides obliquus obliquus* Bolli, *G. bollii* Blow, *Globigerinita glutinata* (Egger), and sporadic *Biorbulina bilobata* (d'Orb.), *Hastigerina siphonifera* (d'Orb.), *Globigerina bulbosa* Le Roy, *Globorotalia merotumida* Blow and Bann., *G. acostaensis* Blow, *G. continuosa* Blow, *Candeina nitida praenitida* Blow, and *Globigerinita naparimaensis* Bronn. On the basis of these species, the deposits should be assigned to the uppermost part of the *Globorotalia continuosa* Zone (N.15) or the lower part of the *Globorotalia acostaensis-Globorotalia merotumida* Zone (N.16). The latter appears to be more probable.

The *Globorotalia acostaensis-Globorotalia merotumida* Zone (N.16) in its typical form is present in calcareous oozes of Core 6 (the core catcher and Section 2). Here, *Globorotalia menardii, G. cultrata, Globigerina nepenthes, Sphaeroidinellopsis seminulina, Sph. subdehiscens, Orbulina universa,* and *Globigerinoides bollii* occur in abundance; they are consistently accompanied by *Globorotalia merotumida* Blow and Bann., *G. paralenguaensis* Blow, *Globigerinoides obliquus extremus* Bolli and Berm., *Candeina nitida* (d'Orb.), *C. nitida praenitida* Blow, and sporadic *Globorotalia acostaensis* Blow, *G. margaritae* Bolli and Berm., *G. pseudopachyderma* Cita, Premoli Silva, and Rossi, *Globigerinoides adriatica* (Forn.), *G. parkerae* Berm., *Globorotaloides variabilis* Bolli, *Globigerina microstoma* Cita, Premoli Silva, and Rossi, *G. eamesi* Blow, *G. decoraperta* Tak. and Saito, and *G. parabulloides* Blow.

Sporadic specimens of *Globorotalia tumida plesiotumida* Blow and Bann. appear in Section 1 of Core 6. These are likely to be the uppermost beds of the Tortonian Stage (or transition to the Messinian Stage). Precise determination is difficult because of the soupy character of sediments.

Two stratigraphic units can be distinguished in the Messinian Stage: the *Globorotalia tumida plesiotumida* Zone (N.17) and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone (N.18) after the terminology of Blow. To the *Globorotalia tumida plesiotumida* Zone (N.17) belong the calcareous oozes of Core 5 (the core catcher and Section 1) with abundant planktonic foraminifera—*Globorotalia tumida plesiotumida* Blow and Bann., *G. miocenica* Palm., *G. menardii* (d'Orb.), *G. margaritae* Bolli and Berm., *G. multicamerata* Cushm. and Jarv., *G. acostaensis* Blow, *Sphaeroidinellopsis seminulina* Schw.), *Sph. subdehiscens* Blow, *Globigerina nepenthes* Todd, *G. parabulloides* Blow, *G. bulloides* d'Orb., *G. microstoma* Cita, Premoli Silva, and Rossi, *Globigerinoides obliquus extremus* Bolli and Berm., *G. bollii* Blow, *G. trilobus* (Reuss), *Orbulina universa* d'Orb., *Globoquadrina altispira* (Cushm. and Jarv.), *Hastigerina siphonifera* (d'Orb.), *Candeina nitida* (D'Orb.), and *Pulleniatina primalis* Blow and Bann. Specimens of *Globorotalia merotumida* Blow and Bann. and *Biorbulina bilobata* (d'Orb.) are sporadic.

Similar assemblages of planktonic foraminifera are indicative of the *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone (N.18). They differ mostly in the presence of numerous specimens of *Globorotalia tumida tumida* (Brady). Somewhat more frequent are *Candeina nitida* (d'Orb.) and *Pulleniatina primalis* Blow and Bann., whereas, specimens of *Globorotalia tumida plesiotumida* Blow and Bann. are sporadic. To this zone are attributed the calcareous oozes of Core 4 (the core catcher, Sections 1, 2, 3).

Precise determination of the boundary between Zones N.17 and N.18 of the Messinian Stage, and the Miocene and Pliocene (i.e., between Zones N.18 and N.19) is difficult because of the soupy character of calcareous oozes and the resultant uphole contamination. For example, in the calcareous oozes of the upper part of Section 1, Core 5 (Zone N.17), *Globorotalia tumida tumida* is present and in fact the deposits could be assigned to Zone N.18. In the deposits of Section 1, Core 4 (Zone N.18), rare *Sphaeroidinella dehiscens, Globigerinoides conglobatus, G. ruber,* and *G. sacculifer* were found; these calcareous oozes could be of Pliocene age (Zone N.19). However, it is most probable that some mixing of weakly consolidated oozes has taken place in the process of drilling.

Pliocene

Drilling in Ita Mai Tai Guyot encountered deposits of the early (Zone N.19) and upper (Zone N.21) parts of the Pliocene. The middle part of the Pliocene (Zone N.20) was poorly recovered.

The lower part of the Pliocene (the *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone, or Zone N.19 according to Blow's terminology) was penetrated in Holes 200 (Core 3), 200A (Core 1), and 202 (Core 1). Planktonic foraminifera are abundant and diverse: *Sphaeroidinella dehiscens* (Park. and Jon.), *Sphaeroidinellopsis seminulina* (Schw.), *Sph. subdehiscens* Blow, *Globorotalia tumida tumida* (Brady), *G. humerosa* Tak. and Saito, *G. crassaformis* (Gall. and Wissl.), *G. hirsuta* (d'Orb.), *G. multicamerata* Cushm. and Jarv., *G. cultrata* (d'Orb.), *Globigerinoides conglobatus* (Brady), *G. trilobus* (Reuss) *Orbulina universa* d'Orb., *Hastigerina siphonifera* (d'Orb.), *Candeina nitida* (d'Orb.), *Pulleniatina obliquiloculata* (Park. and Jon.), *Globigerina nepenthes* Todd, *Globoquadrina altispira* (Cushm. and Jarv.), *G. dehiscens* (Chapm., Parr, and Coll.), *Globigerina bulloides* d'Orb., and *G. apertura* Cushm.

In Hole 200, calcareous oozes of Sections 1 and 2 (Core 3) contain sporadic *Sphaeroidinellopsis* spp., *Globigerina nepenthes, Globoquadrina altispira*, and *G. dehiscens*, marking a transition to the middle part of the Pliocene (the *Globorotalia multicamerata-Pulleniatina obliquiloculata* Zone, or Zone N.20).

The upper part of the Pliocene (the *Globorotalia tosaensis* Zone or Zone N.21) was penetrated in Hole 200 (Core 2). Among the abundant planktonic foraminifera are found a great number of the species common to Zone N.19 (species of *Sphaeroidinella, Pulleniatina, Candeina, Globigerinoides, Globorotalia,* and *Globigerina*). However, *Globorotalia tosaensis* Tak. and Saito appears in this core; *Globigerina nepenthes, Globorquadrina altispira, G. dehiscens,* species of *Sphaeroidinellopsis* are absent. The

presence of sporadic specimens of *Globorotalia multicamerata* indicates the basal part of Zone N.21.

In Hole 200 upper Pliocene deposits are overlain by Pleistocene calcareous oozes with numerous *Globorotalia truncatulinoides* (d'Orb.) and belong in the *Globorotalia truncatulinoides* Zone, or Zone N.22.

REWORKING AND CORE CONTAMINATION IN HOLE 200

Considerable numbers of reworked foraminifera were found in microfaunal samples from the cores of Hole 200. These reworked foraminifera are often fragmented, abraded, or stained red and are similar in preservation and species composition to foraminifera found in Hole 200A-2, CC and 202-2, CC. The oldest reworked specimens belong to the *Globorotalia formosa formosa* Zone (early Eocene) and include *Acarinina broedermanni, A. decepta, A. gravelli, A. mckannai, A. soldadoensis, A. pseudotopilensis, A. triplex, Globorotalia aequa, G. apanthesma, G. aragonensis, G. formosa, G. marginodentata, G. quetra,* and *G. wilcoxensis.* All of the recognizable reworking appears to have been confined to Eocene foraminifera. No Oligocene species were found, indicating that Oligocene deposits may not be present on Ita Maitai Guyot.

Table 4 summarizes the numbers of reworked specimens found in five thousand foraminifera split from 10 cc samples.

Cores 2 through 8 contain varying amounts of uphole contamination caused by the liquid nature of the cored sediment. The uniform preservation of foraminifera in the cores, combined with possible intra-core mixing, makes an estimation of the amounts of contamination difficult. Cores 7 and 8 may consist entirely of uphole material.

SYSTEMATICS

This part of the chapter contains information concerning species and subspecies of planktonic foraminifera that are of interest with regard to morphological, stratigraphic, and geographic distribution and the reconstruction of bionomic conditions. Selected planktonic foraminifera are illustrated by scanning-electron micrographs.

The discussion of each species usually consists of three parts: remarks, containing data on morphology and comparison to specimens of the same species from other regions; stratigraphic occurrence, in sediments penetrated by Leg 20 Holes; and stratigraphic and geographic range, taking into account also data from other areas of occurrence.

This study was aimed mostly at stratigraphic problems. Therefore, the comments on species are given in the order of stratigraphic appearance. As a result, some groups of species are distinguished by stratigraphic subdivisions (transition from Cretaceous to Paleogene, late Paleocene, early Eocene, middle Eocene, Miocene, Pliocene). Some species have long stratigraphic ranges; for these, comments are given in the section dealing with deposits in which these species are most important in determining geological age.

Layers Transitional from Cretaceous to Paleogene

"Globigerina" minutula Luterbacher and Premoli Silva
(Plate 8, Figures 9-11)

1964. *Globigerina minutula* Luterbacher and Premoli Silva, p. 109, pl. 2, fig. 5a-c.

Remarks: Test very small (less than 0.2 mm, sometimes 0.1 mm), smooth-walled, with 3½ chambers in the last whorl. Aperture, a small round opening at the base of the apertural face, extraumbilical, occasionally near the umbilical area.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: "*Globigerina*" *eugubina* Zone (basal layers of the Danian Stage, Paleogene?) of Italy, USSR (Transcaspian area), Pacific Ocean (Caroline Abyssal Plain); Lower part of the Danian Stage (the *Globigerina taurica* Zone) of the Pacific Ocean (Shatsky Rise).

"Globigerina" fringa Subbotina
(Plate 8, Figures 1-2)

1950. *Globigerina fringa* Subbotina, p. 104, pl. 5, Figs. 19-21.

Remarks: Test very small (diameter 0.12-0.20 mm), with a very thin transparent wall, four chambers closely adjacent to one another. Aperture extraumbilical, either a small round opening or a narrow slit at the base of the apertural face. The slit-like aperture of the holotype extends along the base of the apertural face from the umbilicus up to the peripheral margin.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: The "*Globigerina*" *eugubina* Zone (basal layers of the Danian Stage, Paleogene?) of Italy and the Pacific Ocean (Caroline Abyssal Plain); lower part of the Danian Stage (the *Globigerina taurica* Zone)[1] of the USSR (Crimea, North Caucasus) and the Pacific Ocean (Shatsky Rise).

"Globigerina" sabina Luterbacher and Premoli Silva
(Plate 11, Figures 1-3)

1964. *Globigerina sabina* Luterbacher and Premoli Silva, p. 108, pl. 2, figs. 1a-c, 6a-c, 7a-c.

Remarks: Test very small (diameter–0.1-0.2 mm), with a transparent, smooth wall, the last whorl having 4½ to 5 chambers. Aperture extraumbilical in the shape of an arc-like opening or a low slit at the base of the apertural face.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: The "*Globigerina*" *eugubina* Zone (basal beds of the Danian Stage, Paleogene?) of Italy, USSR (Transcaspian area), the Pacific Ocean (Caroline Abyssal Plain); lower part of the Danian Stage (the *Globigerina taurica* Zone) of the Pacific Ocean (Shatsky Rise).

"Globigerina" eugubina Luterbacher and Premoli Silva
(Plate 7, Figures 6-8)

1964. *Globigerina eugubina* Luterbacher and Premoli Silva, p. 105, pl. 2, fig. 8a-c.

Remarks: Test very small (diameter–0.12-0.20 mm), trochospiral, but strongly compressed on the spiral and umbilical sides, with 5½ to 6 chambers in the last whorl. Wall smooth, transparent. Aperture extraumbilical, in the shape of a small rounded opening or an arc-like slit at the base of the apertural face.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: "*Globigerina*" *eugubina* Zone (basal beds of the Danian Stage, Paleogene?) of Italy, USSR (Transcaspian area), Atlantic Ocean (Nicaragua Rise, Hole 152, Beata Ridge, Hole 153), the Pacific Ocean (Caroline Abyssal Plain).

"Globigerina" umbrica Luterbacher and Premoli Silva
(Plate 11, Figures 7-9)

1964. *Globigerina umbrica* Luterbacher and Premoli Silva, p. 106, pl. 2, fig. 2a-c.

Remarks: Test very small (diameter–0.10-0.18), compressed on the spiral and umbilical sides, with six to seven spherical chambers in the last whorl that increase slightly in size as added. Wall smooth, transparent. Aperture, an arc-like slit at the base of the apertural face, extraumbilical.

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[1] In some cases the *Globigerina* (*Eoglobigerina*) *taurica* Zone very likely includes deposits of the "*Globigerina*" *eugubina* Zone as well.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: The "*Globigerina*" *eugubina* Zone (basal beds of the Danian Stage, Paleogene?) of Italy, USSR (Transcaspian area), the Pacific Ocean (Caroline Abyssal Plain).

Guembelitria irregularis Morozova
(Plate 31, Figures 1-2)

1961. *Guembelitria irregularis* Morozova, p. 17, pl. 1, figs. 9, 10.

Remarks: Test tiny, high; height (0.20-0.25 mm) is two to two and a half times more than the width near the apertural end (0.9-0.12 mm). Spire consists of six or seven whorls with 2½ to 3 chambers each. The number of chambers in adjacent whorls varies; for this reason, the chambers do not form regular vertical rows.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: "*Globigerina*" *eugubina* Zone of the Pacific Ocean (Caroline Abyssal Plain); *Globigerina taurica* Zone (the lower part of the Danian Stage) of the USSR (Crimea, Caucasus, Russian platform) and the Pacific Ocean (Shatsky Rise).

Chiloguembilina taurica Morozova
(Plate 5, Figure 1)

1961. *Chiloguembelina taurica* Morozova, p. 18, pl. 1, figs. 7, 8.

Remarks: Test tiny, high (0.4-0.5 mm), and narrow (0.23-0.29 mm), laterally compressed; has the shape of a sharp wedge. Test consists of two rows of chambers, five to six chambers in each row. The initial chambers are relatively low, subspherical; the last chambers are larger, spherical.

Stratigraphic occurrence: Hole 199, Cores 10, 11, "*Globigerina*" *eugubina* Zone.

Stratigraphic and geographic range: "*Globigerina*" *eugubina* Zone of the Pacific Ocean (Caroline Abyssal Plain); *Globigerina taurica* Zone (the lower part of the Danian Stage) of the USSR (Crimea, Caucasus, Russian platform) and the Pacific Ocean (Shatsky Rise).

PALEOGENE

Upper Paleocene

Globorotalia velascoensis (Cushman)
(Plate 30, Figures 4-6)

1925. *Pulvinulina velascoensis* Cushman, p. 19, pl. 3, fig. 5a-c.

Stratigraphic occurrence: Hole 199. In the assemblage of planktonic foraminifera from deposits of the lowermost upper Paleocene (the *Globorotalia pseudomenardii* Zone) this species occupies a subordinate position (Core 10). In the deposits of the uppermost Paleocene (the *Globorotalia velascoensis* Zone) it is abundant (Cores 8, 9).

Stratigraphic and geographic range: This species is very well known from upper Paleocene deposits of many regions of Europe, Asia, Africa, America, and Australia. Very sporadic specimens occur in the basal beds of the lower Eocene (the lower part of the *Globorotalia subbotinae* Zone).

Upper Paleocene deposits with *Globorotalia velascoensis* were recovered by drilling in the Caribbean Sea, the southern part of the Atlantic Ocean, and Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

This species is very sporadic in the upper Paleocene of the USSR (Crimea, North Caucasus).

Globorotalia acuta Toulmin
(Plate 17, Figures 7-9)

1941. *Globorotalia wilcoxensis* var. *acuta* Toulmin, p. 608, pl. 82, figs. 6-8.

Remarks: *G. acuta* differs from a similar species, *G. velascoensis*, by possessing fewer chambers (4-6) in the last whorl, a rapid increase in size of chambers within the last whorl, a large last chamber (occupies 1/4-1/3 part of the whorl), a less well-developed ornamentation of the umbilical shoulders of chambers and the peripheral keel.

Stratigraphic occurrence: Hole 199, Cores 8, 9; common species of the *Globorotalia velascoensis* Zone.

Stratigraphic and geographic range: The upper part of upper Paleocene deposits of many countries of the Caribbean, Mediterranean, Africa, Europe, Asia, Australia, and New Zealand.

It was found during drilling performed by *Glomar Challenger* in the northern and southern parts of the Atlantic Ocean and Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia occlusa Loeblich and Tappan
(Plate 26, Figures 4-6)

1957. *Globorotalia occlusa* Loeblich and Tappan, p. 191, pl. 64, fig. 3a-c.

Remarks: This species differs from *Globorotalia velascoensis* by a smaller test size, a lens-like shape of the test with a strongly convex side, slight ornamentation of the spiral and septal sutures, and a smaller umbilicus.

Stratigraphic occurrence: Hole 199; abundant in Core 10 (*Globorotalia pseudomenardii* Zone); in Cores 8 and 9 (*Globorotalia velascoensis* Zone) specimens of this species are less abundant.

Stratigraphic and geographic range: The upper Paleocene of the United States, Mexico, Australia, New Zealand, some countries of the Caribbean, Mediterranean, Europe, Asia, Africa. It was found during drilling in the upper Paleocene sediments of the Atlantic and Pacific oceans.

Globorotalia pseudomenardii Bolli
(Plate 27, Figures 1-3)

1957. *Globorotalia pseudomenardii* Bolli, p. 77, pl. 20, figs. 14-17.

Stratigraphic occurrence: Hole 199. Typical specimens of this species are rather common in deposits of the *Globorotalia pseudomenardii* Zone (Core 10); in limestones of the *Globorotalia velascoensis* Zone (Cores 8 and 9) they were not found.

Stratigraphic and geographic range: This species is diagnostic for deposits of the lower part of the upper Paleocene (the *Globorotalia pseudomenardii* Zone) in the United Stages, USSR, Australia, New Zealand, many countries of the Mediterranean, Europe, Asia, Africa, and the Caribbean. In deposits of this age, *G. pseudomenardii* was found during drilling in some regions of the Atlantic and Pacific oceans. In the upper part of the upper Paleocene (the *Globorotalia velascoensis* Zone), *G. pseudomenardii* is known in a limited number of specimens (Syria, Rio Grande Rise in the Atlantic Ocean, Shatsky Rise in the Pacific Ocean.

Globorotalia laevigata Bolli
(Plate 23, Figures 4-6)

1956. *Globorotalia pusilla laevigata* Bolli, p. 78, pl. 20, figs. 5-7.

Remarks: *Globorotalia laevigata* is regarded as an independent species differing from *G. pusilla* Bolli in a rounded test outline (equatorial section) and a sharply keeled peripheral margin.

Stratigraphic occurrence: Hole 199. Relatively few specimens in deposits of the *Globorotalia pseudomenardii* and *Globorotalia velascoensis* Zones (Cores 8, 9, 10).

Stratigraphic and geographic range: This species is known from the upper Paleocene of Trinidad, United States, Nigeria, Syria, Egypt, New Zealand, and other countries.

During drilling, the species was found in the upper Paleocene or the Atlantic Ocean (Rio Grande Rise) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia hispidicidaris Loeblich and Tappan
(Plate 22, Figures 4-6)

1957. *Globorotalia hispidicidaris* Loeblich and Tappan, p. 190, pl. 58, fig. 1a-c.

Remarks: The specimens of *G. hispidicidaris* from upper Paleocene sediments of the Caroline Abyssal Plain are surprisingly similar to the holotype of this species described by Loeblich and Tappan from the Aquia Formation (USA). However, on the spiral side of the test of some of them, there were small additional apertural openings (at the intersection of the septal sutures with the spiral sutures.

Stratigraphic occurrence: Hole 199, Cores 8, 9, the *Globorotalia velascoensis* Zone.

Stratigraphic and geographic range: This species has been recorded from deposits of the upper part of the upper Paleocene in the United States, Egypt, Syria, the USSR (North Caucasus) and through drilling in the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain). Sporadic specimens of *G. hispidicidaris* are present at the base of the lower Eocene (the lower part of the *Globorotalia subbotinae* Zone) of the USSR and Caroline Abyssal Plain.

Globorotalia imitata Subbotina
(Plate 22, Figures 10-12)

1953. *Globorotalia imitata* Subbotina, p. 206, pl. 16, figs. 14a-c, 15a-c, 16a-c.

Remarks: Specimens of *G. imitata* from upper Paleocene sediments of the Caroline Abyssal Plain are very similar morphologically to the topotypes of this species, described from Paleocene deposits of the USSR (North Caucasus).

Stratigraphic occurrence: Hole 199, Core 10 (the *Globorotalia pseudomenardii* Zone), Cores 8, 9 (the *Globorotalia velascoensis* Zone).

Stratigraphic and geographic range: The upper Paleocene of many regions of the world; i.e., the USSR, Syria, Egypt, Australia, the United States, the Atlantic Ocean (Rio Grande Rise), and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina intermedia Subbotina
(Plate 2, Figures 3-5)

1953. *Acarinina intermedia* Subbotina, p. 227, pl. 20, figs. 1a,b,c–4a,b,c; 14a,b,c–16a,b,c.

Remarks: *Acarinina intermedia*, described by Subbotina from deposits of the upper Paleocene–lower part of the lower Eocene of the USSR (North Caucasus), is very similar to *Acarinina esnaensis* (LeRoy) in morphology. The latter was described by LeRoy also in 1953 from the Esna shales (upper Paleocene–lower part of the lower Eocene) of the Farafra Oasis, Egypt. *Acarinina intermedia* is characterized by a test half the size of that of *A. esnaensis*, a more rounded outline of the test, and tighter arrangement of chambers of the last whorl. However, separation of these two species of *Acarinina* has to be confirmed by further studies.

Stratigraphic occurrence: Hole 199, Cores 8 and 9, the *Globorotalia velascoensis* Zone.

Acarinina primitiva (Finlay)
(Plate 3, Figures 4-6)

1947. *Globoquadrina primitiva* Finlay, p. 291, pl. 8, figs. 129-134.

Remarks: The holotype of "*Globoquadrina*" *primitiva* was described by Finlay from middle Eocene deposits of New Zealand (Bortonian Stage). This species has been attributed by Jenkins to the new genus *Pseudogloboquadrina, P. primitiva* being given a long stratigraphic range; i.e., Paleocene-middle Eocene. In literature describing the Paleogene deposits of the USSR, Austria, Syria, Egypt, Tunisia, Senegal, Nigeria, Trinidad, and Cuba, this species is usually mentioned from deposits of the upper Paleocene and the lowermost Eocene. In this relation, the scope of the species *Acarinina* (*Pseudogloboquadrina*?) *primitiva* is worth thorough study.

Stratigraphic occurrence: Hole 199, Cores 8 and 9, *Globorotalia velascoensis* Zone.

Acarinina acarinata Subbotina
(Plate 1, Figures 1-3)

1953. *Acarinina acarinata* Subbotina, p. 229, pl. 22, figs. 4a,b,c-10a,b,c.

Remarks: Tests are medium sized (0.3-0.5 mm in diameter), round or oval in the equatorial section, with 4 to 4½ chambers tightly arranged in the last whorl. The chambers are elongated in the direction of test growth. The umbilical side is strongly convex, subspherical; the spiral side is slightly convex. Umibilicus is small. The peripheral margin is widely rounded.

It is possible that this species is a junior synonym of *Acarinina nitida* (Martin) from the Lodo Formation of California.

Stratigraphic occurrence: Hole 199, Cores 8 and 9 (upper Paleocene, the *Globorotalia velascoensis* Zone), where this species is rather common. Hole 200A, Core 2 (lower Eocene, the *Globorotalia formosa formosa* Zone) where *Acarinina acarinata* is represented by very rare specimens.

Stratigraphic and geographic range: *Acarinina acarinata* is abundant in deposits of the uppermost Paleocene (the *Acarinina acarinata* Zone) of the USSR (North Caucasus, Crimea, Transcaspian area, Georgia), and can still be found in a subordinate number of specimens in the lowermost Eocene (the *Globorotalia subbotinae* Zone and the *Globorotalia marginodentata* Zone) of the USSR.

In deposits of the same age, *A. acarinata* has been recorded from localities in Bulgaria, Austria, Syria, Egypt, and in the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain). This is indicative of wide geographical distribution for this species. The problem is whether its specific name is correct (*acarinata* or *nitida*). This requires a comparative analysis of specimens from the Caucasus and California.

Acarinina mckannai (White)
(Plate 2, Figures 6-8)

1928. *Globigerina mckannai* White, p. 194, pl. 27, fig. 16.

Remarks: This species was described by White from deposits of the Velasco Formation of Mexico. Considerably better illustrations of *A. mckannai* were given by Loeblich and Tappan (1957) and Bolli (1957). The Loeblich and Tappan specimens were obtained from the Vincentown Formation (New Jersey), the Aquia Formation (Maryland, Virginia), the Salt Mountain Limestone (Alabama) of the United States and the Velasco Formation of Mexico; and the Bolli specimens, from the Lizard Springs Formation of Trinidad. Hypotypes and lectotypes of *Acarinina mckannai* indicate that *Acarinina subsphaerica* (Subbotina), 1947, from Paleocene and lower Eocene deposits of the USSR is a junior synonym.

Stratigraphic occurrence: Hole 199, Cores 8 and 9, *Globorotalia velascoensis* Zone. Very rare specimens of this species were detected in lower Eocene deposits (the *Globorotalia formosa formosa* Zone) of Hole 200A, Core 2.

Stratigraphic and geographic range: The species has been observed in deposits of the upper Paleocene and the lower part of the lower Eocene of many countries of Europe, Mediterranean, Africa, Asia, America, as well as in Australia and New Zealand. It was also seen during drilling in the Atlantic and Pacific oceans.

Globigerina velascoensis Cushman
(Plate 11, Figures 10-12)

1925. *Globigerina velascoensis* Cushman, p. 19, pl. 3, fig. 6.

Remarks: This species is indicative of upper Paleocene deposits. It is characterized by a medium sized test (0.3-0.4 mm) with a strongly lobate equatorial outline; the last whorl contains four chambers that rapidly increase in size; the last chamber usually occupies 1/3 of the whorl; the chambers are inflated, laterally compressed; the umbilical side is strongly inflated, the spiral side is slightly convex. The aperture has a distinct lip.

Stratigraphic occurrence: Hole 199, Cores 8 and 9, *Globorotalia velascoensis* Zone.

Stratigraphic and geographic range: The species is known from upper Paleocene deposits of the United States (California, the Gulf coast), Mexico, Trinidad, Cuba, Senegal, Nigeria, many Mediterranean countries; it was recovered in deposits of this age during drilling in the Atlantic Ocean (Rio Grande Rise, Bay of Biscay) and in the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globigerina nana Khalilov
(Plate 9, Figures 1-3)

1956. *Globigerina triloculinoides* var. *nana* Khalilov, p. 236, pl. 1, fig. 4a,b,c.

Remarks: Test small (diameter 0.24-0.29 mm), strongly inflated, almost square. Initial whorls can hardly be seen. The last whorl contains three chambers, the last of which is arranged perpendicular to the previous two. Septal sutures are straight. The surface of the wall is roughly reticulate. The aperture is slit-like with a small lip.

Stratigraphic occurrence: Hole 199, Cores 8 and 9, *Globorotalia velascoensis* Zone. This species is represented here by rare specimens.

Stratigraphic and geographic range: *Globigerina nana* is often observed in upper Paleocene deposits of the USSR (North Caucasus, Transcaucasian and Transcaspian areas); this species is known in subordinate numbers of specimens from the lower part of the lower Eocene of these regions. It has also been recorded from the upper Paleocene of the Mediterranean (Syria, Egypt), United States (California) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Early Eocene

Globorotalia aequa Cushman and Renz
(Plate 17, Figures 10-12)

1942. *Globorotalia crassata* var. *aequa* Cushman and Renz, p. 18, pl. 3, fig. 3a-c.

Remarks: Relatively sporadic specimens of this species possess all characteristics of *Globorotalia aequa.*

Stratigraphic occurrence: Hole 199, Core 8, upper Paleocene, *Globorotalia velascoensis* Zone; Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: This species is known to be widely distributed in Paleogene deposits of many areas. It is a consistent element of the assemblage of planktonic foraminifera in the uppermost Paleocene (the uppermost part of the *Globorotalia velascoensis* Zone), and lowermost Eocene (the *Globorotalia subbotinae* Zone). Higher, in deposits of the *Globorotalia formosa formosa* Zone, only sporadic specimens of *G. aequa* occur. It was seen during drilling in the Pacific and Atlantic oceans.

Globorotalia subbotinae Morozova
(Plate 28, Figures 10-12)

1939. *Globorotalia subbotinae* Morozova, p. 80, pl. 2, figs. 16, 17.

Remarks: This species was originally described by Morozova from the lowermost Eocene of the USSR (Transcaspian area, the Emba Basin). It differs from *Globorotalia aequa* by a lens-like test (in *G. aequa* the spiral side is almost flat, the umbilical side is convex), more loose coiling (in the last whorl there are, as a rule, four chambers in a cruciform arrangement), and a distinct ornamented keel.

A junior synonym of this species is *Globorotalia rex* Martin, 1943.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (very rare specimens).

Stratigraphic and geographic range: Sporadic specimens of *Globorotalia subbotinae* seem to appear at the top of the upper Paleocene. In the lowermost Eocene (the *Globorotalia subbotinae* Zone), this species is abundant. Higher, in the *Globorotalia formosa formosa* Zone, the number of specimens in planktonic foraminiferal assemblages rapidly increases.

This species (as *Globorotalia subbotinae* or *G. rex*) has been described from the lowermost Eocene of many areas. The species was also encountered during drilling performed by *Glomar Challenger* in the Atlantic Ocean (Rio Grande Rise, Bahama Banks, Bay of Biscay, Venezuela Basin, Beata Ridge) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia marginodentata Subbotina
(Plate 24, Figures 5-7)

1953. *Globorotalia marginodentata* Subbotina, p. 212, pl. 18, figs. 1a,b,c,-3a,b,c.

Remarks: *Globorotalia marginodentata* differs from the similar species *G. subbotinae* by a flattened lenticular test, a lobate peripheral margin, a wide and thick keel, and a larger number of chambers in the last whorl (usually 5, sometimes 4½ or 6).

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: In the USSR (the Carpathians, Crimea, Transcaspian area), this species (sporadic specimens) appears starting at the base of the lower Eocene (the *Globorotalia subbotinae* Zone). Higher, in the deposits of the *Globorotalia marginodentata* Zone, this species becomes widely distributed, its last specimens disappearing in the basal layers of the *Globorotalia aragonensis* Zone.

Globorotalia marginodentata from the deposits of the lowermost Eocene has been found in Syria, Rumania, Egypt, Austria, Yugoslavia, Italy, Tunisia and New Zealand. Drilling has established the presence of this species in the lower Eocene of the Atlantic Ocean (Rio Grande Rise, Bahama Banks, Bay of Biscay) and that of the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia formosa gracilis Bolli
(Plate 21, Figures 7-9)

1957. *Globorotalia formosa gracilis* Bolli, p. 75, pl. 18, fig. 4-6.

Remarks: *Globorotalia formosa gracilis* differs from *G. marginodentata* by an irregular lens-like test (the umbilical side of the test is much more convex as compared to the spiral side), a less lobate peripheral margin, a gradual increase in chamber size, and a less well developed keel.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: The species is widely-distributed in deposits of the lowermost Eocene (the *Globorotalia subbotinae* Zone and the *Globorotalis formosa formosa* Zone). It was found during drilling in the Atlantic Ocean (Rio Grande Rise, Bahama Banks, Bay of Biscay) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain, Hole 39 off the west coast of California).

Globorotalia formosa formosa Bolli
(Plate 21, Figures 4-6)

1957. *Globorotalia formosa formosa* Bolli, p. 76, pl. 18, figs. 1-3.

Remarks: This species differs from *G. formosa gracilis* by a larger test, a greater number of chambers in the last whorl (6-8 instead of 5-6), and a more conical umbilical side.

Stratigraphic occurrence: Hole 200A, Core 2, the *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: This is a typical species of the lower Eocene, abundant in deposits of the *Globorotalia formosa formosa* Zone (this zone corresponds to the *Globorotalia marginodentata* Zone in the Paleogene of the USSR), and can be found in subordinate numbers of specimens in the *Globorotalia aragonensis* Zone. In the deposits of this age, the species was established in the USSR, Syria, Egypt, Tunisia, Italy, Senegal, Nigeria, Trinidad, Cuba, the United States, India and other countries. During drilling, *G. formosa formosa* was found in the lower Eocene of the Atlantic Ocean (Rio Grande Rise, Bay of Biscay) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia lensiformis Subbotina
(Plate 23, Figures 10-12)

1953. *Globorotalia lensiformis* Subbotina, p. 214, pl. 18, figs. 4a, b, c-5a, b, c.

Remarks: Tests large (0.45-0.60 mm), conical; spiral side slightly convex, umbilical side strongly convex. The last whorl consists of four or five chambers that rapidly increase in size.The last chamber is large, and occupies up to 1/3 of the final whorl. The peripheral margin is sharp, lobate, and ornamented with a thin keel. Umbilical ends of the chambers are closely connected with one another, the umbilicus being very small.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: This species was originally described from lower Eocene deposits of the USSR, where it can be found in the upper part of the *Globorotalia marginodentata* Zone and in the lower part of the *Globorotalia aragonensis* Zone.

Globorotalia lensiformis is widely-distributed, though it is known from a limited number of places: Mediterranean (Syria, the top of the *Globorotalia marginodentata* Zone), the Atlantic Ocean (Rio Grande Rise, Hole 21, undifferentiated *Globorotalia aragonensis-Globorotalia formosa formosa* Zones; Labrador Sea, Hole 111, undifferentiated *Globorotalia subbotinae-Globorotalia formosa formosa* Zones), and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia aragonensis Nuttall
(Plate 18, Figures 4-6)

1930. *Globorotalia aragonensis* Nuttall, p. 288, pl.24, figs. 6-8, 10-11.

Remarks: *Globorotalia lensiformis* Subb. seems to be included by many micropaleontologists within the range of variation *G. aragonensis* Nutt. The latter is characterized by a larger highly-conical test with an almost flat spiral side, a greater number of chambers (6-8) in the last whorl, a slow increase in test size, a slightly lobulate (almost even) peripheral margin, a thicker test wall, a well-developed keel, and a deep umbilicus.

Stratigraphic occurrence: Hole 200A, Core 2, top of the *Globorotalia formosa formosa* Zone (rare specimens).

Statigraphic and geographic range: It is distributed in lower Eocene deposits of many regions of the world; the species was found during drilling in the Atlantic Ocean (Rio Grande Rise, Bahama Banks) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain, Hole 38 westwards of California).

The first rare specimens of *G. aragonensis* appear at the top of the *Globorotalia formosa formosa* Zone. In the upper part of the lower Eocene (the *Globorotalia aragonensis* Zone and the *Globorotalia palmerae* Zone in Bolli's sense), the species is abundant. Specimens of *G. aragonensis* are still common in basal layers of the middle Eocene and sporadic specimens also occur stratigraphically higher in the middle Eocene. For instance, in the USSR (North Caucasus) the last specimens of *G. aragonensis* have been found in the *Hantkenina alabamensis* Zone (=*Orbulinoides beckmanni* Zone).

Globorotalia caucasica Glaessner
(Plate 19, Figures 1-3)

1937. *Globorotalia aragonensis* var. *caucasica* Glaessner, p. 31, pl. 1, fig. 7 a-c.

Remarks: This species is most likely a descendant of *Globorotalia aragonensis* Nutt., being characterized by a wider and deeper umbilicus, ornamented umbilical ends of chambers that are turned to the side opposite from the umbilicus, a thicker keel covered with small spines, and a thick wall ornamented by tubercles and spines.

Globorotalia caucasica shows surprisingly convergent similarilty (homeomorphy) of morphological features with *G. velascoensis* (Cushm.), these being developed in deposits of various age. *Globorotalia caucasica* is characterized mostly by a thick wall supplied with tubercles, granules, and spines. Drawings of foraminifera fail to reflect the difference of these two species. However, a micropaleontologist familiar with typical representatives of *G. caucasica* and *G. velascoensis,* is unlikely to make a mistake identifying these species, as the difference between them can clearly be seen.

In the past, this morphological similarity has probably resulted in misidentifications especially for Paleogene deposits of countries in which either *G. caucasica,* or *G. velascoensis* is rare or absent.

For instance, in the upper Paleocene of the USSR (Crimea, North Caucasus) *Globorotalia velascoensis* (only low-conical specimens can be found) is sporadic or absent. This is very likely the reason that Subbotina (1953) and some other micropaleontologists erroneously report "Globorotalia velasoensis" from deposits of the *Globorotalia aragonensis* Zone (Lower Eocene) and the *Acarinina bullbrooki* Zone (middle Eocene).

In Egypt, the deposits of the *Globorotalia aragonensis* Zone (in a broad sense, including the *Globorotalia palmerae* Zone) are represented by hard limestone of the Thebes Formation. These rocks contain poor assemblages of planktonic foraminifera among which specimens of *G. caucasica* are rare and poorly preserved. This is likely the reason that El-Naggar (1966) considered *G. caucasica* Glaessen, as a subspecies of *G. velascoensis* Cushm. (upper Paleocene), not taking into account another stratigraphic level of development of true *G. caucasica* in the U.S.S.R.

In sections of calcareous Paleogene deposits of many countries it can clearly be seen that the stratigraphic ranges of *Globorotalia velascoensis* (upper Paleocene), *G. aragonensis,* and *G. caucasica* (the upper part of the lower Eocene-the lowermost part of the middle Eocene) are divided by a stratigraphic interval (the lowermost Eocene), where no high-conical *Globorotalia* occur. This fact testifies to the genetic independence of *G. velascoensis* and *G. caucasica.* The peculiarities of the stratigraphic distribution of *G. velascoensis* and *G. caucasica* were elucidated properly by Z. Reiss as far back as in 1957.

Globorotalia crater Finlay (1939, Trans, Roy. Soc. New Zeal., v. 69. pt; 1. p. 125) is a junior synonym of *G caucasica* Glaessner, 1937. This species was described from lower Eocene deposits of New Zealand.

Jenkins (1971) regards *G. causica* as a subspecies of *G. crater.* He believes that *G. crater causica* differs from *G. crater crater* in having six to eight chambers in the final whorl as opposed to five in *G. crater crater.* However, the vast majority of specimens of *G. caucasica* from lower Eocene deposits of the North Caucasus have five chambers in the final whorl (less frequently their number increases up to 6).

Stratigraphic occurrence: Hole 200A, Core 2, top of the *Globorotalia formosa formosa* Zone (very rare specimens).

Stratigraphic and geographic range: The first sporadic specimens of *G caucasica* appear at the top of the *Globorotalia formosa formosa* Zone. In the *Globorotalia aragonensis* Zone (in Bolli's sense), it is represented by rare specimens. It can frequently be observed in deposits of the *Globorotalia palmerae* Zone (lower Eocene) and the *Hantkenina aragonensis* Zone (middle Eocene). The last specimens of the species are known from sediments of the *Globorotalia kulgeri* Zone (in Bolli's sense).

The species is certain to be widely distributed geographically. However, discrepancies in understanding this species (*caucasica, crater, "velascoensis"*) pose difficulties in enumerating its localities. Deep-sea drilling encountered *G. caucasica* in sediments of the upper part of the lower Eocene of the Atlantic Ocean (Rio Grande Rise) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain, Hole 38 to the west of California).

Globorotalia naussi Martin
(Plate 26, Figures 1-3)

1943. *Globorotalia naussi* Martin, p. 116, pl. 8, fig. 3 a-c.

Remarks: The species was originally described from lower Eocene deposits of the Lodo Formation in California. As regards the shape of the test (conical test with a flat spiral side and strongly convex umbilical side, even peripheral margin), it is relatively similar to *G. aragonensis* Nutt. The characteristic features which distinguish *G. naussi* from *G. aragonensis* are a smaller test (0.3-0.4 mm instead of 0.37-0.70 in *G. aragonensis*), a thinner wall, a smaller number of chambers in the final whorl (5½-6 instead of 6-7 in *G. aragonensis),* and a thin glassy keel along the peripheral margin.

Stratigraphic occurrence: Hole 200A, Core 2, top of the *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: *Globorotalia naussi* is associated with deposits of the *Globorotalia aragonensis* Zone (in a broad sense). Besides California, this species has been found in the USSR (North Caucasus) and in the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia marksi Martin
(Plate 24, Figures 8-10)

1943. *Globorotalia marksi* Martin, p. 115, pl. 8, fig. 1 a-c.

Remarks: A medium sized test (0.40-0.50 mm) of conical shape, spiral side slightly convex, the umbilical side strongly convex, almost inflated. In the last whorl, there are five to six inflated chambers, slowly increasing in size. The peripheral margin is subacute, without keel. The umbilicus is small but deep. The wall is thickened, covered by granules.

Globorotalia marksi is a surprisingly peculiar species, differing considerably from other species of planktonic formaninifera. The generic affinity of the species concerned is is open to question. Taking into account the absence of the keel, Sarbekyan (1964) described *G. marksi* from the *Globorotalia aragonensis* Zone of the North Caucasus as *Acarinina marksi* (Mart.).

Stratigraphic occurrence: Hole 200A, Core 2, top of the *Globorotalia formosa formosa* Zone (very rare specimens).

Stratigraphic and geographic range: The *Globorotalia aragonensis* Zone (lower Eocene) of the United States (California), USSR (North Caucasus), the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia pseudoscitula Glaessner
(Plate 27, Figures 7-9)

1937. *Globorotalia pseudoscitula* Glaessner, p. 32, text fig. 3 a-c; p. 33, text fig. 3 d-f.

Remarks: Test small (diameter 0.2-0.3 mm), lenticular, compressed, spiral and umbilical sides almost uniformly convex. In the final whorl there are five to six chambers that are gradually increasing in size. Septal sutures are deepened, strongly curved, on the spiral side, and slightly lobate, almost even, acute, but without a keel, or with a very indistinct keel. The umbilicus is very small.

Stratigraphic occurrence: Hole 200A, Core 2, top of the *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: *Globorotalia pseudoscitula* was initally described from lower Eocene deposits of theUSSR (North Caucasus). The species is ccommon in the *Globorotalia aragonensis* Zone and is found in subordinate numbers of specimens in the middle Eocene.

Globorotalia pseudoscitula has been recorded in the lower Eocene of the Atlantic Ocean (Rio Grande Rise) and the Pacific Ocean (Caroline Abyssal Plain).

Globorotalia wilxcoxensis Cushman and Ponton
(Plate 30, Figures 7-9)

19332. *Globorotalia wilcoxensis* Cushman and Ponton, p. 71, pl. 9, fig. 10 a-c.

Remarks: The peripheral margin at the beginning of the final whorl is rounded; in the last two chambers it becomes angular, acute; sometimes a faint keel is present. The systematic position of the species is open to question–some micropaleontologists assign it to the genus *Globorotalia* ; others, to the genus *Acarinina.*

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (very rare specimens).

Stratigraphic and geographic range: *Globorotalia wilcoxensis* has been recorded in the lower Eocene of many countries: the United States (California, Gulf Coast), Trinidad, Cuba, Madagascar, India, Peru, Czechoslovakia, the USSR, Syria, Egypt, Iran, Cyprus, Yugoslavia, Morocco, etc. This species is characteristic of the *Globorotalia subbotinae* Zone; in the *Globorotalia formosa formosa* Zone, it is represented by very rare specimens.

Globorotalia quetra Bolli
(Plate 27, Figures 10-12)

1957. *Globorotalia quetra* Bolli, p. 79, pl. 19, figs. 1-6.

Remarks: A very peculiar species planktonic foraminifera. It is characterized by an angular test (in the equatorial section), flat spiral side, strongly convex umbilical side, spiny keel on the peripheral margin that is especially distinct in early chamber of the final whorl, and a spinose wall or a wall covered with granules.

Presence of a spiny keel makes *G. quetra* different from *G. wilcoxensis* Cushm. and Pon., as well as from some species of *Acarinina* (*A. triplex* Subb., *A. pseudotopilensis* Subb., *A. esnaensis* LeRoy) that have a similar subsquare angular test.

Considerable resemblance can be seen between *Globorotalia quetra* and *Truncorotaloides topilensis* (Cushm.) from middle Eocene deposits, concerning shape of the test, arrangement of chambers, character of keel, and spinosity of the wall. *Truncorotaloides topilensis* is characterized by supplementary sutural apertures on the spiral side of the test. However, in our materials from the lower Eocene of the Carolina Abyssal Plain, specimens of *Globorotalia quetra*, also with supplementary apertures on the spiral side of the test, occur frequently.

Globorotalia quetra and *Truncorotaloides topilensis* are certain to be two independent species developed in deposits of different age, just as is the case of *Globorotalia velascoensis* and *G. caucasica*. The surprising homeomorphy of morphological features of planktonic foraminifera is worth further study.

Some micropaleontologists assign *Globorotalia quetra* to the genus *Acarinina.*

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (abundant specimens).

Stratigraphic and geographic range: *Globorotalia quetra* is indicative of lower Eocene deposits. The species appears in the upper part of the *Globorotalia subbotinae* Zone, is abundant in the *Globorotalia formosa formosa* Zone, and can still be found in subordinate numbers of specimens in the *Globorotalia aragonensis* Zone (in Bolli's sense). This species occurs in Austria, Italy, Syria, Senegal, Trinidad, Cuba and Australia in deposits of this age. It was also recorded during drilling in the Atlantic Ocean (Rio Grande Rise, Bay of Biscay) and the Pacific Ocean (Hole 38 off the west coast of California, Shatsky Rise, and the Caroline Abyssal Plain).

Globorotalia troelseni Loeblich and Tappan
(Plate 29, Figures 4-6)

1957. *Globorotalia troelseni* Loeblich and Tappan, p. 196, pl. 60, fig. 4 a-c, pl. 63, fig. 5 a-c.

Remarks: The low trochospiral test is laterally compressed with a lobulate equatorial profile. The final whorl contains five to six moderately inflated chambers which gradually increase in size. This whorl has a tendency to become uncoiled and, as a result, the test becomes evolute (initial whorls can be seen in the small umbilicus). The peripheral margin is subangular, narrowly rounded, with a thin keel (developed in early chambers of the last whorl). The surface of the wall is smooth and perforate.

Globorotalia troelseni differs from *G. pseudomenardii* Bolli in the evolute and uncoiled test, more inflated chambers, and a narrowly rounded peripheral margin.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: The species was described for the first time from deposits of the Velasco and Nanafalia formations (Paleocene-lower Eocene) of the United States. Data on the stratigraphic and geographic distribution of *G. troelseni* are very poor. It appears rather worthwhile to establish the relation between *G. troelseni* and *G. chapmani* Parr, and *G. elongata* Glaessn. (the last two species are recorded from upper Paleocene sediments).

Globorotalia apanthesma Loeblich and Tappan
(Plate 18, Figures 1-3)

1957. *Globorotalia apanthesma* Loeblich and Tappan, p. 187, pl. 48, fig. 1 a-c, pl. 55, fig. 1 a-c, pl. 52, fig. 4 a-c, pl. 59, fig. 1 a-c.

Remarks: Test plano-convex, with a lobulate peripheral outline. Spiral side flat or slightly convex; umbilical side strongly convex in the shape of a truncated cone, with a deep and wide umbilicus. The final whorl consists of five chambers; their outlines on the spiral side are lunate and the sutures are strongly curved. The peripheral margin is supplied with a keel consisting of closely arranged spines, the glassy keel being absent. The surface of the test (especially on the umbilical side) is covered with short, closely arranged spines.

Morphologically, *Globorotalia apanthesma* differs rather considerably from other species of planktonic foraminifera obtained from Paleocene and lower Eooene sediments.

Some specimens of *G. apanthesma* from lower Eocene deposits of the Caroline Abyssal Plain possess supplementary apertures on the spiral side of the test, along the spiral suture.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: The species was originally described from the Aquia, Vincentown, and Salt Mountain formations of the Gulf and Atlantic coastal plains (United States). These formations are attributed to the late Paleocene-Early Eocene. *G. apanthesma* is likely to appear in the upper part of the upper Paleocene, reaching its maximum development in the lowermost Eocene (the *Globorotalia subbotinae* and *Globorotalia formosa formosa* zones). In deposits of this age, the species is known (besides the United States) in the USSR, Syria, Egypt, New Zealand and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globorotalia aff. collactea Finlay
(Plate 19, Figures 7-9)

This form occurs as sporadic specimens which in the shape of their test resemble *G. collactea* of Bolli's (1957) interpretation. But Bolli's specimens are probably unrelated to *G. collactea* Finl., as it was shown by Jenkins (1965, 1971), that *G. collactea* is associated with younger deposits of the Paleogene of New Zealand (uppermost

parts of the lower-middle Eocene) and is characterized by a spiny test wall (Jenkins assigns this species to the genus *Truncorotaloides*).

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Acarina pentcamerata pentacamerata (Subbotina)
(Plate 3, Figures 1-3)

1947. *Globorotalia pentacamerata* Subbotina, p. 128, p. 7, figs. 12-17, pl. 9, figs. 24-26.

Remarks: Test large (diameter 0.40-0.60 mm), with a rounded equatorial profile and a slightly lobulate peripheral margin, dorsoventrally compressed. The last whorl has five to six spherical chambers, tightly coiled, that increase slowly in size as added. The spiral side is slightly convex; the umbilical side is convex with a wide umbilicus. The peripheral margin is rounded, sometimes a little angular, without a keel. The wall is covered with granules and spines. Spines in the umbilical part are thick and elongated.

Stratigraphic occurrence: Hole 200A, Core 2, top of the *Globorotalia formosa formosa* Zone. (common).

Stratigraphic and geographic range: *Acarinina pentacamerata pentacamerata* appears in the upper part of the *Globorotalia formosa formosa* Zone; this species is abundant in sediments of the upper part of the lower Eocene (the *Globorotalia aragonensis* Zone in a broad sense); it is still observed in subordinate numbers of specimens at the base of the middle Eocene (the *Acarinina bullbrooki* Zone), but here its descendant with seven to eight chambers in the final whorl, *Acarinina aspensis* is numerically dominant These two species of *Acarinina* seem generally to be regarded as unrelated.

In deposits of the given age, *A. pentacamerata pentacamerata* has been found in the USSR (Carpathians, Crimea, Caucasus), Bulgaria, Syria, Egypt, Yugoslavia, United States, (California), and during drilling in the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain). The authors describing *Acarinina aspensis* from deposits of the *Globorotalia aragonensis* Zone in Spain, on Trinidad, and in the Atlantic Ocean (Rio Grande Rise), seem to include *Acarinina pentacamerata* within the scope of this species.

Acarinina penatacamerata camerata Khalilov
(Plate 2, Figure 9-11)

1956. *Acarinina pentacamerata camerata* Khalilov, p. 252, pl. 5, fig. 6 a-c.

Remarks: This species differs from *A. pentacamerata pentacamerata* in an inflated spiral side.

Stratigraphic occurrence: Hole 200A, Core, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: *A. pentacamerata camerata* can be observed in large numbers in deposits of the lowermost Eocene (the *Globorotalia subbotinae* andd *Globorotalia marginodentata* zones) of the USSR (North Caucasus, Transcaspian, Transcaucasian, areas), and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina broedermanni (Cushman and Bermudez)
(Plate 1, Figures 4-6)

1949. *Globorotalia broedermanni* Cushman and Bermudez, p. 40, pl. 7, figs. 22-24.

Remarks: This species can easily be distinguished from *Acarinina pentacamerata* (Subb.) by its biconvex test (the umbilical side is a little more convex), even equatorial outline, subangular peripheral margin, small umbilicus, convex initial whorls, and subangular chambers with a smooth surface on the spiral side.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (common).

Stratigraphic and geographic range: *Acarinina broedermanni* is frequently found in lower Eocene deposits (from the *Globorotalia subbotinae* Zone to the *Globorotalia aragonensis* Zone) of the USSR, Syria, Egypt, Yugoslavia, Italy, Tunisia, Senegal, Trinidad, Cuba, United States, Pakistan, and New Zealand, as well as in the Atlantic Ocean (Rio Grande Rise) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina decepta (Martin)
(Plate 1, Figures 7-9)

1943. *Globigerina decepta* Martin, p. 114, pl. 7, fig. 2a-c.

Remarks: This species is characterized by a subglobular test with an almost flat spiral side and strongly convex umbilical side; peripheral margin is rounded or bluntly angled, slightly lobulate in the equatorial section. The last whorl has 4 to 4½ chambers, tightly arranged. The umbilicus is very small. The surface is covered with spines.

Acarinina decepta resembles *A. interposita* Subb. from deposits of the same age, being characterized by a strongly convex umbilical side, a small umbilicus, and tight arrangement of the chambers. These two species are worth studying in terms of their relationship to each other.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: *A. decepta* was originally described from the Lodo Formation of California. This species has been recorded from lower Eocene deposits (the *Globorotalia subbotinae* Zone, *Globorotalia aragonensis* Zone) of the USSR (North Caucasus) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina esnaensis (LeRoy)
(Plate 1, Figures 10-12)

1953. *Globigerina esnaensis* Leroy, p. 31, pl. 6, figs. 8-10.

Remarks: Test subsquare with a slightly convex spiral side and strongly convex umbilical side. Peripheral margin lobulate in equatorial profile, rounded, without keel. The last whorl consists of four chambers which rapidly increase in size. The first three chambers are rectangular and arcuate, the last one inflated and globular (on the spiral side). Umbilicus distinct. Wall covered by numerous spines (especially on the umbilical side).

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (very rare specimens).

Stratigraphic and geographic range: This species was originally described from the Esna shales, Farafra Oasis, Egypt, where it is indicative of the uppermost Paleocene (*Globorotalia velascoensis* Zone) and those of the lowermost Eocene (*Globorotalia wilcoxensis* Zone) (El-Naggar, 1966). Very rare specimens occur in sediments of the *Globorotalia formosa formosa* Zone of the Nile Valley.

In deposits of the given age, this species has been reported from Syria, Tunisia, the USSR, Denmark, France, United States, Pakistan, New Zealand, and other countries; it was also found during drilling in the Atlantic Ocean (Rio Grande Rise, Bay of Biscay) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina pseudotopilensis Subbotina
(Plate 3, Figures 7-9)

1953. *Acarinina pseudotopilensis* Subbotina, p. 227, pl. 21, figs. 8a-c, 9a-c, pl. 22, figs. 1a-c, 2a-c, 3a-c.

Remarks: This species resembles *Acarinina esnaensis* (LeRoy), being characterized by the following: the test is square or subsquare with clearly lobulate incised outline; the peripheral margin is narrowly rounded or bluntly angled, chambers are elongate and compressed, their ends lying beyond the general outline of the test; the last chamber is arranged at a right angle to the previous one.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (very common).

Stratigraphic and geographic range: *Acarinina pseudotopilensis* is characteristic of deposits of the whole of the lower Eocene, thus having stratigraphic range different from that of *A. esnaensis*. *Acarinina pseudotopilensis* is certain to be widely distributed geographically. However, it is frequently regarded as a junior synonym of *Acarinina esnaensis*. Therefore, it is difficult to determine the areal distribution of *A. pseudotopilensis*.

During deep-sea drilling, *A. pseudotopilensis* was found in the Atlantic Ocean (Rio Grande Rise, the Labrador Sea) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina triplex Subbotina
(Plate 4, Figures 1-3)

1953, *Acarinina triplex* Subbotina, p. 230, pl. 23, figs. 1a,b,c-5a,b,c.

Remarks: The test is strongly inflated, with a subsquare, weakly lobulate outline in equatorial profile and broadly rounded peripheral margin. Spiral side almost flat, umbilical side strongly inflated, sometimes hemisphaerical. Last whorl consists of 3 to 3½ tightly coiled chambers; their sizes increase quickly in the process of growth and the last chamber occupies ½ of the whorl. Chambers are arranged at right angles to one another. They are elongate with oval contours (especially on the spiral side) and are separated by deep, almost straight sutures. The umbilicus is indistinct, very small. The surface of the wall is covered by numerous spines (especially on the umbilical side).

This species differs from *Acarinina pseudotopilensis* Subb. by its strongly inflated test, broadly rounded peripheral margin, more tight arrangement of chambers, and indistinct umbilicus. It is also distinguished from *Acarinina esnaensis* (LeRoy) by a quick increase in size of chambers as added, and elongate and fewer (3-3½) chambers.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (common).

Stratigraphic and geographic range: The first very rare specimens of *A. triplex* evidently appear in the *Globorotalia subbotinae* Zone (lowermost Eocene). This species is abundant in the remainder of the lower Eocene (*Globorotalia formosa formosa* Zone, *Globorotalia aragonensis* zone in a broad sense), passing into the basal layers of the middle Eocene (*Acarinina bullbrooki* Zone). In the sediments of this age, *A. triplex* has been found in the USSR, Bulgaria, Rumania, Syria, Yugoslavia, Egypt, United States (California), as well as in the process of drilling in the Atlantic ocean (Labrador Sea) and the Pacific ocean (Shatsky Rise, Caroline Abyssal Plain).

Acarinina soldadoensis (Bronnimann)
(Plate 3, Figures 10-12)

1952. *Globigerina soldadoensis* Bronnimann, p. 9, pl. 1, figs. 1-9.

Remarks: Rather large (diameter 0.45-0.60 mm) tests of this species with five chambers in the last whorl resemble in some respects *Acarinina pentacamerata* (Subb.). They are distinguished by a more strongly inflated umbilical side, lobulate equatorial profile, a narrow, rounded, or even subangular peripheral margin, less tight arrangement of chambers, and subangular chamber form.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (common).

Stratigraphic and geographic range: *A. soldadoensis* appears in the *Globorotalia velascoensis* Zone (uppermost Paleocene), is very common in the *Globorotalia subbotinae* and *Globorotalia formosa formosa* zones (lower part of the lower Eocene) and gradually disappears in the *Globorotalia aragonensis* Zone (upper lower Eocene). The geographic distribution of *A. soldadoensis* is very wide–Trinidad, United States (Gulf Coast, California), Nigeria, Pakistan, New Zealand, USSR, Czechoslovakia, Austria, Syria, Egypt, Cyprus, Italy, Spain, Tunisia, etc. This species has also been recorded through drilling by *Glomar Challenger* in the Atlantic Ocean (Rio Grande Rise, Labrador Sea, Bay of Biscay) and the Pacific Ocean (Caroline Abyssal Plain, Shatsky Rise, Hole 39 to the west of California).

Acarinina gravelli (Bronnimann)
(Plate 2, Figures 1-2)

1952. *Globigerina gravelli* Bronnimann, p. 12, pl. 1, figs. 16-18.

Remarks: This species has much in common with *Acarinina mckannai* (White), differing considerably in a larger test with lobulate outline, less compact arrangement of chambers, more inflated chambers, and a more concave initial part of the test. The stratigraphic intervals of *A. gravelli* and *A. mckannai* overlap, but the acmes of their development are different. *Acarinina mckannai* is abundant in deposits of the upper Paleocene; *Acarinina gravelli*, in the *Globorotalia formosa formosa* and *Globorotalia aragonensis* zones (lower Eocene).

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone (common).

Stratigraphic and geographic range: *Acarinina gravelli* is known from the lower Eocene of Trinidad, Cuba, United States, Senegal, USSR, Syria, Italy, Spain and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Chiloguembelina wilcoxensis (Cushman and Ponton)
(Plate 5, Figures 2-3)

1932. *Guembelina wilcoxensis* Cushman and Ponton, p. 66, pl. 8, figs. 16, 17.

Remarks: This species is characterized by a large test (length up to 0.45-0.60 mm), with inflated subglobular chambers and semicircular symmetrical aperture.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: *Chiloguembelina wilcoxensis* has been determined from the lower Eocene of the United States (Alabama) and upper Paleocene-lower Eocene (*Globorotalia formosa formosa* Zone) sediments of Trinidad. The occurrence of this species in the Pacific Ocean (Caroline Abyssal Plain) testifies to its wide geographic distribution.

Chiloguembelina parallela Beckmann
(Plate 4, Figures 10-11)

1957. *Chiloguembelina parallela* Beckmann, p. 91, pl. 21, fig. 8, text-fig. 15(36-38).

Remarks: The most characteristic feature of this species is a high, narrow and symmetrical aperture bordered by two parallel lateral flanges.

Stratigraphic occurrence: Hole 200A, Core 2, *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: J. Beckmann (1957), describing *Ch. parallela*, mentioned its restricted stratigraphic range–the *Globorotali rex* Zone, lower Eocene of Trinidad. Actually, the range of this species is longer because in the Caroline Abyssal Plain it was found in sediments of the *Globorotalia formosa formosa* Zone.

Globigerina taroubaensis Bronnimann
(Plate 11, Figures 4-6)

1952. *Globigerina taroubaensis* Bronnimann, p. 18, pl. 2, figs. 16-18.

Remarks: This species of *Globigerina* is identical in morphology to *G. taroubaensis* described by P. Bronnimann (1952) and H. Bolli (1957) from sediments of the *Globorotalia aragonensis* Zone (lower Eocene) of Trinidad.

Stratigraphic occurrence: Hole 200A, Core 2, top of *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: Apart from Trinidad and the Caroline Abyssal Plain, *Globigerina taroubaensis* has been found in undifferentiated sediments of the *Globorotalia aragonensis-Globorotalia formosa formosa* zones of the Rio Grande Rise (Atlantic Ocean), and in Pakistan.

Globigerina prolata Bolli
(Plate 10, Figures 2-3)

1957. *Globigerina prolata* Bolli, p. 72, pl. 15, figs. 24-26.

Remarks: Test low trochospiral with 4 to 4½ globular chambers in the last whorl which increase rapidly in size as added. Contour of the test in equatorial profile is elongate, lobulate, with the peripheral margin rounded. Surface smooth. The aperture opens in the umbilicus or is umbilical-extraumbilical.

Stratigraphic occurrence: Hole 200A, Core 2, top of *Globorotalia formosa formosa* Zone.

Stratigraphic and geographic range: *Globigerina prolata* was originally described from the lower Eocene of Trinidad (the *Globorotalia formosa formosa* and *Globorotalia aragonensis* zones of Bolli). *Globigerina prolata* is recorded in sediments of this age in Italy, Syria, Cuba, and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Middle Eocene

Orbulinoides beckmanni (Saito)
(Plate 31, Figure 12)

1962. *Porticulasphaera beckmanni* Saito, p. 221, pl. 34, figs. 1a-2.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: This well known species with a short stratigraphic range has been found in the middle Eocene of many tropical and subtropical areas (Caribbean, Mediterranean, Senegal, Mexico, Tanzania, Pakistan, Australia, Japan, etc.), as well as during drilling in the Atlantic Ocean (Holes 10, 108, 144 in the northern part and Hole 19 in the southern part) and the Pacific Ocean (Horizon Rise–Holes 44, 171, Caroline Abyssal Plain). Evidently, it is less abundant in more northerly regions. For example, in the southernmost USSR (Transcaucasian Armenia), *Orbulinoides beckmanni* is represented by very rare specimens and in the middle Eocene of the North Caucasus it is not found.

Globigerapsis kugleri Bolli, Loeblich and Tappan
(Plate 5, Figures 6-7)

1957. *Globigerapsis kugleri* Bolli, Loeblich and Tappan, p. 34, pl. 6, fig. 6a-b.

Remarks: In sediments of the middle Eocene, *G. kugleri* is usually associated with *G. index* (Finlay), differing in a larger final chamber covering the umbilicus, low-arched supplementary apertures along the spiral suture, and a more tightly coiled test.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: This species is widely distributed in the middle Eocene (*Globigerapsis kugleri* Zone-*Orbulinoides beckmanni* Zone) of many regions of the world (Caribbean, Mediterranean, Middle East, Senegal, etc.) and has also been found in the Atlantic Ocean (Rio Grande Rise) and the Pacific Ocean (Horizon Rise, Caroline Abyssal Plain). Apparently, its geographic range is more limited as compared to that of *Globigerapsis index*. For instance, it is absent in the middle Eocene of the North Caucasus where *Globigerapsis index* is exceedingly abundant.

Globigerapsis index (Finlay)
(Plate 5, Figures 4-5)

1939. *Globigerinoides index* Finlay, p. 125, pl. 14, figs. 85-88.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: This species has a very long stratigraphic range, nearly all of the middle and upper Eocene; it is recorded in many regions of the world including the Caribbean, Mediterranean, Middle East, USSR, Bulgaria, Poland, Roumania, Czechoslovakia, West Germany, Pakistan, New Zealand, Australia, Solomon Islands, Indonesia, and the Mariana Islands, as well as in many holes in the Atlantic Ocean (6, 10, 14, 19, 20, 98, 112, 116, 117) and the Pacific Ocean (44, 171, 202).

Globigerinatheka barri Bronnimann
(Plate 12, Figures 4-5)

1952. *Globigerinatheka barri* Bronnimann, p. 27, text fig. 3a.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: *Globigerinatheka barri* appears in the *Globigerapsis kugleri* Zone (middle Eocene) and disappears in the lower part of the upper Eocene. In sediments of this age, *G. barri* has been recognized in many countries of the Caribbean region, Mediterranean, Middle East, Poland, Czechoslovakia, Switzerland, Senegal, Pakistan, New Zealand, Philippines, Japan, etc., and also in the Atlantic (Holes 19, 98, 144) and Pacific (Holes 44, 171, 202) oceans.

Globigerina pseudoeocaena Subbotina
(Plate 10, Figures 4-6)

1953. *Globigerina pseudoeocaena* Subbotina, p. 66, pl. 4, fig. 9a-c, pl. 5, figs. 1a,b,c-6a,b,c.

Remarks: Test large (diameter 0.40-0.65 mm), with strongly lobate outline and concave initial whorls. The final whorl consists of four inflated, almost globular chambers. They are loosely connected, rapidly increase in size as added. As a result, the test is elongate in the direction of growth. The peripheral margin is broadly rounded. The umbilicus is deep. Septal sutures are depressed, and straight. The surface is roughly porous, and cancellate.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: *Globigerina pseudoeocaena* is abundant in the lower Eocene (*Globorotalia aragonensis* Zone) and the middle Eocene of the USSR (Carpathians, Crimea, Caucasus, Transcaspian); reported from Bulgaria, Poland, Rumania, Czechoslovakia, Syria, Yugoslavia, Tunisia, Egypt, United States (California) and the Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globogerina pseudovenezuelana Blow and Banner
(Plate 10, Figures 7-8)

1962. *Globigerina yeguaensis pseudovenezuelana* Blow and Banner, p. 100, pl. XI, figs. J-L,N,O.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: This species appears (as rare specimens) in the *Orbulinoides beckmanni* Zone (middle Eocene) and disappears in the lower Oligocene. *G. pseudovenezuelana* has usually been included within the scope of *G. venezuelana, G. pseudoeocaena, G. yeguaensis,* etc. Therefore, the geographic distribution of the sepcies remains unknown, but it is evidently very wide: Trinidad, Tanzania, USSR, Syria, Pacific Ocean (Shatsky Rise, Caroline Abyssal Plain).

Globigerina galavisi Bermudez
(Plate 8, Figures 3-5)

1961. *Globigerina galavisi* Bermudez, p. 183, pl. 4, fig. 3.

Remarks: The specimens observed are similar to *G. galavisi*, in the sense of Bermudez (1961) and Blow (1969) and *G. yeguaensis*, as interpreted by Blow and Banner (*in* Eames et al., 1962).

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: the species appears in deposits of the *Orbulinoides beckmanni* Zone (middle Eocene) and disappears in the *Globorotalia opima* Zone (middle part of the Oligocene). In the deposits of this age, the species has been recorded in the USSR, Syria, Tanzania, United States (Gulf Coast), Trinidad, the Atlantic Ocean (Rio Grande Rise, Labrador Sea, Rockall Basin) and the Pacific Ocean (to the west of California, Horizon Rise, the western termination of the Clipperton Fracture Zone, and the area northward of this zone).

Globorotalia centralis Cushman and Bermudez
(Plate 19, Figures 4-6)

1937. Globorotalia centralis Cushman and Bermudez, p. 26, pl. 2, figs. 62-65.

Remarks: Toumarkine and Bolli (1970), studying topotypical specimens of *G. centralis* Cushm. and Berm., considered this species a synonym of *G. cerroazulensis cerroazulensis* (Cole), though the latter is characterized by compressed chambers, a narrowly rounded peripheral margin, flange-like chambers and curved septal sutures on the spiral side of the test. So, if the above observations of Toumarkine and Bolli are correct, the species concerned appears to be named *G. pomeroli* Toum. and Bolli.

Geographical occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone (abundant).

Stratigraphic and geographic range: The species described (whether its specific term is correct or not) appears in great numbers of specimens at the base of the *Orbulinoides beckmanni* Zone, gradually decreasing in the *Truncorotaloides rohri* Zone (middle Eocene). In the upper Eocene, it is observed in subordinate numbers. In deposits of this age, the species has been recorded in many countries of Europe, Asia, Africa, America, Australia, as well as in the Atlantic and Pacific oceans through drilling by the *Glomar*

Challenger. However, it is not certain whether the scope of this species is interpreted uniformly.

Globorotalia spinulosa Cushman
(Plate 28, Figures 7-9)

1927. *Globorotalia spinulosa* Cushman, p. 114, pl. 23, fig. 4.

Remarks: This species differs from the similar *G. lehneri* Cushm. and Jarv. in a less compressed lens-like test, truncated conical umbilical side, flange-like chambers, lobulate peripheral margin, and glassy thickenings along the septal sutures on the spiral side.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: *Globorotalia spinulosa* appears at the base of the middle Eocene and disappears in its upper part (in basal layers of the *Truncorotaloides rohri* Zone). In deposits of this age, the species has been found in the Mediterranean (Syria, Yugoslavia, Italy, Spain), countries of Africa (Morocco, Senegal, Tanzania), the Caribbean area (Cuba, Trinidad, Barbados), United States, Mexico, Pakistan, Australia, USSR, the Atlantic Ocean (Rio Grande Rise, the east coast of North America–Hole 108 and South America–Hole 144) and the Pacific Ocean (Horizon Rise, Ontong Java Plateau).

Globorotalia lehneri Cushman and Jarvis
(Plate 23, Figures 7-9)

1929. *Globorotalia lehneri* Cushman and Jarvis, p. 17, pl. 3, fig. 16.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: The species is widely distributed in deposits of the *Globorotalia lehneri* Zone and disappears at the top of the middle Eocene. It is recorded in many countries of the Mediterranean (Syria, Yugoslavia, Italy, Spain), Africa (Senegal, Tanzania), Asia (Iran, Japan), the Caribbean (Cuba, Trinidad), United States, Mexico, the Atlantic Ocean (Bermuda Rise, Rio Grande Rise) and the Pacific Ocean.

Truncorotaloides topilensis (Cushman)
(Plate 35, Figures 4-6)

1925. *Globigerina topilensis* Cushman, p. 7, pl. 1, fig. 9.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: The species is frequently observed in the deposits of the *Globorotalia lehneri* and *Orbulinoides beckmanni* zones (middle Eocene). The geographical distribution of the species is wide: FRG, Bulgaria, USSR, Syria, Iran, Yugoslavia, Italy, Morocco, Senegal, Trinidad, Barbados, Mexico, New Zealand, Japan, Pakistan, the Atlantic Ocean (Rio Grande Rise, Bahama Banks) and the Pacific Ocean (Horizon Rise).

Truncorotaloides rohri Bronnimann and Bermudez
(Plate 31, Figures 1-3)

1953. *Truncorotaloides rohri* Bronnimann and Bermudez, p. 818, pl. 87, figs. 7-9.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: The first specimens of *T. rohri* appear in the lower part of the middle Eocene; the species is rather peculiar to the deposits of the *Globorotalia lehneri, Orbulinoides beckmanni*, and *Truncorotaloides rohri* zones. It is known from the middle Eocene of the Mediterranean region, Caribbean, Africa (Tanzania, Senegal), the Atlantic Ocean (Bermuda Rise, Rio Grande Rise, Bahama Banks, the eastern coast of South America–Hole 144) and the Pacific Ocean (Horizon Rise).

Hantkenina alabamensis Cushman
(Plate 31, Figures 3, 6)

1924. *Hantkenina alabamensis* Cushman, p. 3, pl. 1, figs. 1-6, pl. 2, fig. 5.

Stratigraphic occurrence: Hole 202, Core 2, *Orbulinoides beckmanni* Zone.

Stratigraphic and geographic range: The species is representative of deposits of the *Orbulinoides beckmanni* Zone (middle Eocene). In the stratigraphic scale of the USSR Paleogene (the Crimean-Caucasian regions), equivalent deposits are distinguished as the *Hantkenina alabamensis* Zone. In the sediments of younger age (*Truncorotaloides rohri* Zone of the middle and upper Eocene), the species becomes less frequent. Geographically, *H. alabamensis* is cosmopolitan; it occurs in Europe (USSR, Bulgaria, Yugoslavia, Italy, Spain), Asia (Syria, Cyprus, Afganistan, the Philippines), Africa (Morocco, Tanzania), America (United States, Mexico, Panama, Ecuador, Peru), as well as in New Zealand, Australia, Cuba, Trinidad, and the Dominican Republic. Deep-sea drilling found this species in the Atlantic Ocean (Rio Grande Rise, Bahama Banks) and the Pacific Ocean (Horizon Rise).

NEOGENE

Deep Sea Drilling holes penetrate Neogene deposits considerably more often than sediments of older age. Therefore, the biostratigraphy of Neogene planktonic foraminifera is fairly well known. Some of the "Initial Reports of the Deep Sea Drilling Project" contain numerous plates of planktonic foraminifera and more or less detailed comments on these species (Volumes IV, XI and XII of the "Initial Reports. . ." for the Atlantic Ocean and Volumes VII and IX for the Pacific Ocean). These publications show that many of the Neogene species are interpreted uniformly; therefore, the remarks given below on Neogene planktonic foraminifera will be brief.

Lower Miocene

Globigerina angustiumbilicata Bolli
(Plate 5, Figures 8-10)

1957. *Globigerina ciperoensis angustiumbilicata* Bolli, p. 109, pl. 22, figs. 12-13.

Stratigraphic occurrence: Hole 200, Cores 9 and 10, upper part of *Globigerinita stainforthi* Zone, *Praeorbulina glomerosa* Zone.

Stratigraphic and geographic range: The species appears at the top of the upper Eocene and is widely developed in Oligocene and lower Miocene deposits. In sediments of younger age, it is sporadic. The species has been recorded in many countries of the Caribbean region, the Mediterranean, and the Atlantic and Pacific oceans.

Globigerina praebulloides Blow
(Plate 9, Figures 10-12)

1959. *Globigerina praebulloides* Blow, p. 180, pl. 8, fig. 47, pl. 9, fig. 48.

Stratigraphic occurrence: Hole 200, Cores 9 and 10, upper part of *Globigerinita stainforthi* Zone, *Praeorbulina glomerosa* Zone.

Stratigraphic and geographic range: The species appears in the upper part of the middle Eocene and evidently disappears in the lowermost part of the upper Miocene (Tortonian Stage). Its distribution is cosmopolitan.

Globigerina juvenilis Bolli
(Plate 8, Figure 6)

1957. *Globigerina juvenilis* Bolli, p. 110, pl. 24, figs. 5-6.

Stratigraphic occurrence: Hole 200, Core 10 (upper part of *Globigerinita stainforthi* Zone, abundant), Cores 9 and 10 (*Praeorbulina glomerosa* Zone, rare).

Stratigraphic and geographic range: The species is abundant in deposits of the lower part of the lower Miocene (*Globorotalia kugleri, Globigerinita stainforthi* zones); in the upper part of the lower Miocene, specimens of *G. juvenilis* are less numerous; in the middle and upper Miocene, it is sporadic. The species has been recorded from the Miocene of many countries of the Caribbean region, Mediterranean and the Atlantic and Pacific oceans.

Globigerina bradyi Wiesner
(Plate 6, Figures 7-8)

1901-1903. *Globigerina bradyi* Wiesner; see Bolli, 1957, p. 110, pl. 23, fig. 5.

Stratigraphic occurrence: Hole 200, Core 10 (upper part of *Globigerinita stainforthi* Zone, abundant), Cores 9 and 10 (*Praeorbulina glomerosa* Zone, very rare).

Stratigraphic and geographic range: *Globigerina bradyi* is peculiar to deposits of the lowermost Miocene (*Globorotalia kugleri, Globigerinita stainforthi* zones); in the upper part of the lower Miocene, the species is represented by sporadic specimens. Globigerinids with a high-conical test are also found in upper Miocene, Pliocene, and Quaternary sediments. Their relationship with lower Miocene *G. bradyi* remains obscure. It is very likely that they belong to different species. *Globigerina bradyi* Wiesner should be used for Quaternary and late Neogene globigerinids, whereas, the high-conical lower Miocene "*G. bradyi*" requires a new specific name.

"*Globigerina bradyi,*" as presently interpreted, has been recognized from the lower Miocene of many regions of the world.

Globigerina binaiensis Koch
(Plate 6, Figures 1-3)

1935. *Globigerina binaiensis* Koch; nom. nov. for *Globigerina aspera* Koch, 1926, p. 746, figs. 22-23.

Stratigraphic occurrence: Hole 200, Core 10 (upper part of *Globigerinita stainforthi* Zone), abundant.

Stratigraphic and geographic range: Specimens of *G. binaiensis* from the lower Miocene of the Caroline Abyssal Plain are similar to illustrations of this species given by Koch (1926) and Blow (1969) of specimens from the lower Miocene of Kalimantan Island. According to Blow (1969), this species with peculiar morphological features is characterized by a narrow stratigraphic range (*Globigerina angulisuturalis* Zone, upper Oligocene to *Globoquadrina dehiscens praedehiscens* Zone, lower Miocene) and is distributed within the Indo-Pacific area only. It appears that the stratigraphic range of *G. binaiensis* is somewhat longer; in the Caroline Abyssal Plain cores, this species was found in sediments of younger age (*Globigerinatella insueta-Globigerinita dissimilis* Zone according to Blow's zonal scheme, or *Globigerinita stainforthi* Zone of Bolli's scheme). It does not occur, however, in the basal layers of the *Praeorbulina glomerosa* Zone (upper part of the Burdigalian Stage). Unfortunately, sediments of an intermediate age (*Globigerinatella insueta-Globigerinoides trilobus* Zone, lower part of the Burdigalian Stage) in Hole 200 are poorly defined and it was not possible to establish the true level of disappearance of *G. binaiensis.*

Globigerina venezuelana Hedberg
(Plate 12, Figures 1-2)

1937. *Globigerina venezuelana* Hedberg, p. 681, pl. 92, fig. 7.

Stratigraphic occurrence: Hole 200, Core 10, upper part of *Globigerinita stainforthi* Zone, rare; Cores 9 and 10 *Praeorbulina glomerosa* Zone, very rare.

Stratigraphic and geographic range: The species appears at the top of the Oligocene (*Globigerina angulisuturalis* Zone), is abundant in sediments of the lowermost Miocene (*Globorotalia kugleri* Zone, *Globigerinita stainforthi* Zone) and occurs rarely in planktonic foraminiferal assemblages of the upper part of the lower Miocene. It is sporadic in the middle and upper Miocene. The data presented by some authors about the presence of *G. venezuelana* in middle-upper Miocene deposits require additional study. The species has a cosmopolitan distribution in the Miocene of the tropical, subtropical, and probably temperate areas.

Globigerina falconensis Blow
(Plate 7, Figures 9-11)

1959. *Globigerina falconensis* Blow, p. 177, pl., fig. 40-41.

Stratigraphic occurrence: Hole 200, Core 10, upper part of *Globigerinita stainforthi* Zone, comparatively rare specimens; Cores 9 and 10 *Praeorbulina glomerosa* Zone, common.

Stratigraphic and geographic range: the species is common in deposits of the upper part of the lower Miocene (Burdigalian Stage), subordinate in the middle Miocene, and probably disappears in the lower part of the upper Miocene (Tortonian Stage). It has a wide geographic distribution.

Globigerina bollii Cita and Premoli Silva
(Plate 6, Figures 4-6)

1960. *Globigerina bollii* Cita and Premoli Silva, p. 119, pl. 13, figs. 1-18, text-fig. 1.

Remarks: Blow (1969) believes that *G. bollii*, 1960, is a junior synonym of *G. falconensis*, 1959. However, the species concerned is characterized by subquadrate test outline, a tight arrangement of chambers, slight increase of chamber size as added, and large test size.

Stratigraphic occurrence: Hole 200, Core 10, upper part of *Globigerinita stainforthi* Zone, very rare specimens.

Stratigraphic and geographic range: In the Mediterranean, the species is common in deposits of the lower part of the Burdigalian Stage (the *Globigerinatella insueta-Globigerinoides trilobus* Zone), is frequently found in its upper half (*Praeorbulina glomerosa* Zone), and becomes sporadic in the middle Miocene (sediments with *Orbulina suturalis*). The geographic range of the species is poorly known, though *G. bollii* has been recorded in the Miocene of the Atlantic and Pacific oceans.

Globigerinoides trilobus (Reuss)
(Plate 15, Figures 6-9)

1850. *Globigerina triloba* Reuss, p. 374, pl. 47, fig. 11.

Stratigraphic occurrences: Hole 200, Cores 1-7, 9, 10, lower Miocene-Quaternary; Hole 202, Core 1, Pliocene.

Stratigraphic and geographic range: The species is highly variable and is characterized by wide stratigraphic and geographic distribution. Rare specimens of *G. trilobus trilobus* can be found in the upper part of the Aquitanian Stage (*Globigerinita dissimilis* and *Globigerinita stainforthi* zones of Bolli's zonal scheme); abundant specimens of *G. trilobus trilobus* occur beginning from the Burdigalian Stage (the *Globigerinatella insueta-Globigerinoides trilobus* Zone of Blow's scheme).

Globigerinoides subquadratus Bronnimann
(Plate 15, Figures 3-5

1954. *Globigerinoides subquadratus* Bronnimann, p. 680, pl. 1, fig. 5.

Stratigraphic occurrence: Hole 200, Cores 9, 10, upper part of *Globigerinita stainforthi* Zone, *Praeorbulina glomerosa* Zone, lower Miocene, common; Cores 6, 7, *Globorotalia continuosa* Zone and *Globorotalia acostaensis-Globorotalia merotumida* Zone, upper Miocene, very rare specimens.

Stratigraphic and geographic range: The species is representative of deposits of the Burdigalian Stage (lower Miocene), being frequently observed in middle Miocene sediments also. In the lower part of the upper Miocene (Tortonian Stage), specimens of *G. subquadratus* are sporadic and somewhat different from typical forms of this species.

Globigerinoides diminutus Bolli
(Plate 13, Figure 9)

1957. *Globigerinoides diminuta* Bolli, p. 114, pl. 25, fig. 11.

Stratigraphic occurrence: Numerous specimens of this very peculiar species were seen in Hole 200, Core 9, *Praeorbulina glomerosa* Zone.

Stratigraphic and geographic range: The species is typical for the Burdigalian Stage (*Globigerinatella insueta* Zone in Bolli's sense). According to Bolli (1957), the species is found mostly in the lower part of this zone. However, in the Caroline Abyssal Plain material, *G. diminutus* is also found in the upper part of the *Globigerinatella insueta* Zone. The species probably disappears in the basal layers of the middle Miocene.

Globigerinoides sicanus De Stefani
(Plate 15, Figures 1-2)

1950. *Globigerinoides sicanus* De Stefani, v. 3, note 4, p. 9.

Stratigraphic occurrence: Hole 200, Cores 9, 10, *Praeorbulina glomerosa* Zone, lower Miocene (abundant) and *Globorotalia peripheroronda* Zone, middle Miocene (sporadic).

Stratigraphic and geographic range: The distribution of *G. sicanus* in the Miocene sediments of Hole 200 reflects the entire stratigraphic range of this species (upper part of the Burdigalian Stage, lower Miocene to basal layers of the middle Miocene). Distribution cosmopolitan.

Globigerinoides mitra Todd
(Plate 14, Figures 1-2)

1956. *Globigerinoides mitra* Todd, p. 302, pl. 78, figs. 3, 6.

Stratigraphic occurrence: Hole 200, Cores 9, 10, *Praeorbulina glomerosa* Zone, numerous specimens.

Stratigraphic and geographic range: The stratigraphic range of *G. mitra* in the area of the Atlantic and Pacific oceans covers almost the whole Miocene. The species is worth thorough study. It may prove heterogenous.

Globoquadrina praedehiscens Blow and Banner
(Plate 17, Figures 1-3)

1962. *Globoquadrina dehiscens praedehiscens* Blow and Banner, pl. 116, pl. 15, figs. Q-S.

Stratigraphic occurrence: Hole 200, Core 10, upper part of *Globigerinita stainforthi* Zone, very rare specimens.

Stratigraphic and geographic range: The species is very characteristic for the deposits of the lower part of the lower Miocene (Aquitanian Stage, *Globorotalia kugleri* Zone to *Globigerinita stainforthi* Zone). The first specimens seem to appear in the top of the upper Oligocene. It has been recorded in the Aquitanian Stage in many countries of the Mediterranean region, the Caribbean region and the areas of the Atlantic and Pacific oceans.

Globoquadrina dehiscens (Chapman, Parr, and Collins)
(Plate 16, Figures 4-6)

1934. *Globorotalia dehiscens* Chapman, Parr, and Collins, p. 569, pl. 11, fig. 36.

Stratigraphic occurrence: Hole 200, Core 10, upper part of *Globigerinita stainforthi* Zone (sporadic specimens); Cores 3-7, 9, 10, *Praeorbulina glomerosa* Zone, lower Miocene through the *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone, lower Pliocene (common in many samples). Hole 200 A, Core 1, and Hole 202, Core 1, lower Pliocene.

Stratigraphic and geographic range: This cosmopolitan species has a wide stratigraphic range; considerable numbers of specimens of *G. dehiscens* are found in deposits of the Burdigalian Stage, lower Miocene through the lower Pliocene. Rare specimens of *G. dehiscens* appear in the upper part of the Aquitanian Stage, lower Miocene.

Globoquadrina altispira (Cushman and Jarvis)
(Plate 15, Figures 10-12)

1936. *Globigerina altispira* Cushman and Jarvis, p. 5, pl. 1, figs. 13, 14.

Stratigraphic occurrence: In Holes 200, 200A, and 202, *G. altispira* has the same stratigraphic range as *G. dehiscens.*

Stratigraphic and geographic range: Sporadic specimens of *G. altispira* are known from deposits of the Aquitanian Stage (the *Globorotalia kugleri* to *Globigerinita stainforthi* zones). Great numbers of specimens appear beginning from the base of the *Globigerinatella insueta* Zone of Bolli's zonal scheme (Burdigalian Stage); it disappears in the middle part of the Pliocene, at the lower boundary of the *Globorotalia tosaensis* Zone (upper Pliocene). The distribution is cosmopolitan.

Globoquadrina larmeui obesa Akers
(Plate 16, Figures 10-12)

1955. *Globoquadrina obesa* Akers, p. 661, pl. 65, fig. 5.

Stratigraphic occurrence: Hole 200, Core 9, *Praeorbulina glomerosa* Zone, rare specimens.

Stratigraphic and geographic range: According to Blow (1969), the stratigraphic range of *G. larmeui obesa* covers the *Praeorbulina glomerosa* Zone (Burdigalian Stage, early Miocene) through the *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone (early Pliocene).

Globoquadrina baroemoenensis (LeRoy)
(Plate 16, Figures 1-3)

1939. *Globigerina baroemoenensis* LeRoy, p. 263, pl. 6, figs. 1-2.

Stratigraphic occurrence: Hole 200, Core 10, upper part of *Globigerinita stainforthi* Zone, numerous specimens; Cores 9 and 10, *Praeorbulina glomerosa* Zone, lower Miocene, and *Globorotalia peripheroronda-Orbulina Suturalis* Zone, middle Miocene, very rare specimens.

Stratigraphic and geographic range: The species is poorly known in the micropaleontological literature. It was originally described from the Miocene of Indonesia, and observed in some countries of the Caribbean area. According to Blow (1969), the species is characterized by a long stratigraphic range: from the *Globorotalia opima* Zone (middle part of the Oligocene) up to the *Globorotalia acostaensis-Globorotalia merotumida* Zone (Tortonian Stage, upper Miocene).

Globoquadrina langhiana Cita and Gelati
(Plate 16, Figures 7-9)

1960. *Globoquadrina langhiana* Cita and Gelati, p. 241, pl. 29, fig. 1-20.

Stratigraphic occurrence: Hole 200, Cores 9 and 10, *Praeorbulina glomerosa* Zone, lower Miocene, common; *Globorotalia peripheroronda-Orbulina suturalis* Zone, middle Miocene, very rare.

Stratigraphic and geographic range: *Globoquadrina langhiana* is developed in the deposits of the upper part of the lower Miocene (Burdigalian Stage) and middle Miocene. The species was originally described from the deposits of the Langhian Stage of Italy. Its occurrence in the Clifdenian and Lillburnian stages of New Zealand (Jenkins, 1971) testifies to a wide geographical distribution of *G. langhiana.*

Blow (1969) considers that *G. langhiana* is a synonym (or subspecies) of *G. baroemoenensis* (LeRoy). However, the former is characterized by an oval test outline in equatorial profile (in *G. baroemoenensis* the test is approximately subquadrate), more globular chambers, the rounded shape of the apertural face, and a weakly developed umbilical tooth. Therefore, *G. langhiana* is here regarded as a separate species.

Cassigerinella chipolensis (Cushman and Ponton)
(Plate 4, Figures 7-9)

1932. *Cassidulina chipolensis* Cushman and Ponton, p. 98, pl. 15, fig. 2.

Stratigraphic occurrence: Hole 200, Cores 9 and 10, upper part of *Globigerinita stainforthi* Zone and *Praeorbulina glomerosa* Zone, sporadic specimens.

Stratigraphic and geographic range: Very common in sediments from the base of the Oligocene up to the top of the lower Miocene. In the middle Miocene, this species is represented by very rare specimens. Cosmopolitan distribution.

Globigerinita stainforthi (Bolli, Loeblich, and Tappan)
(Plate 12, Figures 10-11)

1957. *Catapsydrax stainforthi* Bolli, Loeblich, and Tappan, p. 37, pl. 7, fig. 11.

Stratigraphic occurrence: Sporadic specimens of this species were found in Hole 200, Core 10, in the upper part of the *Globigerinita stainforthi* Zone. Phylogenetically, these appear to be the latest specimens of *G. stainforthi*, differing somewhat in morphology from typical specimens of this species.

Stratigraphic and geographic range: The species appears in deposits of the *Globorotalia kugleri* Zone, but it is very rare; common in the *Globigerinita dissimilis* and *Globigerinita stainforthi* zones of Bolli's scale; disappears at the base of the *Globigerinatella insueta* Zone. Wide geographic distribution.

Globigerinita incrusta Akers
(Plate 12, Figures 7-8)

1955. *Globigerinita incrusta* Akers, p. 655, pl. 65, fig. 2A-D.

Stratigraphic occurrence: Hole 200, Cores 3-7, 9, 10, upper part of *Globigerinita stainforthi* Zone, *Praeorbulina glomerosa* Zone (lower Miocene)-*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone (lower Pliocene), sporadic specimens.

Stratigraphic and geographic range: This peculiar species has a very long stratigraphic range which includes the whole of the Miocene, Pliocene, and evidently the Quaternary.

Globigerinatella insueta Cushman and Stainforthi
(Plate 12, Figure 3)

1945. *Globigerinatella insueta* Cushman and Stainforth, p. 68.

Stratigraphic occurrence: Hole 200, Core 9, *Praeorbulina glomerosa* Zone, rare specimens.

Stratigraphic and geographic range: The species appears in the *Globigerinita stainforthi* Zone, but it is most common in deposits of the *Globigerinatella insueta* Zone of Bolli's zonal scheme (Burdigalian Stage). The species is characterized by a wide geographic distribution, but, as a rule, it is found in small numbers of specimens.

Praeorbulina transitoria (Blow)
(Plate 32, Figures 3-4)

1956. *Globigerinoides transitoria* Blow, p. 65, text-fig. 2, Nos. 12-15.

Stratigraphic occurrence: Hole 200, Cores 9, 10, *Praeorbulina glomerosa* Zone, common; Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone, middle Miocene, rare.

Stratigraphic and geographic range: The species is characterized by a short stratigraphic range. The first sporadic specimens of *P. transitoria* appear in the lower part of the *Praeorbulina glomerosa* Zone; it is found in considerable numbers of specimens somewhat higher in the zone. It disappears in the lowermost part of the *Globorotalia peripheroronda-Orbulina suturalis* Zone (middle Miocene). Cosmopolitan distribution.

Praeorbulina glomerosa (Blow)
(Plate 32, Figures 1-2)

1956. *Globigerinoides glomerosa* Blow, p. 64, text-fig. 1, No. 9-19, text-fig. 2, Nos. 1-4.

Stratigraphic occurrence: Hole 200, Cores 9, 10, *Praeorbulina glomerosa* Zone, comparatively common; Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone (middle Miocene); rare specimens.

Stratigraphic and geographic range: The range of this species is almost the same as that of *P. transitoria.* However, *P. glomerosa* (including all its varieties–*curva, glomerosa, circularis*) appears somewhat later (middle part of the *Praeorbulina glomerosa* Zone, lower Miocene) and disappears a little later (middle part of the *Globorotalia peripheroronda-Orbulina suturalis* Zone, middle Miocene). Cosmopolitan distribution.

Globorotalia obesa Bolli

1957. *Globorotalia obesa* Bolli, p. 119, pl. 29, figs. 2-3.

Stratigraphic occurrence: Hole 200, Cores 9 and 10, upper part of *Globigerinita stainforthi, Praeorbulina glomerosa* (lower Miocene) and *Globorotalia peripheroronda-Orbulina suturalis* (middle Miocene) zones, common; Cores 6, 7, *Globorotalia acostaensis-Globorotalia merotumida* Zone (Tortonian Stage, upper Miocene), rare specimens.

Stratigraphic and geographic range: This cosmopolitan species has a very long stratigraphic range. Rare specimens are known from deposits of the Aquitanian Stage; rather common in the Burdigalian Stage and middle Miocene; relatively scarce in upper Miocene and Pliocene deposits.

Globorotalia siakensis LeRoy
(Plate 28, Figures 4-6)

1939. *Globorotalia siakensis* LeRoy, p. 39, pl. 3, figs. 30, 31.

Stratigraphic occurrence: Hole 200, Cores 9 and 10, upper part of *Globigerinita stainforthi* and *Praeorbulina glomerosa* zones (lower Miocene), *Globorotalia peripheroronda-Orbulina suturalis* Zone (middle Miocene), common.

Stratigraphic and geographic range: This species appears in the upper Oligocene; rather common in sediments of the lower Miocene and the lower part of the middle Miocene; in the top of the middle Miocene it occupies a subordinate position.

Globorotalia continuosa Blow
(Plate 19, Figures 10-12)

1959. *Globorotalia continuosa* Blow, p. 218, pl. 19, fig. 125.

Stratigraphic occurrence: Hole 200, Core 9, *Praeorbulina glomerosa* Zone (lower Miocene) and *Globorotalia peripheroronda-Orbulina suturalis* Zone (middle Miocene), common; Core 7, *Globorotalia acostaensis-Globorotalia merotumida* Zone (upper Miocene), rare specimens.

Stratigraphic and geographic range: The species is representative of the Burdigalian Stage (lower Miocene), middle Miocene and the lower part of the upper Miocene (Tortonian Stage).

Globorotalia peripheroronda Blow and Banner
(Plate 26, Figures 7-9)

1966. *Globorotalia peripheroronda* Blow and Banner, p. 294, pl. I, fig. 1, pl. 2, figs. 1-3.

Stratigraphic occurrence: Hole 200, Core 9, *Praeorbulina glomerosa* Zone, lower Miocene and *Globorotalia peripheroronda-Orbulina suturalis* Zone, middle Miocene, common or relatively rare.

Stratigraphic and geographic range: Rare specimens of *G. peripheroronda* appear in the top of the Aquitanian Stage (*Globigerinita stainforthi* Zone); the species is common in deposits of the Burdigalian Stage (lower Miocene) and basal layers of the middle Miocene (*Globorotalia peripheroronda-Orbulina suturalis* Zone); it disappears in the middle part of the middle Miocene. The species has been recorded from the lower-middle Miocene of many countries.

Globorotalia archeomenardii Bolli
(Plate 18, Figures 7-9)

1957. *Globorotalia archeomenardii* Bolli, p. 119, pl. 28, fig. 11.

Stratigraphic occurrence: Hole 200, Core 9, *Praeorbulina glomerosa* Zone, rare specimens.

Stratigraphic and geographic range: The species has been observed in a relatively limited number of regions of the tropical and subtropical areas. According to Bolli (1957), *G. archeomenardii* is characteristic of the upper part of the *Globigerinatella insueta* Zone (lower Miocene) and the lower part of the middle Miocene (up to the lower part of the *Globorotalia fohsi fohsi* Zone).

Middle Miocene

As shown above, the middle Miocene deposits penetrated by Hole 200 can be attributed to the lowermost part of the middle Miocene (the *Globorotalia peripheroronda-Orbulina suturalis* Zone). Predominant in the fauna are species *Globoquadrina, Globigerina,* and *Globorotalia.* The constant presence of *Orbulina suturalis* Bronn., *Globorotalia praemenardii* Cushm. and Stainf., and *G. (Clavatorella) bermudezi* (Bolli) confirm that these sediments belong to the lowermost part of the middle Miocene.

Orbulina suturalis Bronnimann
(Plate 31, Figure 10)

1951. *Orbulina suturalis* Bronnimann, p. 135, text-fig. 2, No. 1-2, 5-8, 10; text-fig. 3, Nos. 3-8, 11, 13-16, 18, 20-22; text-fig. 4, Nos. 2-4, 7-12, 15-16, 19-22.

Stratigraphic occurrence: Hole 200, Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone, common.

Stratigraphic and geographic range: The species is very widely distributed in the Miocene of the tropical, subtropical, and temperate areas (it is also known under the name of *Candorbulina universa* Jedl.). *Orbulina suturalis* appears in the top of the *Praeorbulina glomerosa* Zone (lower Miocene, base of *Orbulina suturalis* Zone) abundant in middle Miocene sediments, and rare in the upper Miocene.

Globorotalia praemenardii Cushman and Stainforth

1945. *Globorotalia praemenardii* Cushman and Stainforth, p. 70, pl. 13, fig. 14.

Stratigraphic occurrence: Hole 200, Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone, rare specimens.

Stratigraphic and geographic range: A common species of the middle Miocene (predominantly the lower half) of tropical and subtropical areas.

Globorotalia (Clavatorella) bermudezi (Bolli)
(Plate 18, Figures 10-12)

1957. *Hastigerinella bermudezi* Bolli, p. 112, pl. 25, Fig. 1.

Stratigraphic occurrence: Hole 200, Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone, comparatively rare specimens.

Stratigraphic and geographic range: The species is characterized by a short stratigraphic range–the lowermost part of the middle Miocene (*Globorotalia peripheroronda-Orbulina suturalis* Zone). It occurs predominantly in tropical areas.

Globorotalia peripheroacuta Blow and Banner

1966. *Globorotalia peripheroacuta* Blow and Banner, p. 294, pl. 1, fig. 2, pl. 2, figs. 4-5, 13.

Stratigraphic occurrence: Hole 200, Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone, rare specimens. It is likely that the presence of *G. peripheroacuta* in sediments of this zone is related to downhole contamination.

Stratigraphic and geographic range: The middle part of the middle Miocene (*Globorotalia peripheroacuta* Zone, *Globorotalia fohsi* Zone of Bolli's zonal scheme), common from the middle Miocene of tropical and subtropical areas.

Late Miocene

Biorbulina bilobata (d'Orbigny)
(Plate 4, Figure 4)

1846. *Globigerina bilobata* d'Orbigny, p. 164, pl. 9, figs. 11-14.

Stratigraphic occurrence: Hole 200, Cores 1-7, upper Miocene, Pliocene, Quarternary; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene; rare and sporadic specimens.

Stratigraphic and geographic range: This cosmopolitan species is frequently observed in the middle Miocene; in sediments of the upper Miocene, Pliocene, and Quaternary, the number of specimens decreases.

Orbulina universa d'Orbigny
(Plate 31, Figure 11)

1839. *Orbulina universa* d'Orbigny, p. 2, pl. 1, fig. 1 (*in* Ellis and Messina).

Stratigraphic occurrence: Hole 200, Cores 1-7, upper Miocene, Pliocene, Quaternary; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene; common, sometimes abundant.

Stratigraphic and geographic range: Infrequent numbers of *O. universa* appear in the upper part of the middle Miocene; abundant beginning from the base of the Tortonian Stage (upper Miocene). Cosmopolitan distribution.

Hastigerina siphonifera (d'Orbigny)
(Plate 31, Figures 7-9)

1839. *Globigerina siphonifera* d'Orbigny, p. 83, pl. 4, figs. 15-18 (*in* Ellis and Messina).

Stratigraphic occurrence: Hole 200, Cores 1-7, upper Miocene, Pliocene, Quaternary; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene; relatively rare or sporadic specimens.

Stratigraphic and geographic range: Sporadic specimens of this species are known from the top of the lower Miocene. However, only beginning with the base of the middle Miocene (the *Globorotalia peripheroronda-Orbulina suturalis* Zone) does *Hastigerina siphonifera* become a constant component of planktonic foraminiferal assemblages. It is observed in middle Miocene through Quaternary deposits.

Sphaeroidinellopsis seminulina (Schwager)
(Plate 34, Figures 6-7)

1866. *Globigerina seminulina* Schwager (neotype, 1960, Banner and Blow, p. 24, pl. 7, fig. 7).

Stratigraphic occurrence: Hole 200, Core 9, *Globorotalia peripheroronda-Orbulina suturalis* Zone, middle Miocene, rare; Cores 3-7, upper Miocene, lower Pliocene, common; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), common.

Stratigraphic and geographic range: Sporadic specimens of *Sph. seminulina* appear at the top of the lower Miocene; it can be frequently observed in deposits of the middle and upper Miocene and lower Pliocene. It has a wide geographical distribution, and is most common from sediments of tropical and subtropical areas.

Sphaeroidinellopsis subdehiscens (Blow)
(Plate 34, Figures 8-9)

1959. *Sphaerodinella dehiscens subdehiscens* Blow, p. 195, pl. 12, fig. 71.

Stratigraphic occurrence: Hole 200, Cores 3-7, *Globorotalia acostaensis-Globorotalia merotumida* Zone (upper Miocene), *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone (lower Pliocene), common; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common.

Stratigraphic and geographic range: The species appears in the upper part of the middle Miocene (*Sphaeroidinellopsis subdehiscens-Globigerina druryi* Zone of Blow's zonal scheme). Common in sediments of the upper Miocene and lower Pliocene of tropical and subtropical areas (disappears at the top of the *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone).

Candeina nitida praenitida Blow
(Plate 4, Figure 6)

1969. *Candeina nitida praenitida* Blow, p. 385, pl. 22, figs. 5-8.

Stratigraphic occurrence: Hole 200, Cores 5, 6 and 7, *Globorotalia acostaensis-Globorotalia merotumida* Zone and *Globorotalia tumida plesiotumida* Zone, upper Miocene, rare specimens.

Stratigraphic and geographic range: According to Blow (1969), *C. nitida praenitida* is distinguished from *C. nitida nitida* "in possessing intercameral sutural apertures confined to the last two chambers only of the final whorl" and is characterized by a short stratigraphic range–the same two zones of the upper Miocene as in the Miocene of the Caroline Abyssal Plain.

Pulleniatina primalis Banner and Blow
(Plate 32, Figures 8-10)

1967. *Pulleniatina primalis* Banner and Blow, p. 142, pl. 1, figs. 3-8, pl. 3, fig. 2.

Stratigraphic occurrence: Hole 200, Cores 4 and 5, *Globorotalia tumida plesiotumida* and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zones (upper Miocene, Messinian Stage), sporadic specimens, but sometimes common.

Stratigraphic and geographic range: The species appears in the upper Miocene (*Globorotalia tumida plesiotumida* Zone) and disappears in the lower Pliocene (likely in the top of the *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone). It is frequently observed in deposits of the upper Miocene (Messinian Stage) and lower Pliocene of tropical and subtropical areas.

Globigerinita naparimaensis Bronnimann
(Plate 12, Figure 9)

1951. *Globigerinita naparimaensis* Bronnimann, p. 18.

Stratigraphic occurrence: Hole 200, Cores 6 and 7, *Globorotalia acostaensis-Globorotalia merotumida* Zone (Tortonian Stage, upper Miocene), sporadic specimens.

Stratigraphic and geographic range: Relatively rare in deposits of the upper part of the middle Miocene and the lower part of the upper Miocene (Tortonian Stage) of tropical and subtropical areas.

Globigerinita glutinata (Egger)
(Plate 12, Figure 6)

1895. *Globigerina glutinata* Egger, p. 371, pl. 13, figs. 19-21 (in Ellis and Messina).

Stratigraphic occurrence: Hole 200, Cores 1-7, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone), Quaternary; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene; rare specimens, sometimes common.

Stratigraphic and geographic range: This species seems to appear in the middle Miocene; common in upper Miocene through Quaternary deposits of tropical, subtropical and temperate areas.

Globorotaloides variabilis Bolli

1957. *Globorotaloides variabilis* Bolli, p. 117, pl. 27, figs. 15-20.

Stratigraphic occurrence: Hole 200, Cores 6 and 7, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone), comparatively rare specimens.

Stratigraphic and geographic range: The species is found in deposits of the middle Miocene and the lower part of the upper Miocene (Tortonian Stage) of tropical and subtropical areas.

Globigerina nepenthes Todd
(Plate 9, Figures 4-6)

1957. *Globigerina nepenthes* Todd, p. 301, pl. 78, fig. 7.

Stratigraphic occurrence: Hole 200, Cores 3-7, upper Miocene (Tortonian Stage, *Globorotalia acostaensis-Globorotalia merotumida* Zone), lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone); Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene; abundant or common.

Stratigraphic and geographic range: This biostratigraphically important species appears in the uppermost part of the middle Miocene; widely developed in sediments of the upper Miocene (Tortonian and Messian stages) and lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone). Wide geographical distribution.

Globigerina bulloides d'Orbigny

1826. *Globigerina bulloides* d'Orbigny, p. 277 (*in* Ellis and Messina).

Stratigraphic occurrence: Hole 200, Cores 1-7, upper Miocene (Tortonian Stage, *Globorotalia acostaensis-Globorotalia merotumida* Zone), Quaternary; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene; very common.

Stratigraphic and geographic range: This widespread species (from tropical to boreal regions) is frequently observed in sediments of the upper Miocene, Pliocene, and Quaternary.

Globigerina bulbosa LeRoy
(Plate 6, Figures 9-11)

1944. *Globigerina bulbosa* LeRoy, p. 39, pl. 3, figs. 26-27.

Stratigraphic occurrence: Hole 200, Cores 6 and 7, upper Miocene (Tortonian Stage, *Globorotalia acostaensis-Globorotalia merotumida* Zone), comparatively rare.

Stratigraphic and geographic range: *G. bulbosa* appears in the upper part of the middle Miocene, but is most characteristic of the lower part of the upper Miocene (Tortonian Stage). The last specimens of *G. bulbosa* seem to disappear in the Messinian Stage; wide geographic range.

Globigerina parabulloides Blow
(Plate 9, Figures 7-9)

1959. *Globigerina parabulloides* Blow, p. 179, pl. 10, fig. 46.

Stratigraphic occurrence: Hole 200, Cores 3, 4, 5, 6, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone), lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone); Hole 202, Core 1, lower Pliocene; sporadic specimens.

Stratigraphic and geographic range: The species appears in deposits of the upper part of the middle Miocene (*Sphaeroidinellopsis subdehiscens-Globigerina druryi* Zone of Blow); common in the upper Miocene, Pliocene, and Quaternary deposits of tropical, subtropical, and temperate regions.

Globigerina decoraperta Takayanagi and Saito
(Plate 7, Figures 1-2)

1962. *Globigerina druryi decoraperta* Takayanagi and Saito, p. 85, pl. 28, fig. 10.

Stratigraphic occurrence: Hole 200, Cores 4, 5, 6, upper Miocene (from the *Globorotalia acostaensis-Globorotalia merotumida* Zone up to the *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), comparatively rare specimens.

Stratigraphic and geographic range: *G. decoraperta* has been recorded in sediments of the uppermost part of the middle Miocene (the *Globigerina nepenthes-Globorotalia siakensis* Zone of Blow), but is most characteristic of the upper Miocene. The species is also found in the Pliocene.

Globigerina eamesi Blow
(Plate 7, Figures 3-5)

1959. *Globigerina eamesi* Blow, p. 176, pl. 9, fig. 39.

Stratigraphic occurrence: Hole 200, Cores 5, 6, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* and *Globorotalia tumida plesiotumida* zones), sporadic specimens.

Stratigraphic and geographic range: According to Blow (1969), the stratigraphic interval of *G. eamesi* covers the latest part of the middle Miocene (*Globigerina nepenthes-Globorotalia siakensis* zone) and the whole upper Miocene.

Globigerina microstoma Cita, Premoli Silva and Rossi
(Plate 8, Figures 7-8)

1965. *Globigerina microstoma* Cita, Premoli Silva and Rossi, p. 250, pl. 25, figs. 1-2, pl. 31, fig. 1.

Stratigraphic occurrence: Hole 200, Cores 5 and 6, upper Miocene (Tortonian and Messinian stages, *Globorotalia acostaensis-Globorotalia merotumida* and *Globorotalia tumida plesiotumida* zones), sporadic specimens.

Stratigraphic and geographic range: Upper Miocene of tropical and subtropical areas.

Globigerinoides adriatica (Fornasini)
(Plate 13, Figures 1-2)

1899. *Globigerina adriatica* Fornasini, p. 10, pl. 3, figs. 6, 7 (*in* Ellis and Messina).

Stratigraphic occurrence: Hole 200, Cores 5 and 6, upper Miocene (Tortonian and Messinian stages, *Globorotalia acostaensis-Globorotalia merotumida* and *Globorotalia tumida plesiotumida* zones), sporadic specimens.

Stratigraphic and geographic range: As the species was originally described from Quaternary deposits of the Mediterranean, the stratigraphic interval of *G. adriatica* includes the upper Miocene, Pliocene, and Quaternary.

Globigerinoides parkerae Bermudez

1961. *Globigerinoides parkerae* Bermudez, p. 232, pl. 10, figs. 10, 11.

Stratigraphic occurrence: Hole 200, Cores 4, 5, 6, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida, Globorotalia tumida plesiotumida*, and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* zones), relatively rare specimens; Hole 200A, Core 1, lower Pliocene, rare specimens.

Stratigraphic and geographic range: *G. parkerae* evidently appears at the very top of the middle Miocene, common in sediments of the upper Miocene and Pliocene of tropical and subtropical areas.

Globigerinoides obliquus obliquus Bolli
(Plate 14, Figures 5-6)

1957. *Globigerinoides obliqua* Bolli, p. 113, pl. 25, figs. 9-10.

Stratigraphic occurrence: Hole 200, Cores 3-7, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida, Globorotalia tumida plesiotumida, Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* zones) and lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), common; Hole 202, Core 1, lower Pliocene, comparatively rare specimens.

Stratigraphic and geographic range: *G. obliquus obliquus* has a very long stratigraphic range (lower Miocene through Quaternary). This subspecies is rather abundant in the upper part of the middle Miocene and most characteristic of the upper Miocene and the lower half of the Pliocene. Wide geographic distribution.

Globigerinoides obliquus extremus Bolli and Bermudez
(Plate 14, Figures 3-4)

1965. *Globigerinoides obliquus extremus* Bolli and Bermudez, p. 159, pl. 1, figs. 10-12.

Stratigraphic occurrence: Hole 200, Cores 3, 4, 5, 6, the same stratigraphic distribution as *G. obliquus obliquus* (upper Miocene-lower Pliocene). However, in the *Globorotalia acostaensis-Globorotalia merotumida* Zone this subspecies is uncommon, becoming common in the *Globorotalia tumida plesiotumida* Zone (Messinian Stage).

Stratigraphic and geographic range: upper Miocene-Pliocene.

Globigerinoides bollii Blow
(Plate 13, Figures 3-4)

1959. *Globigerinoides bollii* Blow, p. 189, pl. 10, fig. 65.

Stratigraphic occurrence: Hole 200, Cores 3-7, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida, Globorotalia tumida plesiotumida,* and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zones) and lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* zone); common, sometimes rare; Hole 202, Core 1, lower Pliocene, rare specimens.

Stratigraphic and geographic range: *G. bollii* appears in the upper part of the middle Miocene; most frequently, however, it is observed in the upper Miocene and lower Pliocene. It probably disappears in the upper part of the Pliocene.

Globigerinoides conglobatus canimarensis Bermudez
(Plate 13, Figures 7-8)

1961. *Globigerinoides canimarensis* Bermudez, p. 225, pl. 10, fig. 5.

Stratigraphic occurrence: Hole 200, Cores 5 and 6, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* and *Globorotalia tumida plesiotumida* zones), rare specimens.

Stratigraphic and geographic range: Upper Miocene of tropical regions.

Globorotalia merotumida Blow and Banner
(Plate 25, Figures 1-3)

1965. *Globorotalia merotumida* Blow and Banner, *in* Banner and Blow, 1965, p. 1352, fig. 1.

Stratigraphic occurrence: Hole 200, Core 7, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone), rare specimens; Core 6, upper Micoene (the same zone), common; Core 5, upper Miocene (*Globorotalia tumida plesiotumida* Zone), rare specimens.

Stratigraphic and geographic range: Upper Miocene (within the *Globorotalia acostaensis-Globorotalia merotumida* Zone and the *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone).

Globorotalia paralenguaensis Blow

1969. *Globorotalia paralenguaensis* Blow, p. 402, pl. 46, figs. 1-6.

Stratigraphic occurrence: Hole 200, Core 6, upper Miocene, *Globorotalia acostaensis-Globorotalia merotumida* Zone, rare specimens.

Stratigraphic and geographic range: According to Blow (1969), who described this species from the upper Miocene of Papua, *G. paralenguaensis* is characterized by a short stratigraphic range: the upper part of the *Globorotalia continuosa* Zone through the lower part of the *Globorotalia acostaensis-Globorotalia merotumida* Zone.

Globorotalia pseudopachyderma Cita, Premoli Silva, and Rossi
(Plate 27, Figures 4-6)

1965. *Globorotalia pseudopachyderma* Cita, Premoli Silva, and Rossi, p. 233, pl. 20, figs. 3, 4, 6; pl. 31, fig. 6; text-fig. 5.

Stratigraphic occurrence: Hole 200, Core 6, upper Miocene, *Globorotalia acostaensis-Globorotalia merotumida* Zone, rare specimens.

Stratigraphic and geographical range: This species has been found in the upper Miocene (Tortonian and Messinian stages) of the Mediterranean, and in the Atlantic and Pacific oceans.

Globorotalia acostaensis Blow
(Plate 17, Figures 4-6)

1959. *Globorotalia acostaensis* Blow, p. 208, pl. 17, figs. 106-107.

Stratigraphic occurrence: Hole 200, Cores 6 and 7, upper Miocene, *Globorotalia acostaensis-Globorotalia merotumida* Zone, rare specimens; Cores 3-5, upper Miocene (*Globorotalia tumida plesiotumida* Zone) through lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), very rare specimens. Hole 202, Core 1, Pliocene, very rare specimens.

Stratigraphic and geographic range: The species has a rather long stratigraphic range–upper Miocene and Pliocene. However, *G. acostaensis* is most frequently observed in upper Miocene deposits (*Globorotalia acostaensis-Globorotalia merotumida* and *Globorotalia tumida plesiotumida* zones). Cosmopolitan species.

Globorotalia menardii (d'Orbigny)
(Plate 24, Figures 11-13)

1826. *Rotalia menardii* d'Orbigny, p. 273, mod. N 10 (*in* Ellis and Messina).

Stratigraphic occurrence: Hole 200, Cores 1-7, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone) through Quaternary; frequent or common in the upper Miocene, common or rare in Pliocene and Quaternary sediments. Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common.

Stratigraphic and geographic range: The species is common in deposits of the uppermost part of the middle Miocene (?), upper Miocene, Pliocene and Quaternary of tropical and subtropical areas.

Globorotalia cultrata (d'Orbigny)
(Plate 20, Figures 4-6)

1839. *Rotalina cultrata* d'Orbigny, p. 76, pl. 5, figs. 7-9 (*in* Ellis and Messina).

Stratigraphic occurrence: The same as *Globorotalia menardii.* Hole 200, Core 7-1, upper Miocene through Quaternary; Hole 200A, Core 1, lower Pliocene; Hole 202, Core 1, Pliocene.

Stratigraphic and geographic range: The same as *Globorotalia menardii.* Upper Miocene through Quaternary of tropical and subtropical regions.

Globorotalia tumida plesiotumida Blow and Banner
(Plate 00, Figures 10-12)

1965. *Globorotalia tumida plesiotumida* Blow and Banner, *in* Banner and Blow, 1965, p. 1353, fig. 2.

Stratigraphic occurrence: Hole 200, Core 5, upper Miocene, *Globorotalia tumida plesiotumida* Zone, abundant or common; Core 4, upper Miocene, *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone, sporadic specimens.

Stratigraphic and geographic range: The stratigraphic interval of the species in Hole 200 corresponds to its whole interval (upper Miocene, Messinian Stage). *Globorotalia tumida plesiotumida* is common in Messinian deposits of tropical and subtropical areas.

Globorotalia multicamerata Cushman and Jarvis
(Plate 25, Figures 7-9)

1930. *Globorotalia multicamerata* Cushman and Jarvis, p. 367, pl. 34, fig. 8.

Stratigraphic occurrence: Hole 200, Cores 4 and 5, upper Miocene (*Globorotalia tumida plesiotumida* Zone and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), common; Core 3, lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), common; Core 2, upper Pliocene (basal layers of the *Globorotalia tosaensis* Zone), rare specimens. Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common or rare specimens.

Stratigraphic and geographic range: The stratigraphic interval of the species covers the upper Miocene (*Globorotalia tumida plesiotumida* Zone) and the middle part of the Pliocene (*Globorotalia multicamerata-Pulleniatina obliquiloculata* Zone). The last scarce specimens of *G. multicamerata* are observed at the base of the upper Pliocene.

Globorotalia miocenica Palmer
(Plate 25, Figures 4-6)

1945. *Globorotalia menardii miocenica* Palmer, p. 70, pl. 1, fig. 10.

Stratigraphic occurrence: Hole 200, Cores 4 and 5, upper Miocene (*Globorotalia tumida plesiotumida* Zone and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), common, sometimes rare.

Stratigraphic and geographic range: Reports of Tortonian specimens of *G. miocenica* are likely to be erroneous. The species is representative of the Messinian Stage of the upper Miocene and the lower part of the Pliocene. *G. miocenica* disappears at the lower boundary of the upper Pliocene (*Globorotalia tosaensis* Zone). Common in the upper Miocene-lower Pliocene of tropical and subtropical areas.

Globorotalia margaritae Bolli and Bermudez
(Plate 24, Figures 1-4)

1965. *Globorotalia margaritae* Bolli and Bermudez, p. 139, pl. 1, figs. 16-18.

Stratigraphic occurrence: Hole 200, Core 6, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone), sporadic specimens (their presence may be related to downhole contamination); Cores 4 and 5, upper Miocene (*Globorotalia tumida plesiotumida* Zone and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), common, sometimes rare; Core 3, lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), common. Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common or rare.

Stratigraphic and geographic range: Questionable specimens of *G. margaritae* have been recognized in deposits of the *Globorotalia acostaensis-Globorotalia merotumida* Zone (upper Miocene, Tortonian Stage). The species is representative of sediments of the upper part of the *Globorotalia tumida plesiotumida* Zone (upper Miocene, Messinian Stage) and the *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone (lower Pliocene). It has been recorded in countries of the Caribbean area, the Mediterranean, and the Atlantic and Pacific oceans.

Pliocene-Quaternary

Pulleniatina obliquiloculata (Parker and Jones)
(Plate 32, Figures 5-7)

1862. *Pullenia obliquiloculata* Parker and Jones (*in* Banner and Blow, 1967, p. 137, pl. 3, fig. 4, pl. 4, fig. 9).

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, frequent or common; Hole 200A, Core 1 and Hole 202, Core 1, Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), common.

Stratigraphic and geographic range: Cosmopolitan species in Pliocene and Quaternary deposits.

Pulleniatina aff. spectabilis Parker
(Plate 33, Figures 1-3)

Stratigraphic occurrence: Numerous specimens of this species, similar to *P. spectabilis* Parker in their morphology (1965, p. 151, text-figs. 1-4), were found in the lower Pliocene (*Sphaeroidinella dehiscens-Globorotalia altispira* Zone) of Hole 200, Core 3.

Sphaeroidinella dehiscens (Parker and Jones)
(Plate 34, Figures 1-2)

1865. *Sphaeroidina dehiscens* Parker and Jones (*in* Banner and Blow, 1960, p. 35, pl. 7, fig. 3).

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, frequent; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene (*Sphaeroidinella dehiscens-Globoquadrina altispira* Zone), common.

Stratigraphic and geographic range: Cosmopolitan species in Pliocene and Quaternary deposits.

Candeina nitida d'Orbigny

1839. *Candeina nitida* d'Orbigny, p. 107 (*in* Bolli, Loeblich and Tappan, p. 35, pl. 6, figs. 10-11).

Stratigraphic occurrence: Hole 200, Core 6, upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone), sporadic specimens (downhole contamination is not excluded); Cores 4 and 5, upper Miocene (*Globorotalia tumida plesiotumida* Zone and the *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), rare specimens; Cores 1-3, Pliocene-Quaternary, common or rare specimens. Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common or rare specimens.

Stratigraphic and geographic range: This species appears in the upper Miocene (*Globorotalia tumida plesiotumida* Zone), but it is most characteristic of Pliocene and Quaternary deposits of the tropical and subtropical areas.

Globigerinoides conglobatus (Brady)
(Plate 13, Figures 5-6)

1884. *Globigerina conglobata* Brady, p. 603, pl. 80, figs. 1-5, pl. 82, fig. 5.

Stratigraphic occurrence: Hole 200, Cores 1-3, lower Pliocene-Quaternary, frequent or common; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, frequent or common.

Stratigraphic and geographic range: This cosmopolitan species can frequently be observed in Pliocene and Quaternary deposits. According to Blow (1969), *G. conglobatus* appears in the upper Miocene (*Globorotalia tumida plesiotumida* Zone).

Globigerinoides sacculifer (Brady)
(Plate 14, Figures 10-12)

1884. *Globigerina sacculifera* Brady, p. 604, pl. 80, figs. 11-17, pl. 82, fig. 4.

Stratigraphic occurrence: Hole 200, Cores 1-3, lower Pliocene-Quaternary, common; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common.

Stratigraphic and geographic range: This cosmopolitan species is characteristic of Pliocene and Quaternary deposits. However, it has a highly variable morphology; there are different opinions concerning the scope of *G. sacculifer* and, hence, its stratigraphic range. Thus, as Blow believes (1969), the stratigraphic interval of *G. sacculifer* includes the lower Miocene (*Globigerinita stainforthi* Zone) through Quaternary.

Globigerinoides fistulosus (Schubert)
(Plate 13, Figures 10-12)

1910. *Globigerina fistulosa* Schubert, p. 323, pl. 2, fig. 13.

Stratigraphic occurrence: Hole 200, Core 2, upper Pliocene (*Globorotalia tosaensis* Zone), common.

Stratigraphic and geographic range: This species appears at the top of the upper Miocene (*Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone) and is developed in Pliocene deposits (predominantly in tropical areas). It does not range above the Pliocene-Quaternary boundary.

Globorotalia humerosa Takayanagi and Saito
(Plate 22, Figures 7-9)

1962. *Globorotalia humerosa* Takayanagi and Saito, p. 78, pl. 28, figs. 1-2.

Stratigraphic occurrence: Hole 200, Core 4, upper Miocene (*Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), comparatively rare specimens; Cores 1-3, Pliocene-Quaternary, frequent or common. Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, common.

Stratigraphic and geographic range: *G. humerosa* is found in deposits of the upper Miocene (*Globorotalia tumida plesiotumida* Zone and *Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone), Pliocene and Quaternary of many regions of the Caribbean, Mediterranean, and the Atlantic and Pacific Oceans.

Globorotalia inflata (d'Orbigny)
(Plate 23, Figures 1-3)

1839. *Globigerina inflata* d'Orbigny, p. 134, pl. 2, figs. 7-9 (see Banner and Blow, 1967, p. 145, pl. 4, figs. 1, 11).

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, comparatively rare; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, comparatively rare.

Stratigraphic and geographic range: *G. inflata* appears at the top of the upper Miocene, and is representative of Pliocene and Quaternary deposits. The species is characteristic of temperate and subtropical areas; it is rare in tropical areas.

Globorotalia ungulata Bermudez
(Plate 30, Figures 1-3)

1960. *Globorotalia ungulata* Bermudez, p. 304, pl. 15, fig. 6.

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, rare specimens; Hole 202, Core 1, lower Pliocene, rare specimens.

Stratigraphic and geographic range: Pliocene and Quaternary sediments of tropical and subtropical regions.

Globorotalia hirsuta (d'Orbigny)
(Plate 22, Figures 1-3)

1839. *Rotalina hirsuta* d'Orbigny (*in* Blow, 1969, p. 398, pl. 8, figs. 1-3, pl. 43, figs. 1, 2).

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, rare; Hole 200A, Core 1, lower Pliocene, rare.

Stratigraphic and geographic range: This species (in a broad sense) is characteristic of Pliocene and Quaternary deposits. Blow (1969) believes that *G. hirsuta praehirsuta* developed in the Pliocene, whereas *G. hirsuta hirsuta* proper appears in Quaternary deposits.

Globorotalia scitula (Brady)
(Plate 28, Figures 1-3)

1882 *Pulvinulina scitula* Brady (*fide* Ellis and Messina, 1940, *et seq.*)

Stratigraphic occurrence: Hole 200, Cores 1-7 (upper Miocene to Quaternary) rare.

Stratigraphic and geographic range: This species appears in the middle Miocene and is common in Pliocene and Quaternary deposits.

Globorotalia crassaformis crassaformis (Galloway and Wissler)
(Plate 20, Figures 1-3)

1927 *Globigerina crassaformis* Galloway and Wissler, p. 41, pl. 7, fig. 12.

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, common; Hole 200A, Core 1 and Hole 202, Core 1, Pliocene, common. Sporadic specimens of *G. crassaformis crassaformis* have also been recognized at the top of the upper Miocene (*Globorotalia tumida tumida-Sphaeroidinellopsis subdehiscens paenedehiscens* Zone). However, they can be related to downhole contamination (Hole 200, Core 4).

Stratigraphic and geographic range: *G. crassaformis crassaformis* is widely developed in Pliocene and Quaternary deposits of tropical and especially subtropical and temperate areas. According to Blow (1969), the species appears in the upper Miocene (*Globorotalia acostaensis-Globorotalia merotumida* Zone).

Globorotalia crassaformis ronda Blow

1969. *Globorotalia crassaformis ronda* Blow, p. 388, pl. 4, figs. 4-6, pl. 37, figs. 6-9.

Stratigraphic occurrence: Hole 200, Cores 1-3, Pliocene-Quaternary, common or rare specimens; Hole 200A, Core 1 and Hole 202, Core 1, lower Pliocene, relatively rare specimens.

Stratigraphic and geographic range: According to Blow (1969), *G. crassaformis* ronda occurs in sediments of the upper Miocene (*Globorotalia tumida plesiotumida* Zone) through Quaternary.

Globorotalia tosaensis Takayanagi and Saito
(Plate 29, Figures 1-3)

1962. *Globorotalia tosaensis* Takayanagi and Saito, p. 81, pl. 28, figs. 11-12.

Stratigraphic occurrence: Hole 200, Core 2, upper Pliocene (*Globorotalia tosaensis* Zone), relatively rare specimens.

Stratigraphic and geographic range: This cosmopolitan species is characteristic of the upper part of the Pliocene (*Globorotalia tosaensis* Zone).

Globorotalia truncatulinoides (d'Orbigny)

1839. ?*Rotalina truncatulinoides* d'Orbigny (neotype, Blow, 1969, p. 403, pl. 5, figs. 10-12, pl. 49, fig. 6).

Stratigraphic occurrence: Hole 200, Core 1, Quaternary (*Globorotalia truncatulinoides* Zone), common.

Stratigraphic and geographic range: Quaternary deposits. Most characteristic of the sediments of subtropical and temperate areas; less frequent in tropical areas.

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REFERENCES

Akers, W. H., 1955. Some planktonic foraminifera of the American Gulf Coast and suggested correlations with the Caribbean Tertiary: J. Paleont., v. 29, p. 647-664.

Banner, F. T. and Blow, W. H., 1965. Two new taxa of the Globorotaliinae (Globigerinacea, Foraminifera) assisting determination of the Late Miocene/Middle Miocene boundary: Nature, v. 207, no. 5004, p. 1351-1354.

_____, 1967. The origin, evolution, and taxonomy of the foraminiferal genus *Pulleniatina* Cushman, 1927: Micropaleontology, v. 13, no. 2, p. 133-162.

Beckmann, J. P., 1957. *Chiloguembelina* Loeblich and Tappan and related foraminifera from the lower Tertiary of Trinidad: U. S. Natl. Mus. Bull. 215, p. 83-95.

Bermudez, P. J., 1961. Contribucion al Estudio de las Globigerinidea de la Region Caribe-Antillana. 3rd Congress Geol. Venezolano, Bol. Geol., Mem., v. 3, p. 1.119-1.393.

Blow, W. H., 1956. Origin and evolution of the foraminiferal genus *Orbulina*, d'Orbigny: Micropaleontology, v. 2, no. 1, p. 57-70.

_____, 1959. Age, correlation, and biostratigraphy of the upper Tocuyo (San Lorenzo) and Pozón formations, eastern Falcón, Venezuela: Bull. Am. Paleont., v. 39, no. 178, p. 67-251.

_____, 1969. Late middle Eocene to Recent planktonic foraminiferal biostratigraphy: Internatl. Conf. Plankt. Microfossils, 1st, Leiden, Proc. (E. J. Brill), v. 1, p. 199-421.

_____, 1971. Deep Sea Drilling Project, Leg 6, foraminifera from selected samples. *In* Fischer, A. G., Heezen, B. C., et al., Initial Reports of the Deep Sea Drilling Project, Volume VI: Washington (U. S. Government Printing Office).

Blow, W. H. and Banner, F. T., 1962. The mid-Tertiary (Upper Eocene to Aquitanian) Globigerinaceae. *In* Eames, F. E., et al., Fundamentals of mid-Tertiary stratigraphical correlation: Cambridge England (Cambridge University Press), p. 61-151.

_____, 1966. The morphology, taxonomy and biostratigraphy of *Globorotalia barisanensis* Le Roy, *Globorotalia fohsi* Cushman and Ellisor, and related taxa: Micropaleontology, v. 12, no. 3, p. 286-302.

Bolli, H. M., 1957. The genera *Globigerina* and *Globorotalia* in the Paleocene-Lower Eocene Lizard Springs Formation of Trinidad, B. W. I.: U. S. Natl. Mus. Bull. 215, p. 61-81.

———, 1957. Planktonic foraminifera from the Oligocene-Miocene Cipero and Lengua formations of Trinidad, B. W. I.: U. S. Natl. Mus. Bull. 215, p. 97-123.

———, 1957. Planktonic foraminifera from the Eocene Navet and San Fernando formations of Trinidad, B. W. I.: U. S. Natl. Mus. Bull. 215, 155.

Bolli, H. M. and Bermudez, P. J., 1965. Zonation based on planktonic foraminifera of middle Miocene to Pliocene warm-water sediments: Asoc. Venezolana Geol. Miner., y Petr., Bol. Informativo, v. 8, no. 5, p. 121-149.

Bolli, H. M., Loeblich, A. R., Jr., and Tappan, H., 1957. Planktonic foraminiferal families Hantkeninidae, Orbulinidae, Globorotaliidae, and Globotruncanidae: U. S. Natl. Mus. Bull. 215, p. 3-50.

Brady, H. B., 1882. Report on the foraminifera. *In* Tizard and Murray, Exploration of the Faröe Channel, during the summer of 1880, in H.M.S. *Knight Errant*, with subsidiary reports: Roy. Soc. Edinburgh, Proc., Edinburgh, v. 11, (1880-1882), no. 111, p. 708-717.

———, 1884. Report on the foraminifera dredged by H.M.S. *Challenger* during the years 1873-1876: *Challenger* Exped. 1873-1876, Rept., London, Zool., v. 9, pt. 22, p. 1-814.

Bronnimann, P., 1951. *Globigerinita naparimaensis*, n. gen., n. sp., from the Miocene of Trinidad, B. W. I.: Contrib. Cushman Found. Foram. Res., v. 2, pt. 1, p. 16-18.

———, 1951. The genus *Orbulina* d'Orbigny in the Oligo-Miocene of Trinidad, B. W. I.: Contrib. Cushman Found. Foram. Res., v. 2, pt. 4, p. 132-138.

———, 1952. Trinidad Paleocene and lower Eocene Globigerinidae: Bull. Am. Paleont., v. 34, no. 143, p. 1-34.

———, 1952. *Globigerinoita* and *Globigerinatheka*, new genera from the Tertiary of Trinidad: Contrib. Cushman Found. Foram. Res., v. 3, pt. 1, p. 25-28.

———, 1954. *In* an appendix to Todd, R., Cloud, P. E., Low, D., and Schmidt, R. G., Probable occurrence of Oligocene on Saipan: Am. J. Sci., v. 252, no. 11, p. 673-682.

Bronnimann, P. and Bermudez, P. J., 1953. *Truncorotaloides*, a new foraminiferal genus from the Eocene of Trinidad, B. W. I.: J. Paleont., v. 27, p. 817-820.

Chapman, F., Parr, W. J., and Collins, A. C., 1934. Tertiary foraminifera of Victoria, Australia – the Balcombian deposits of Port Phillip, Part III: Linnean Soc. J., v. 38, no. 262, p. 553-577.

Cita, M. B. and Gelati, R., 1960. *Globoquadrina langhiana* n. sp. del Langhiano-tipo: Riv. Ital. Paleont., v. 66, no. 2, p. 241-246.

Cita, M. B. and Premoli Silva, I., 1960. *Globigerina bollii*, nuova specie delle Langhe: Riv. Ital. Paleont., v. 66, no. 1, p. 119-126.

Cita, M. B., Premoli Silva, I., and Rossi, R., 1965. Foraminiferi plactonici del Tortoniano tipo: Riv. Ital. Paleont., v. 71, no. 1, p. 217-308.

Cushman, J. A., 1924. A new genus of Eocene foraminifera: U. S. Natl. Mus. Proc., v. 66, art. 30, p. 1-4.

———, 1925. Some new foraminifera from the Velasco shale of Mexico: Contrib. Cushman Lab. Foram. Res., v. 1., p. 19.

———, 1927. New and interesting foraminifera from Mexico and Texas: Contrib. Cushman Lab. Foram. Res., v. 3, p. 114.

Cushman, J. A. and Bermudez, P. J., 1937. Further new species of foraminifera from the Eocene of Cuba: Contrib. Cushman Lab. Foram. Res., v. 13, pt. 1, p. 1-29.

———, 1949. Some Cuban species of *Globorotalia*: Contrib. Cushman Lab. Foram. Res., v. 25, pt. 2, p. 26-45.

Cushman, J. A. and Jarvis, P. W., 1929. New foraminifera from Trinidad: Contrib. Cushman Lab. Foram. Res., v. 5, p. 6-17.

———, 1930. Miocene foraminifera from Buff Bay, Jamaica: J. Paleont., v. 4, p. 353-368.

———, 1936. Three new foraminifera from the Miocene Bowden marl of Jamaica: Contrib. Cushman Lab. Foram. Res., v. 12, pt. 1, p. 3-5.

Cushman, J. A. and Ponton, G. M., 1932. Foraminifera of the upper, middle, and part of the lower Miocene of Florida: Florida Geol. Surv. Bull. 9, p. 1-147.

Cushman, J. A. and Ponton, G. M., 1932. An Eocene foraminiferal fauna of Wilcox age from Alabama: Contrib. Cushman Lab. Foram. Res., v. 8, p. 51-72.

Cushman, J. A. and Renz, H. H., 1942. Eocene, midway, foraminifera from Soldado Rock, Trinidad: Contrib. Cushman Lab. Foram. Res., v. 18, p. 1-14.

Cushman, J. A. and Stainforth, R. M., 1945. The foraminifera of the Cipero Marl Formation of Trinidad, British West Indies: Cushman Lab. Foram. Res., Special Publ. 14, p. 1-74.

Eames, F. E., Banner, F. T., Blow, W. H., and Clarke, W. J., 1962. Fundamentals of mid-Tertiary stratigraphic correlation: Cambridge England (Cambridge University Press).

Edgar, T., Saunders, J., Donnelly, T., Schneidermann, N., Maurrasse, F., Bolli, H., Hay, W., Riedel, W., Premoli Silva, I., Boyce, R., and Prell, W. 1971. Deep Sea Drilling Project, Leg 15. Geotimes (April).

Egger, J. G., 1893. Foraminifera aus Meeresgrund-proben, gelothet von 1874 bis 1876 von S. M. Sch. "Gazelle": Abhandl. K. Bayer. Akad. Wiss. München, CLII, v. 18, p. 195-458.

Ellis, B. F. and Messina, A. R., 1940, etc., A catalogue of foraminifera: Am. Mus. Nat. Hist. Spec. Publ. (30 vols. and supplements).

El-Naggar, Z. R. 1966. Stratigraphy and planktonic foraminifera of the Upper Cretaceous – Lower Tertiary succession in the Esna-Idfu region, Nile valley, Egypt, UAR: Brit. Mus. (Nat. Hist.), Geol. Bull., Suppl. 2.

Fahmy, S. E., Krasheninnikov, V. A., Mikhailov, I. A., and Samodurov, V. I., 1969. Biostratigraphy of Paleogene deposits in Egypt: African Micropaleont. Colloq., 3d, Cairo, Proc., P. 477.

Finlay, H. J., 1939, New Zealand foraminifera, key species in stratigraphy: Roy. Soc. New Zealand, Trans., v. 69, pt. 1, p. 89-128.

———, 1947. New Zealand foraminifera, key species in stratigraphy: New Zealand J. Sci. Tech., v. 28, no. 5, sec. B, p. 259-292.

Fischer, A. G., Heezen, B. C., Boyce, R. E., Bukry, D., Douglas, R. G., Garrison, R. E., Kling, S. A., Krasheninnikov, V. A., Lisitzin, A. P., Pimm, A. C., 1971. Initial Reports of the Deep Sea Drilling Project, Volume VI: Washington (U. S. Government Printing Office).

Fornasini, C., 1899. *Globigerina adriatiche*: Mem. R. Acc. Sc. Bologna, v. 7, p. 3-14.

Galloway, J. J. and Wissler, S. G., 1927. Pleistocene foraminifera from the Lomita Quarry, Palos Verdes Hills, California: J. Paleont., v. 1, p. 35-87.

Glaessner, M. F., 1937. Planktonforaminiferen aus der Kreide und dem Eozän und ihre stratigraphische Bedeutung: Moscow Univ., Lab. Paleont., Studies Micropaleont., v. 1, pt. 1, p. 27-46.

Hedberg, H. D., 1937. Foraminifera of the middle Tertiary Carapita Formation of northeastern Venezuela: J. Paleont., v. 11, no. 8, p. 661-697.

Jenkins, D. G., 1965. A re-examination of *Globorotalia collactea* Finlay, 1939: New Zealand J. Geol. Geophys., v. 8 (5), p. 843.

_____, 1971. New Zealand Cenozoic planktonic foraminifera: New Zealand Geol. Surv. Paleont. Bull., v. 42.

Khalilov, D. M., 1956. On a pelagic foraminiferal fauna of Paleogene deposits of Azerbaidzhan: Akad. Nauk. Azerbaidzhanskoi SSR, Inst. Geol., Trudy, v. 17, p. 234-255.

Koch, R., 1926. Mitteltertiäre Foraminiferen aus Bulongan, Öst-Borneo: Ecl. Geol. Helv., 19, 722.

Krasheninnikov, V. A., 1964. Significance of planktonic foraminifera of open tropical basins of the Danian and Paleogene time for the creation of the international stratigraphic scale (in Russian): Voprosi Micropaleontol., v. 8, p. 190.

_____, 1965. Zonal Paleogene stratigraphy of the eastern Mediterranean (in Russian): Geol. Inst. Acad. Sci. USSR trans., v. 133.

_____, 1971. Stratigraphy and foraminifera of the Cenozoic pelagic sediments of the Pacific northwestern part (based on materials of deep-sea drilling) (in Russian): Voprosi Micropaleontol., v. 14, p. 140.

Krasheninnikov, V. A. and Abdel Razik, T. M., 1969. Zonal stratigraphy of the Paleocene in Qusseir, Red Sea Coast: African Micropaleont. Colloq., 3d, Cairo Proc., 299.

Le Roy, L. W., 1939. Some small foraminifera, Ostracoda and otoliths from the Neogene ("Miocene") of the Rokan-Tapanoeli area, central Sumatra: Natuurk. Tijdschr. Nederl.-Indie, v. 99, no. 6, p. 215-296.

_____, 1944. Miocene foraminifera of central Sumatra, Netherlands East Indies: Colorado School Mines, Quart., v. 39, no. 3, pt. 1, p. 9-69.

_____, 1953. Biostratigraphy of the Magfi section, Egypt: Geol. Soc. Am., Mem. 54, p. 1-73.

Loeblich, A. R., Jr. and Tappan, H., 1957. Planktonic foraminifera of Paleocene and early Eocene age from the Gulf and Atlantic coastal plains: U. S. Natl. Mus. Bull. 215, p. 173-198.

Luterbacher, H. P. and Premoli Silva, I., 1964. Biostratigrafia del limite Cretaceo-Terziario nell'Apennino Centrale: Riv. Ital. Paleont., v. 70, p. 67-128.

Martin, L. T., 1943. Eocene foraminifera from the type Lodo formation, Fresno County, California: Stanford Univ., Ser. Geol. Sci., v. 3, p. 117.

Morozova, V. G., 1939. The stratigraphy of the Upper Cretaceous and Lower Tertiary deposits in the Emba oil-bearing district according to the foraminiferal fauna (in Russian): Soc. Nat. Moscow, Bull., n.s., v. 47, p. 80.

Nevzorova, L. S., 1971. Sediments of the western Kopet-Dag ridge analogous to the Italian *Globigerina eugubina* Zone of the Danian stage (in Russian). 2d Sci. Conf. Geol. Dept. Turcmenian SSR., v. 36.

Nuttall, W. L. F., 1930. Eocene foraminifera from Mexico: J. Paleont., v. 4, p. 271-293.

Orbigny, A. D. d', 1826. Tableau Méthodique de la classe des Céphalopodes: An. Sci. Nat., Paris, ser. 1, v. 7, p. 96-314.

_____, 1839. Foraminifères. *In* de la Sagra, R., Histoire physique, politique et naturelle de l'ile de Cuba: Paris (Bertrand) p. 1-224.

_____, 1846. Foraminifères fossiles du Bassin Tertiaire de Vienne (Autriche): Paris (Gide and Comp.) p. 1-303.

Palmer, D. K., 1945. Notes on the foraminifera from Bowden, Jamaica: Bull. Am. Paleont., v. 29, p. 1-82.

Parker, F. L., 1965. A new planktonic species (Foraminiferida) from the Pliocene of Pacific deep-sea cores: Contrib. Cushman Found. Foram. Res., v. 16, p. 151-152.

Parker, W. K. and Jones, T. R., 1865. On some foraminifera from the North Atlantic and Arctic oceans, including Davis Straits and Baffin's Bay: Roy. Soc. London, Phil. Trans., v. 155, p. 325-441.

Reiss, Z., 1957. Notes on Foraminifera from Israel. 1. Remarks on *Truncorotalia aragonensis caucasica* (Glaessner): Israel Geol. Survey Bull. 9, i.

Reuss, A. E., 1850. Neues Foraminiferen aus den Schichten des österreichischen Tertiärbeckens: K. Akad. Wiss. Wien, Math.-Naturwiss. Cl., Denkschr., v. 1, p. 365-390.

Saito, T., 1962. Eocene planktonic foraminifera from Hahajima (Hilsborough Island): Palaeont. Soc. Japan, Trans. and Proc., new ser., no. 45, p. 209-225.

Saribekyan, A. D., 1964. Representatives of *Acarinina* from the Lower and Middle Eocene sediments of the Nalchik region (North Caucasus) (in Russian): Acad. Sci. Armenian SSR Trans., v. 17 (6).

Schubert, R. J., 1910. Über foraminiferen und einen Fischotoliten aus dem fossilen Globigerinenschlamm von Neu-Guinea: Geol. Reichsanst., Verhandl, Vienna, p. 318-328.

Subbotina, N. N., 1947. Danian and Paleogene foraminifera of the northern Caucasus (in Russian): Leningrad, Vses. Neft. Nauchno-Issled. Geol.-Razved. Inst. (VNIGRI), p. 108.

_____, 1950. Microfauna and stratigraphy of the Elburgansk horizon and the horizon of the Goryachij Klyuchj. *In* Microfauna of the U.S.S.R.: v. 4, p. 5-12.

_____, 1953. Globigerinidae, Hantkeninidae, and Globorotaliidae: fossil foraminifera of the USSR: VNIGRI, Trudy, n. ser., no. 76, pp. 1-296.

Takayanagi, Y. and Saito, T., 1962. Planktonic foraminifera from the Nobori Formation, Shikoku, Japan: Tohoku Univ., Sendai, Japan, Sci. Repts., 2d Ser. (Geol.), Spec. v. 5, p. 67-106.

Todd, R., 1957. Geology of Saipan, Mariana Islands: smaller foraminifera: U. S. Geol. Surv. Prof. Paper 280-H. p. 165-320.

Toulmin, L. D., 1941. Eocene smaller foraminifera in the Salt Mountain of Alabama: J. Paleont., v. 15, p. 567-611.

Toumarkine, M., Bolli, H. M., 1970. Evolution de *Globorotalia cerroazulensis* (Cole) dans l'Eocène moyen et supérieur de Possagno (Italie). Rev. Micropaleont., v. 13 (3), p. 131.

White, M. P., 1928. Some index foraminifera of the Tampico embayment area of Mexico: J. Paleont., v. 2, p. 280-317.

PLATE 1

Figures 1-3 *Acarinina acarinata* Subbotina. Site 199, Core 8. *Globorotalia velascoensis* Zone; late Paleocene.
1. Umbilical view, X 185.
2. Spiral view, X 170.
3. Side view, X 160.

Figures 4-6 *Acarinina broedermanni* (Cushman and Bermudez). Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
4. Umbilical view, X 155.
5. Spiral view, X 170.
6. Side view, X 155.

Figures 7-9 *Acarinina decepta* (Martin). Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
7. Umbilical view, X 110.
8. Spiral view, X 100.
9. Side view, X 105.

Figures 10-12 *Acarinina esnaensis* (LeRoy). Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
10. Umbilical view, X 165.
11. Spiral view, X 165.
12. Side view, X 110.

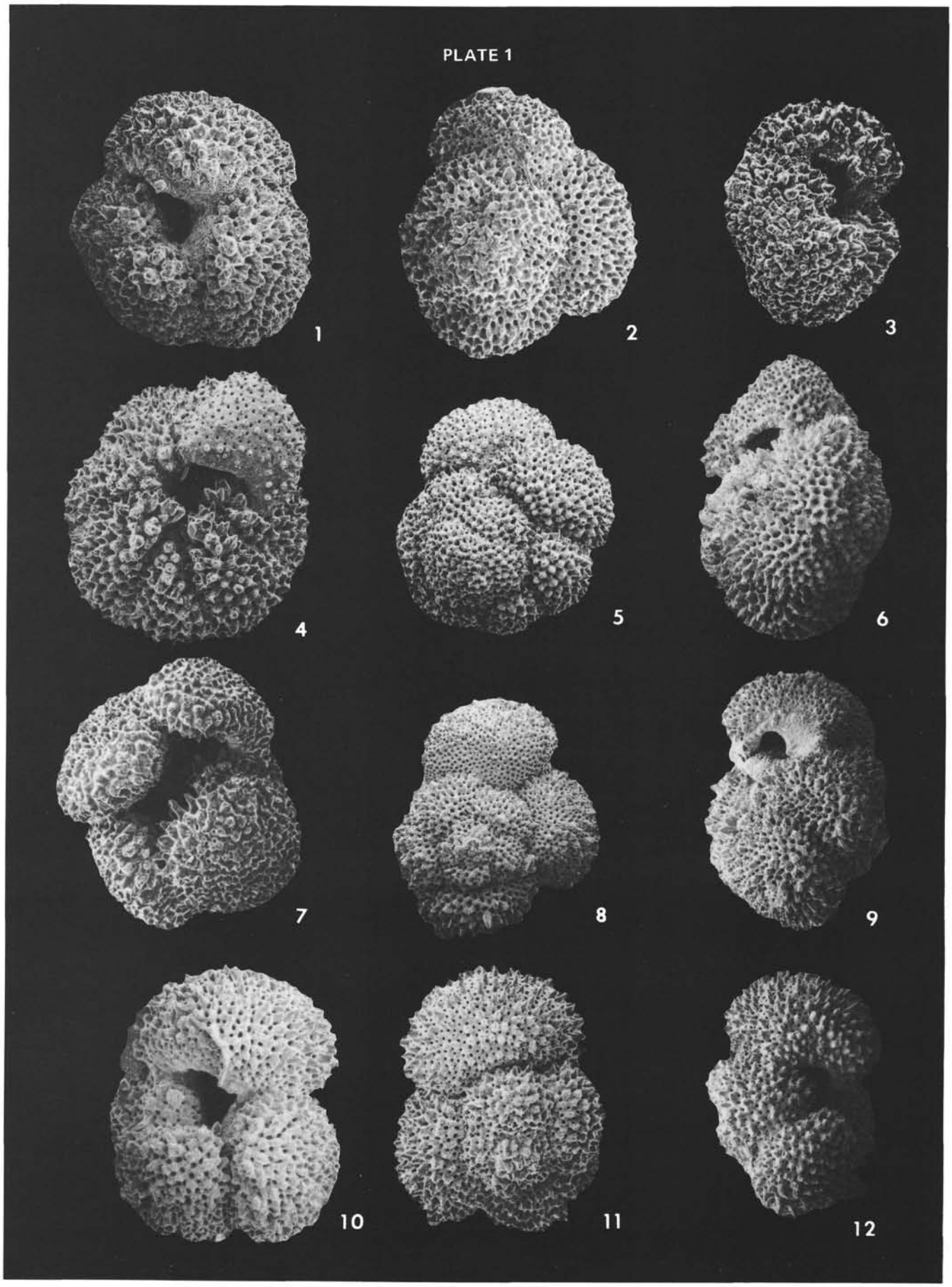
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PLATE 2

Figures 1-2 *Acarinina gravelli* (Bronnimann). Site 200A, Core 2; *Globorotalia formosa formosa* Zone; early Eocene.
1. Umbilical view, X 105.
2. Side view, X 110.

Figures 3-5 *Acarinina intermedia* Subbotina. Site 199, Core 8; *Globorotalia velascoensis* Zone; late Paleocene.
3. Umbilical view, X 140.
4. Spiral view, X 150.
5. Side view, X 140.

Figures 6-8 *Acarinina mckannai* (White). Site 199, Core 8; *Globorotalia velascoensis* Zone; late Paleocene.
6. Umbilical view, X 155.
7. Spiral view, X 135.
8. Side view, X 130.

Figures 9-11 *Acarinina pentacamerata camerata* Khalilov. Site 200A, Core 2; *Globorotalia formosa formosa* Zone, early Eocene.
9. Umbilical view, X 105.
10. Spiral view, X 127.
11. Edge view, X 127.

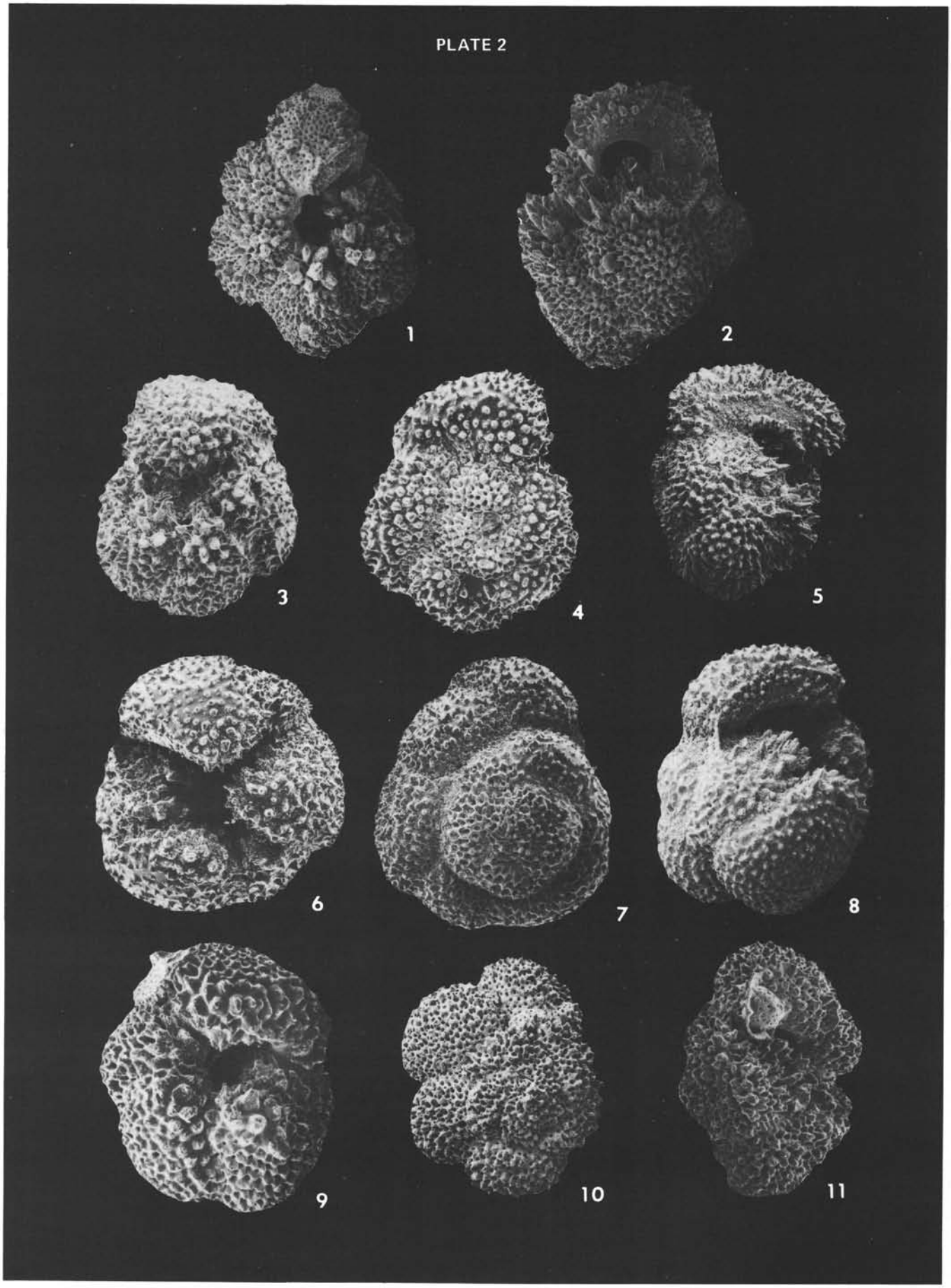
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PLATE 3

Figures 1-3 *Acarinina pentacamerata pentacamerata* (Subbotina). Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
1. Umbilical view, X 35.
2. Spiral view, X 90.
3. Side view, X 100.

Figures 4-6 *Acarinina primitiva* (Finlay). Site 199, Core 8; *Globorotalia velascoensis* Zone; late Paleocene.
4. Umbilical view, X 165.
5. Spiral view, X 165.
6. Side view, X 155,

Figures 7-9 *Acarinina pseudotopilensis* Subbotina. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
7. Umbilical view, X 125.
8. Spiral view, X 170.
9. Side view, X 120.

Figures 10-12 *Acarinina soldadoensis* (Bronnimann). Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
10. Umbilical view, X 150.
11. Spiral view, X 140.
12. Side view, X 150.

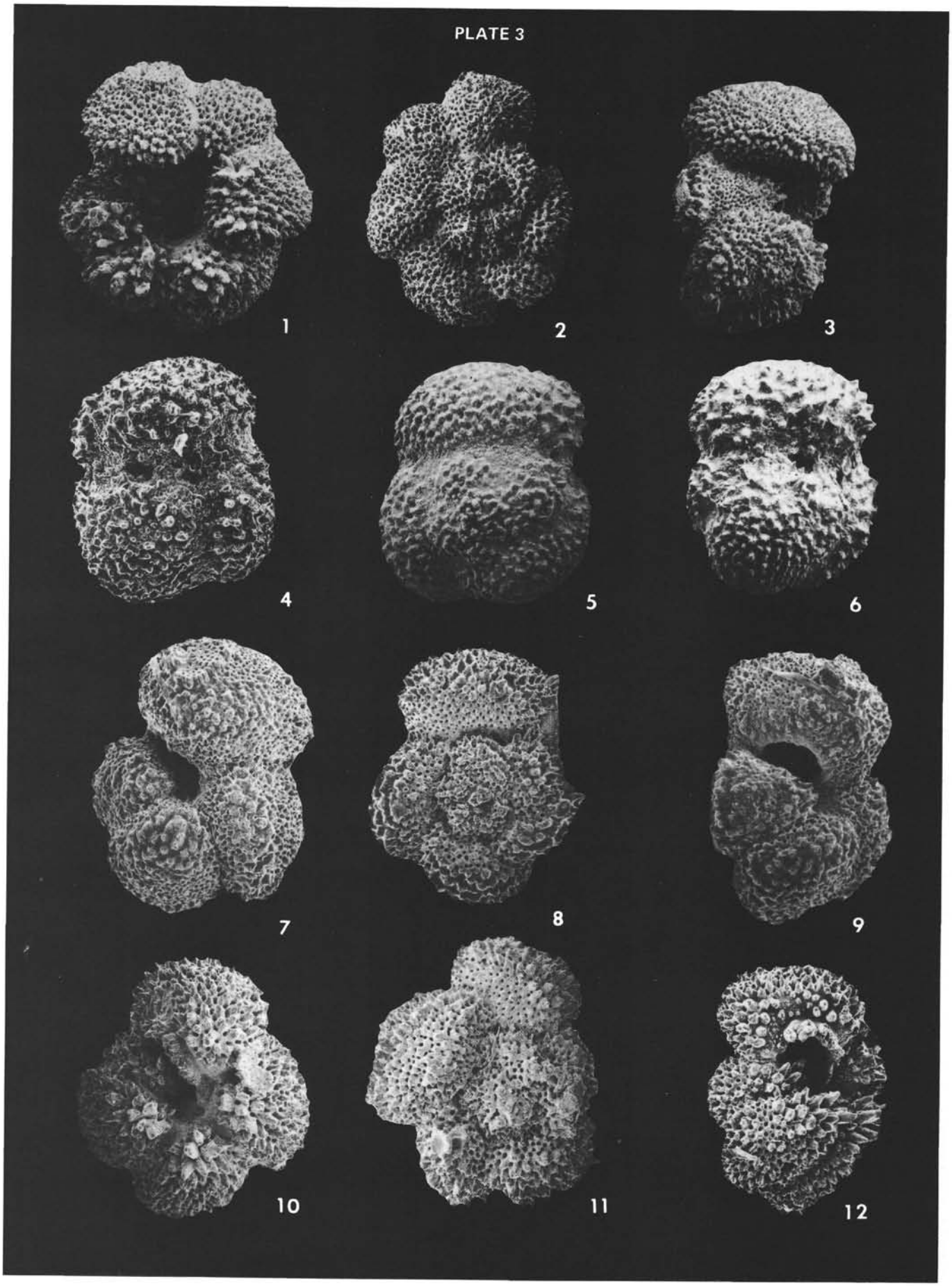
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PLATE 4

Figures 1-3 *Acarinina triplex* Subbotina. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
1. Umbilical view, X 135.
2. Spiral view, X 120.
3. Side view, X 125.

Figure 4 *Biobulina bilobata* (d'Orbigny); X54. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

Figure 5 *Candeina nitida* d'Orbigny; X120. Site 200, Core 3, core catcher; *Sphaeroidnella dehiscens-Globoquadrina altispira* Zone; early Pliocene.

Figure 6 *Candeina* cf *praenitida* Blow; X230. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

Figures 7-9 *Cassigerinella chipolensis* (Cushman and Ponton). Figure 7, X275; Figure 8, X250; Figure 9, X275. Site 200, Core 10, core catcher (hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.

Figures 10-11 *Chiloguembelina parallela* Beckmann. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
10. Apertural view, X 190.
11. Side view, X 165.

PLATE 4

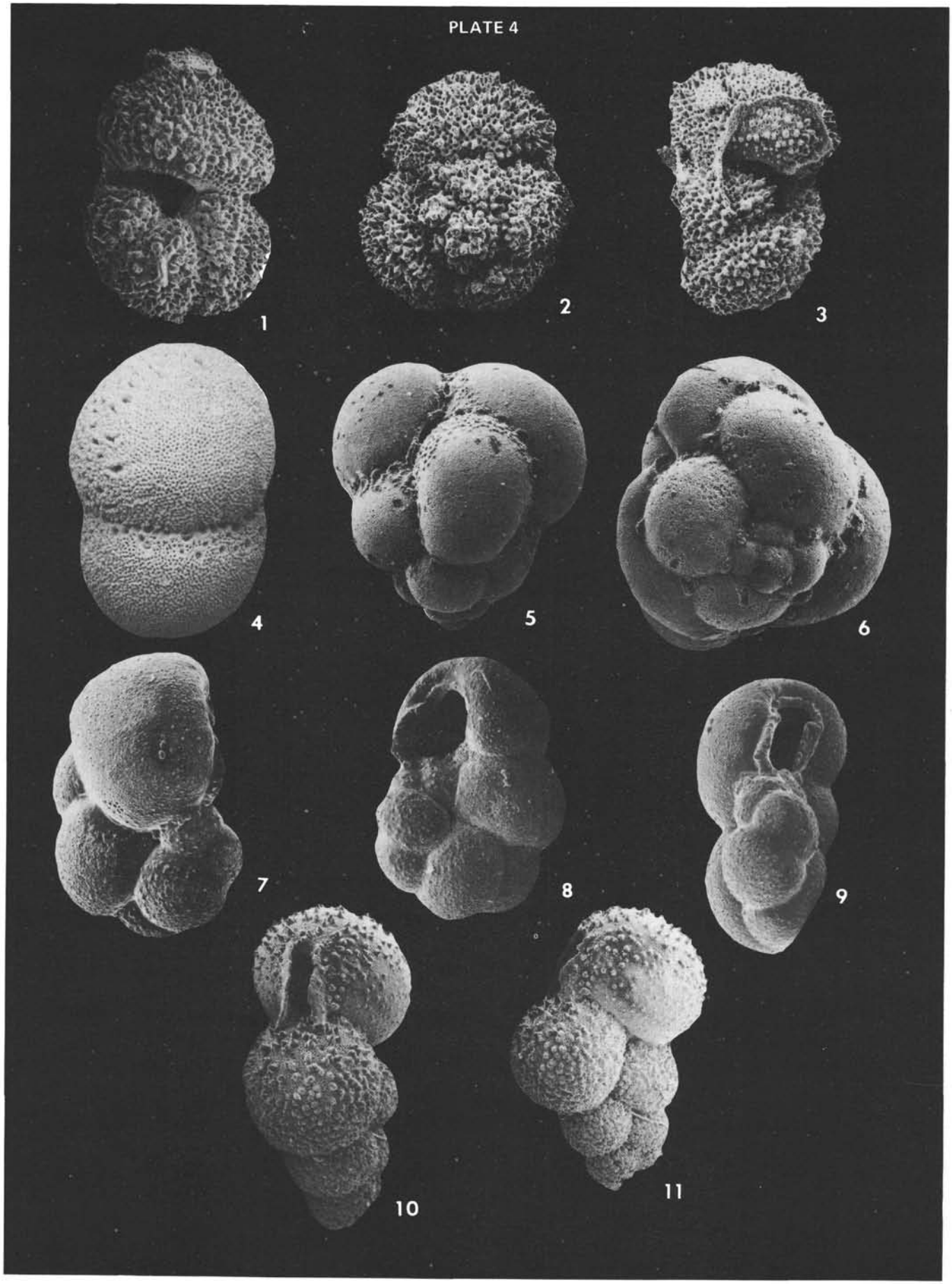

PLATE 5

Figure 1 — *Chiloguembelina taurica* Morozova; ×200. Site 199, Core 10-11; "*Globigerina*" *eugubina* Zone.

Figures 2-3 — *Chiloguembelina wilcoxensis* (Cushman and Ponton). Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
2. Edge view, × 155.
3. Side view, × 145.

Figures 4-5 — *Globigerapsis index* (Finlay). Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
4. Umbilical view, × 140.
5. Spiral view, × 145.

Figures 6-7 — *Globigerapsis kugleri* Bolli, Loeblich, and Tappan. Site 202, Core 2, core catcher, *Orbulinoides beckmanni* Zone; middle Eocene.
6. × 83.
7. × 84.

Figures 8-10 — *Globigerina angustiumbilicata* Bolli. Site 200, Core 10, core catcher (hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone, early Miocene.
8. Umbilical view, × 250.
9. Spiral view, × 225.
10. Side view, × 260.

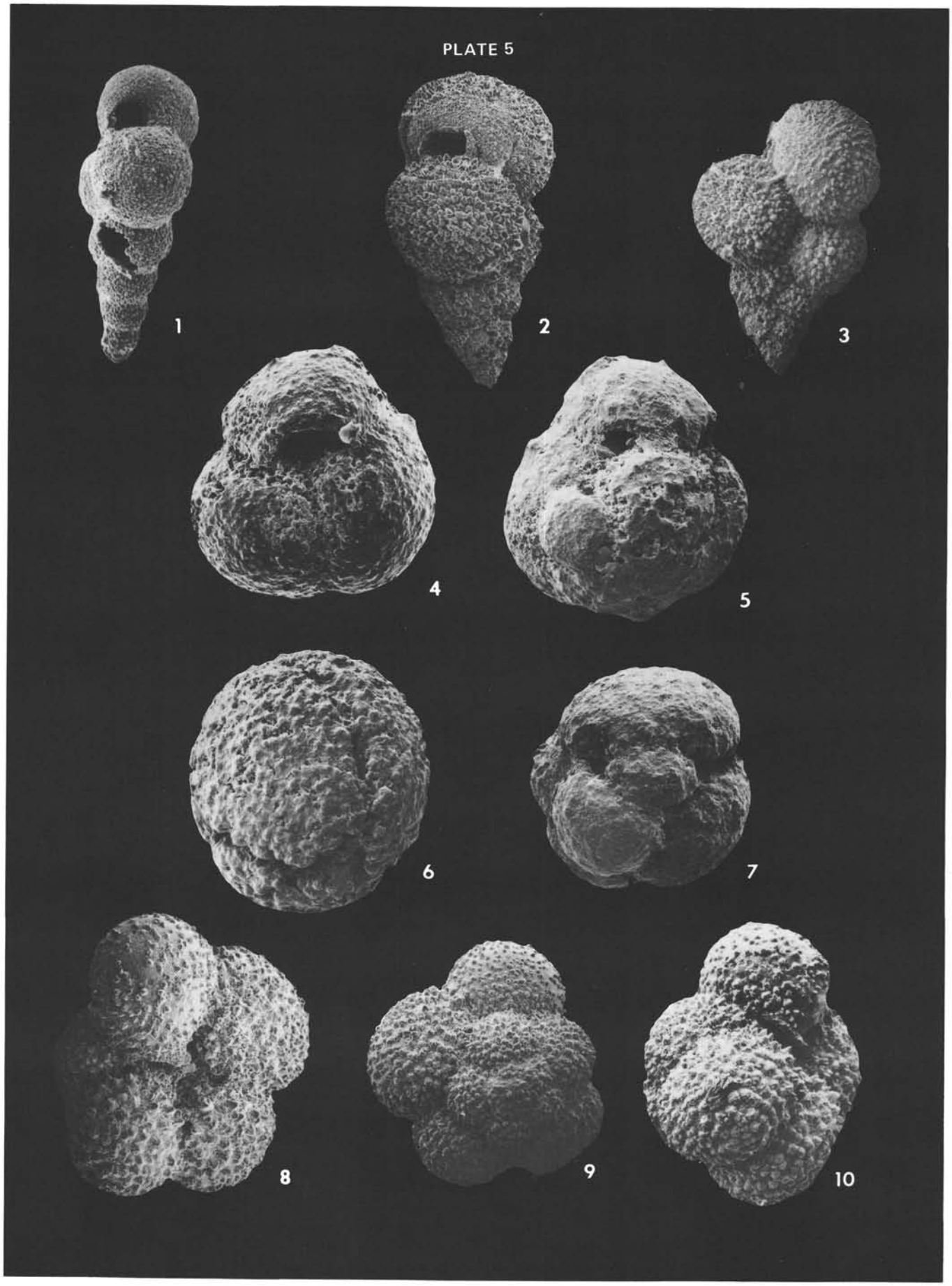
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PLATE 6

Figures 1-3 *Globigerina binaensis* Koch. Site 200, Core 10, core catcher (hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
1. Umbilical view, X 115.
2. Spiral view, X 110.
3. Side view, X 140.

Figures 4-6 *Globigerina bollii* Cita and Silva. Site 200, Core 10, core catcher (hard limestone); *Globigeriniatella insueta-Globigerinita dissimilis* Zone. early Miocene.
4. Umbilical view, X 94.
5. Spiral view, X 89.
6. Side view, X 94.

Figures 7-8 *Globigerina bradyi* Wiesner. Site 200, Core 10, core catcher (hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone, early Miocene.
7. Apertural view, X 260.
8. Apertural view, X 195.

Figures 9-11 *Globigerina bulbosa* LeRoy. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
9. Umbilical view, X 115.
10. Spiral view, X 105.
11. Side view, X 115.

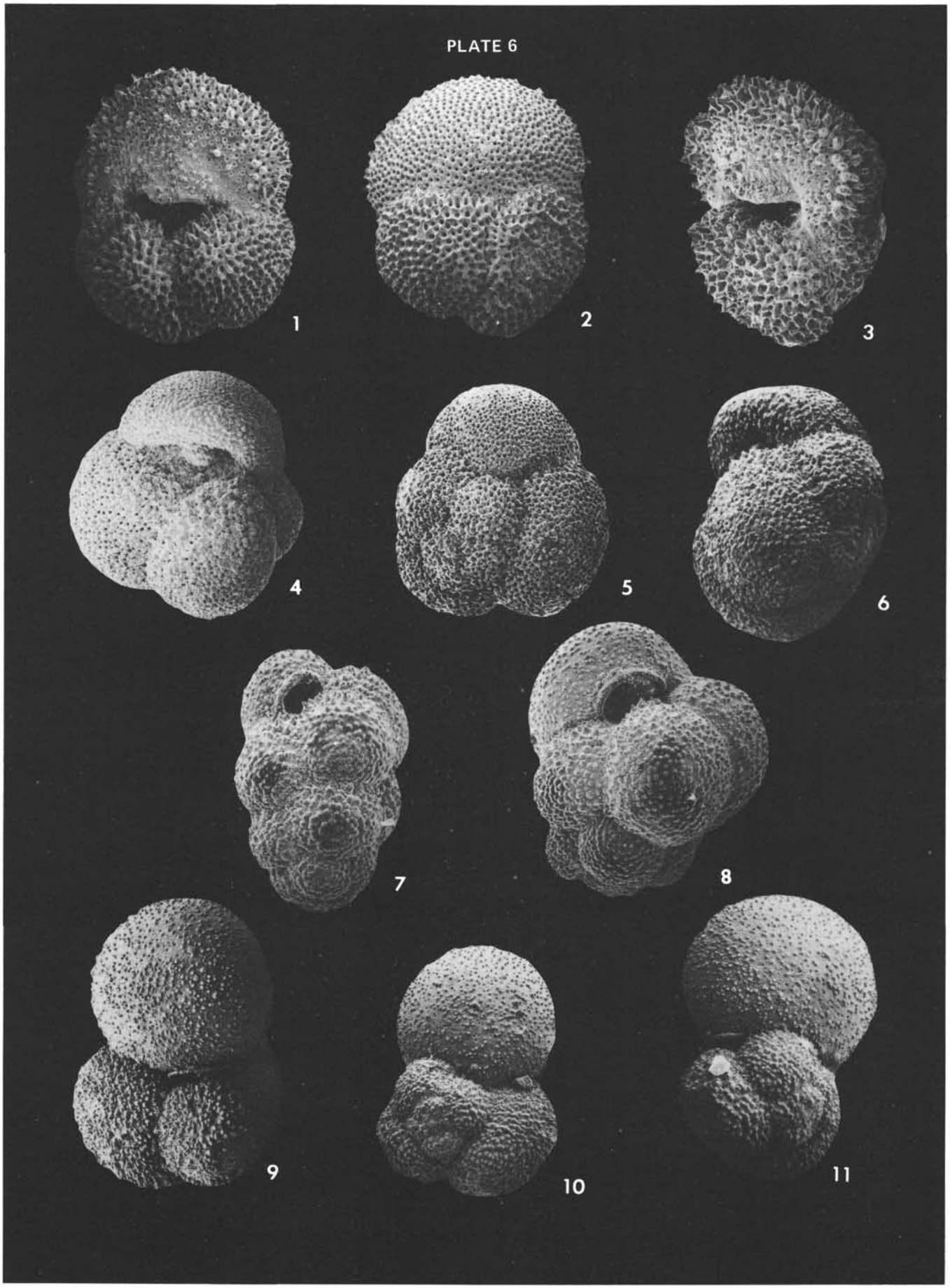
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PLATE 7

Figures 1-2 *Globigerina decoraperta* Takayanagi and Saito. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
1. Umbilical view, X 250.
2. Spiral view, X 250.

Figures 3-5 *Globigerina eamesi* Blow. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
3. Umbilical view, X 150.
4. Spiral view, X 175.
5. Side view, X 165.

Figures 6-8 *Globigerina eugubina* Luterbacher and Premoli Silva. Site 199, Core 10, Section 2; "*Globigerina*" *eugubina* Zone.
6. Umbilical view, X 350.
7. Spiral view, X 350.
8. Side view, X 350.

Figures 9-11 *Globigerina falconensis* Blow. Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.
9. Umbilical view, X 70.
10. Spiral view, X 70.
11. Edge view, X 70.

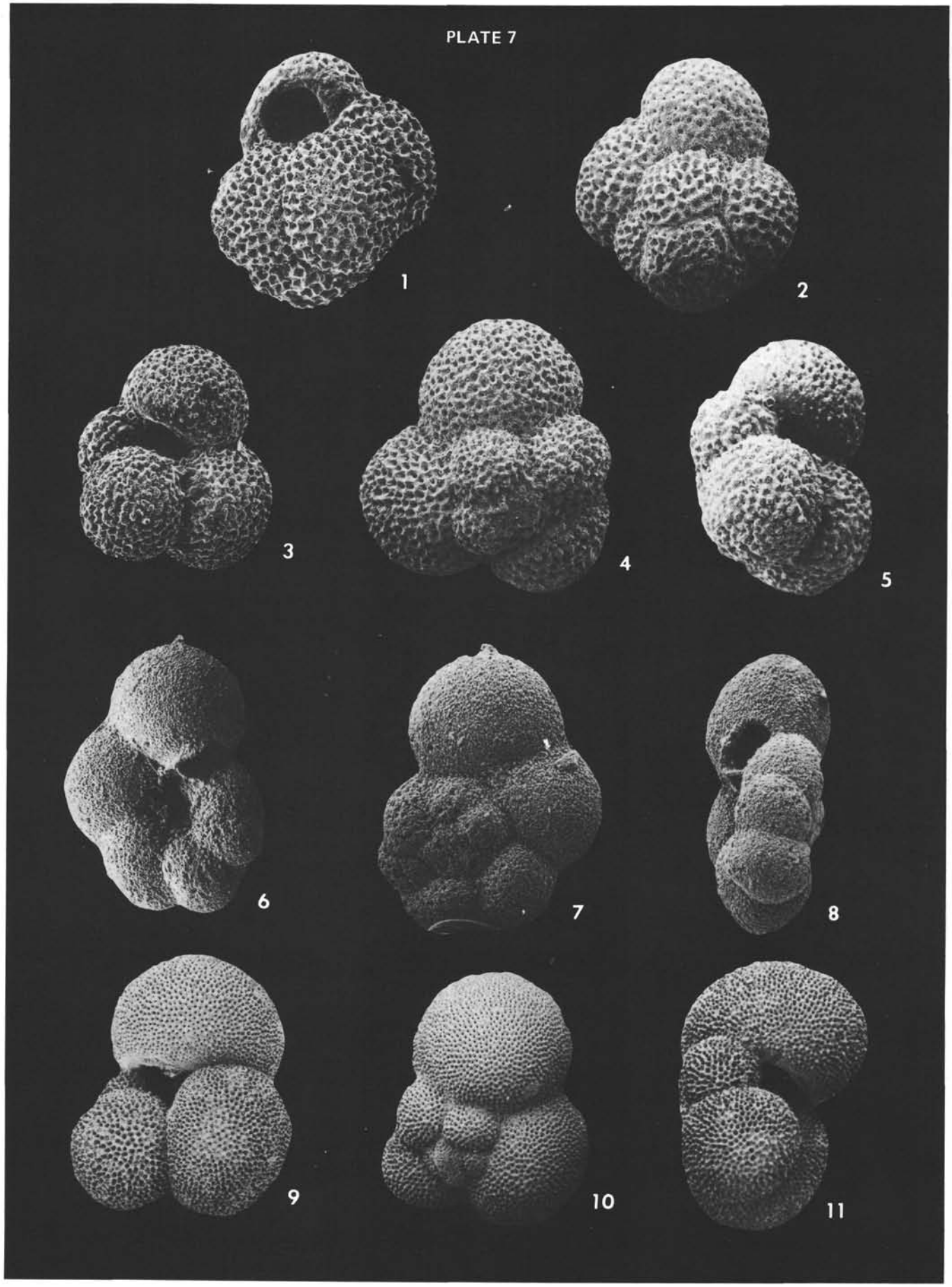
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PLATE 8

Figures 1-2 — *Globigerina* aff. *fringa* Subbotina. Site 199, Core 10, Section 2; "*Globigerina*" *eugubina* Zone.
1. Umbilical view, X 375.
2. Side view, X 375.

Figures 3-5 — *Globigerina galavisi* Bermudez. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
3. Umbilical view, X 120.
4. Spiral view, X 110.
5. Side view, X 110.

Figure 6 — *Globigerina juvenilis* Bolli; Umbilical view, X 200. Site 200, Core 10, core catcher (hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.

Figures 7-8 — *Globigerina microstoma* Cita, Premoli Silva, and Rossi. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone, late Miocene.
7. Umbilical view, X 270.
8. Spiral view, X 290.

Figures 9-11 — *Globigerina minutula* Luterbacher and Premoli Silva. Site 199, Core 10, Section 2; "*Globigerina*" *eugubina* Zone.
9. Umbilical view, X 450.
10. Spiral view, X 450.
11. Side view, X 450.

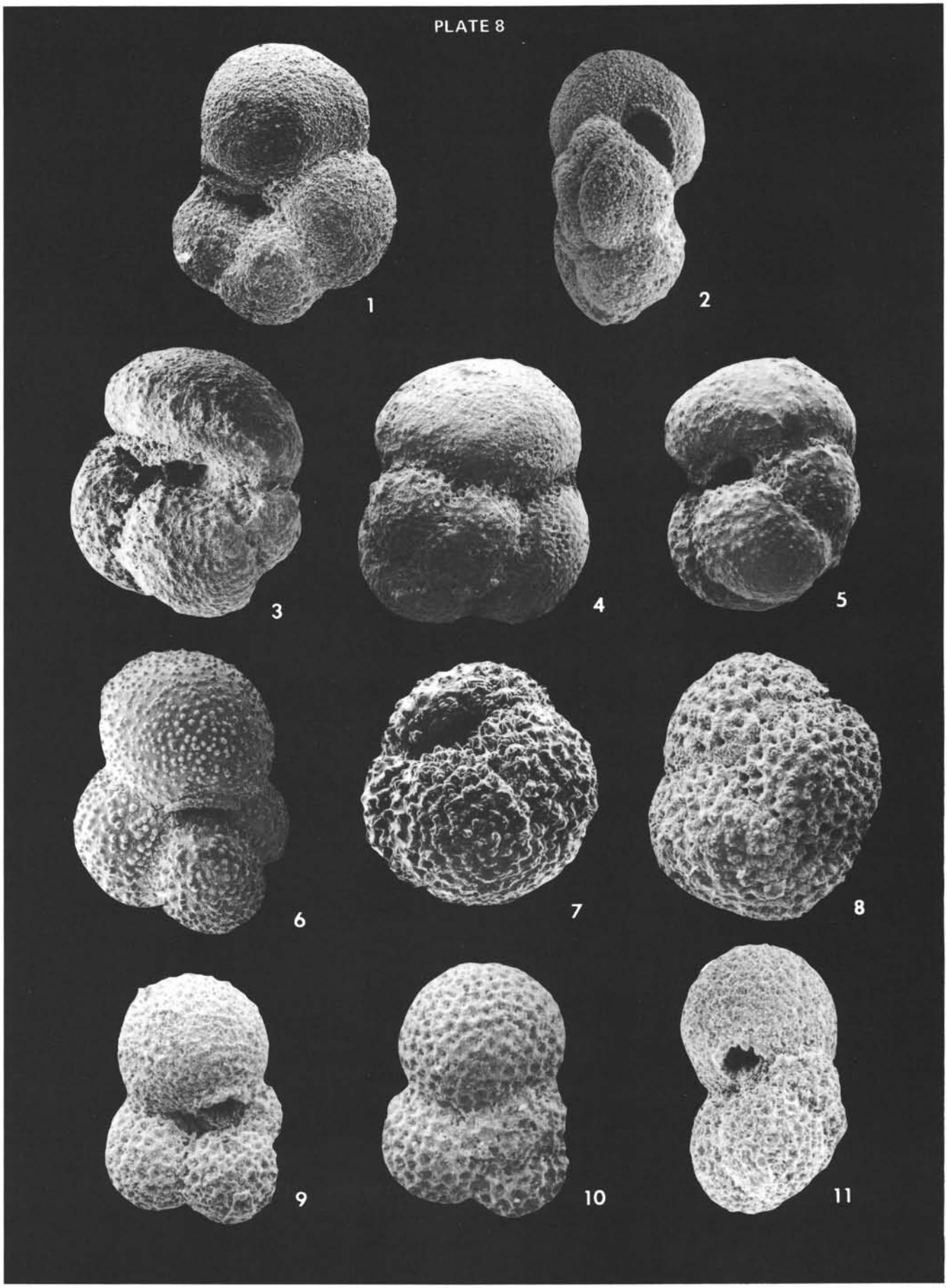
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PLATE 9

Figures 1-3 *Globigerina nana* Khalilov. Site 199, Core 9; *Globorotalia velascoensis* Zone; late Paleocene.
1. Umbilical view, X 135.
2. Spiral view, X 140.
3. Side view, X 140.

Figures 4-6 *Globigerina nepenthes* Todd. Site 200; Figures 4-5, Core 4, Section 1, *Globorotalia tumida-Sphaeroidinellopsis subdehiscens paenodehiscens* Zone, early Pliocene; Figure 6, *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
4. Umbilical view, X 112.
5. Spiral view, X 135.
6. Umbilical view, X 165.

Figures 7-9 *Globigerina parabulloides* Blow. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
7. Umbilical view, X 250.
8. Spiral view, X 200.
9. Side view, X 235.

Figures 10-12 *Globigerina praebulloides* Blow. Site 200, Core 10, core catcher; *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
10. Umbilical view, X 265.
11. Spiral view, X 175.
12. Side view, X 265.

PLATE 9

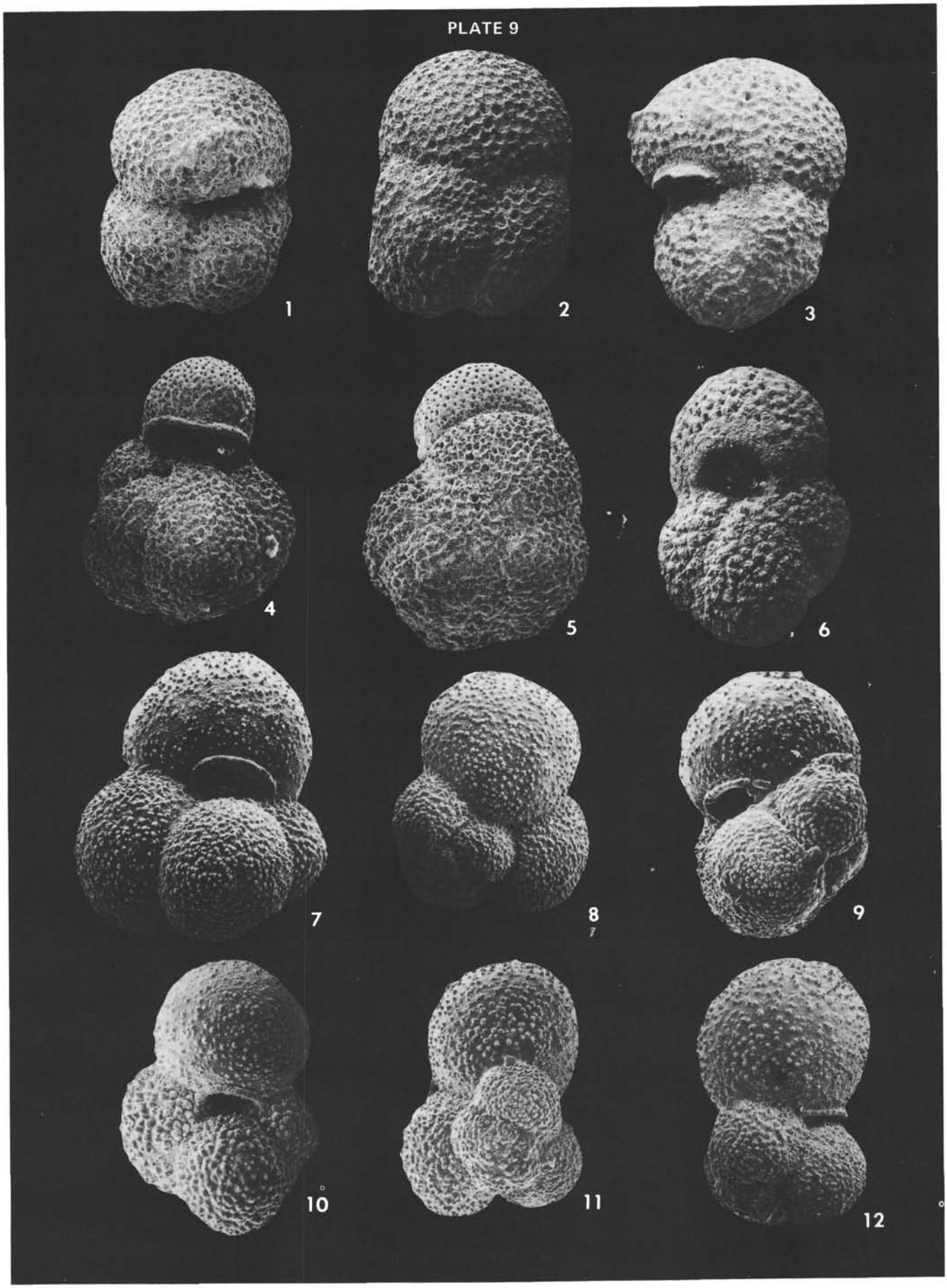

PLATE 10

Figure 1 — *Globigerina praedigitata* Parker; umbilical view. Site 200, Core 1, Section 5; *Globorotalia truncatulinoides* Zone; Pleistocene.

Figures 2-3 — *Globigerina prolata* Bolli. Site 200A, Core 2, core catcher: *Globorotalia formosa formosa* Zone; early Miocene.
2. Umbilical view, X 135.
3. Side view, X 135.

Figures 4-6 — *Globigerina pseudoeocaena* Subbotina. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
4. Umbilical view, X 85.
5. Spiral view, X 87.
6. Side view, X 95.

Figures 7-8 — *Globigerina pseudovenezuelana* Blow and Banner. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
7. Umbilical view, X 95.
8. Spiral view, X 95.

Figures 9-10 — *Globigerina rubescens* Hofker. Site 200, Core 1, Section 2; *Globorotalia truncatulinoides* Zone; Pleistocene.
9. Umbilical view, X 250.
10. Spiral view, X 250.

PLATE 10

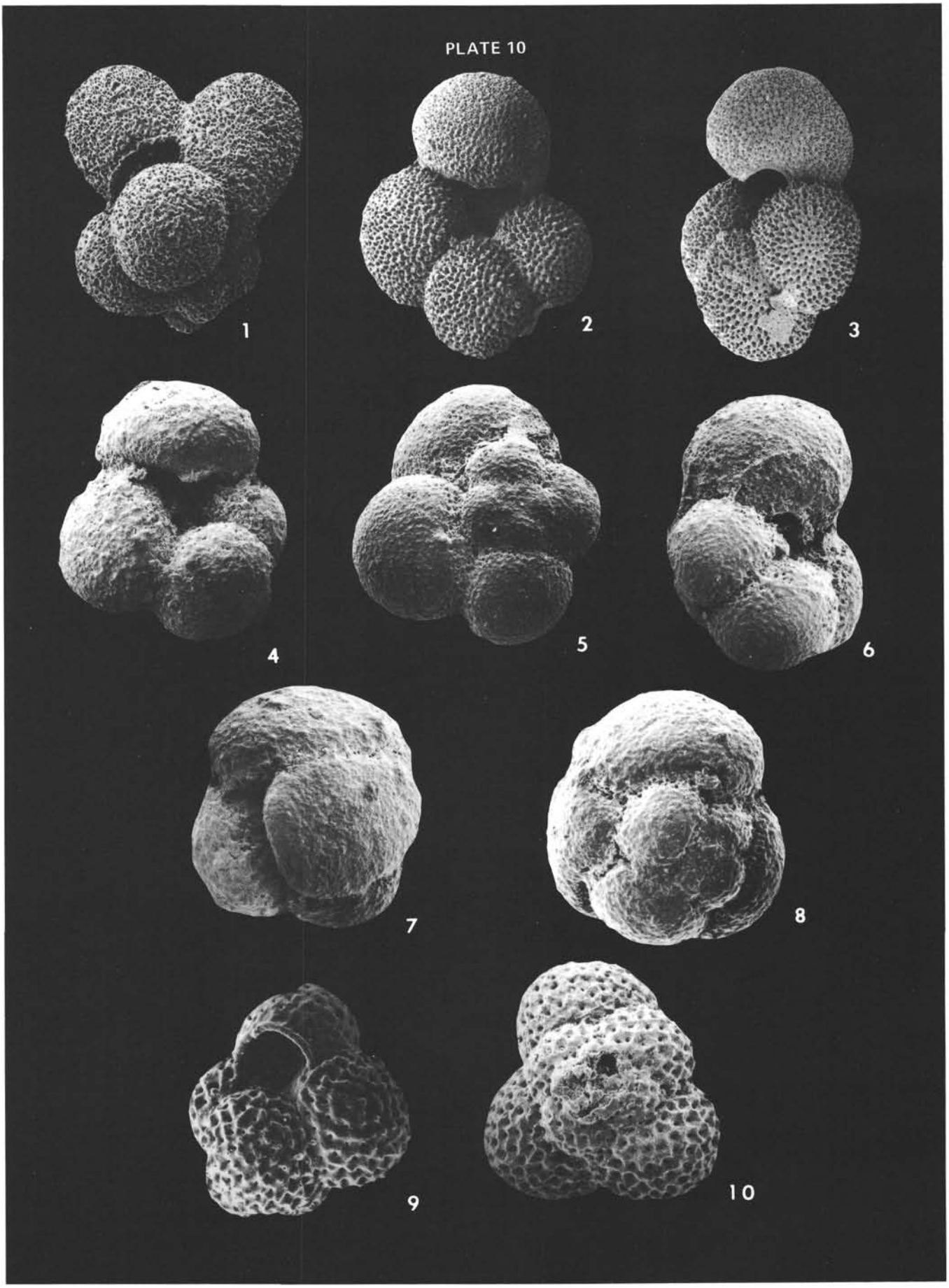

PLATE 11

Figures 1-3 *Globigerina sabina* Luterbacher and Premoli Silva. Site 199, Core 10, Section 2; "*Globigerina*" *eugubina* Zone.

1. Umbilical view, X 400.
2. Spiral view, X 400.
3. Side view, X 400.

Figures 4-6 *Globigerina taroubaensis* Bronnimann. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.

4. Umbilical view, X 175.
5. Spiral view, X 165.
6. Side view, X 190.

Figures 7-9 *Globigerina umbrica* Luterbacher and Premoli Silva. Site 199, Core 10, Section 2; "*Globigerina*" *eugubina* Zone.

7. Umbilical view, X 540.
8. Spiral view, X 560.
9. Side view, X 500.

Figures 10-12 *Globigerina velascoensis* Cushman. Site 199, Core 8, Section 1 (107 cm); *Globorotalia velascoensis* Zone; late Paleocene.

10. Umbilical view, X 145.
11. Spiral view, X 145.
12. Side view, X 155.

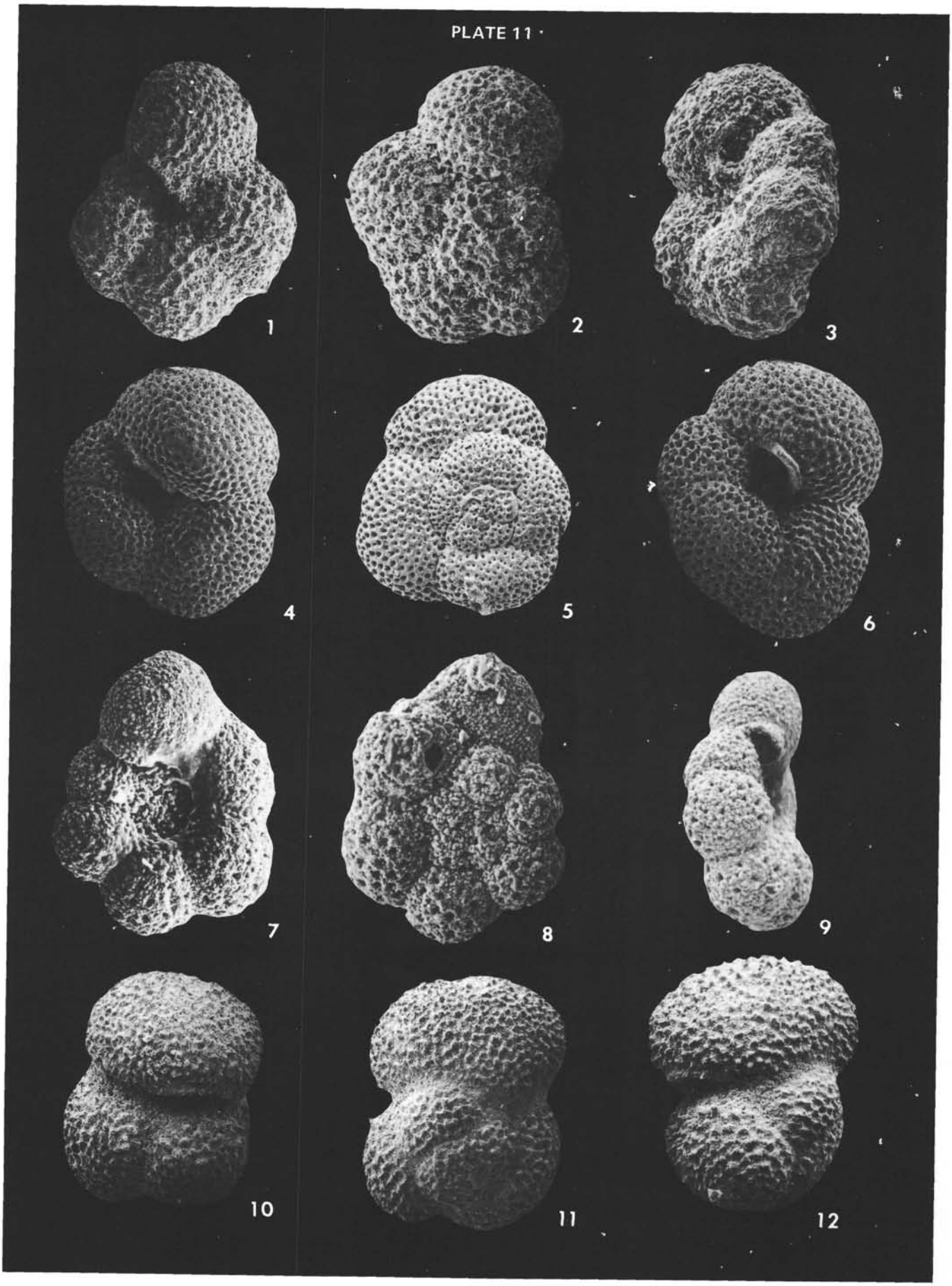
PLATE 11
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PLATE 12

Figures 1-2 *Globigerina venezuelana* Hedburg. Site 200, Core 4, Section 3; *Globorotalia tumida-Sphaeroidinellopsis subdehiscens paenodehiscens* Zone; early Pliocene.
1. Umbilical view, X 120.
2. Spiral view, X 120.

Figure 3 *Globigerinatella insueta* Cushman and Stainforth; X120, Site 200, Core 9, Section 3; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.

Figures 4-5 *Globigerinatheca barri* Bronnimann. Figure 4, X105; Figure 5, X105. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.

Figure 6 *Globigerinita glutinata* (Egger); Umbilical view, X175. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

Figures 7-8 *Globigerinita incrusta* Akers. Site 200, Core 10, core catcher; *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
7. Umbilical view, X 210.
8. Spiral view, X 200.

Figure 9 *Globigerinita naparimaensis* Bronnimann; Umbilical view, X155. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

Figures 10-11 *Globigerinita* aff. *stainforthi* (Bolli, Loeblich and Tappan). Site 200, Core 10, core catcher (hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
10. Umbilical view, X 185.
11. Spiral view, X 185.

PLATE 12

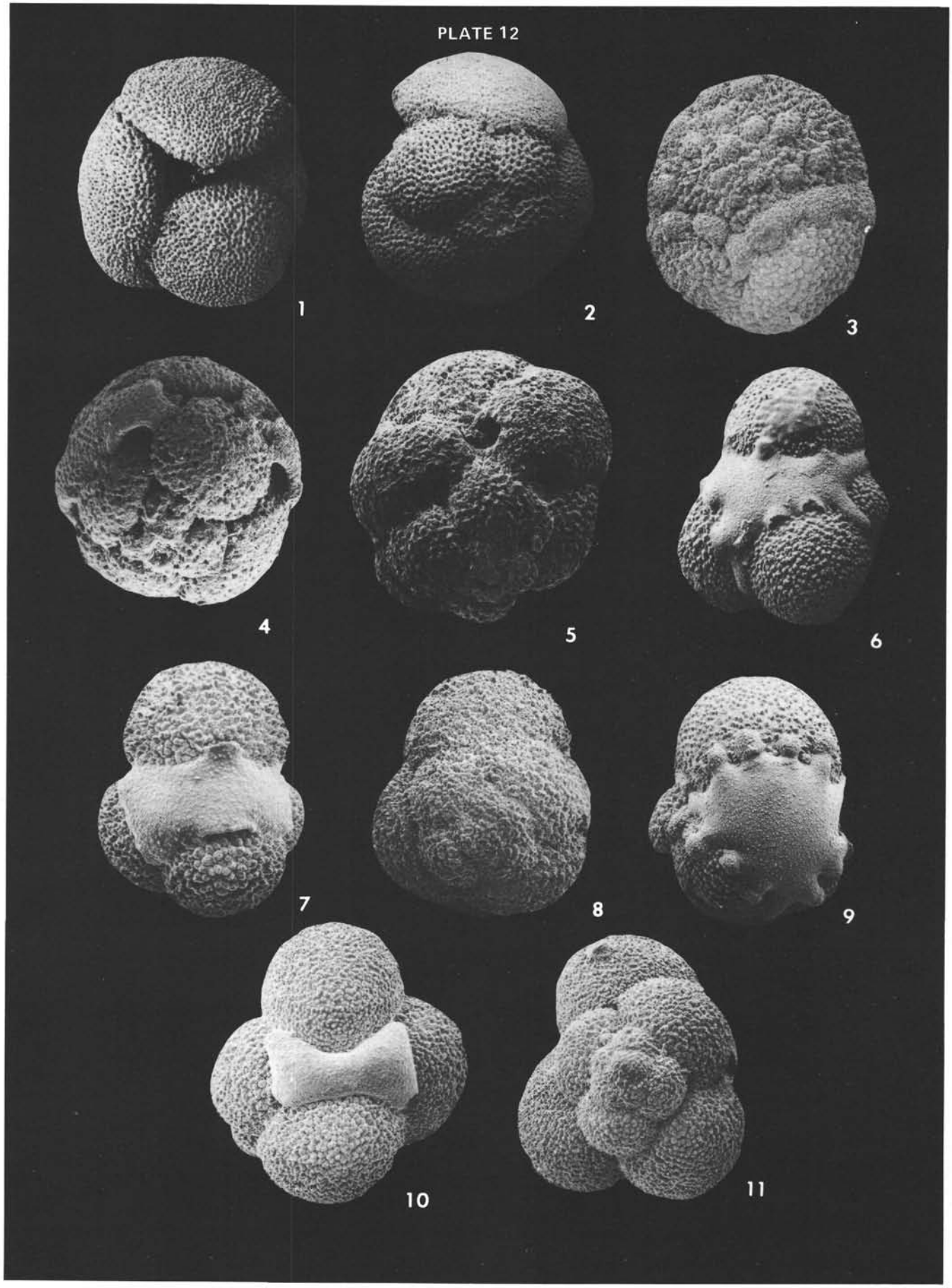

PLATE 13

Figures 1-2 *Globigerinoides adriatica* (Fornasini). Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
1. Umbilical view, X 110.
2. Spiral view, X 110.

Figures 3-4 *Globigerinoides bollii* Blow. Site 200, Core 3, Section 2; *Globorotalia multicamerata-Pulleniatina obliquiloculata* Zone; Pliocene.
3. Umbilical view, X 170.
4. Spiral view, X 170.

Figures 5-6 *Globigerinoides conglobatus* (Brady). Site 200, Core 3, core catcher; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
5. Umbilical view, 70.
6. Spiral view, 70.

Figures 7-8 *Globigerinoides conglobatus canimarensis* Bermudez. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
7. Umbilical view, X 70.
8. Spiral view, X 68.

Figure 9 *Globigerinoides diminutus* Bolli; Umbilical view, X145. Site 200, Core 9, Section 3; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.

Figures 10-12 *Globigerinoides fistulosus* (Schubert). Site 200, Core 2, core catcher; *Globorotalia tosaensis* Zone; upper Pliocene.
10. Umbilical view, X 46.
11. Umbilical view, X 34.
12. Spiral view, X 37;

PLATE 13

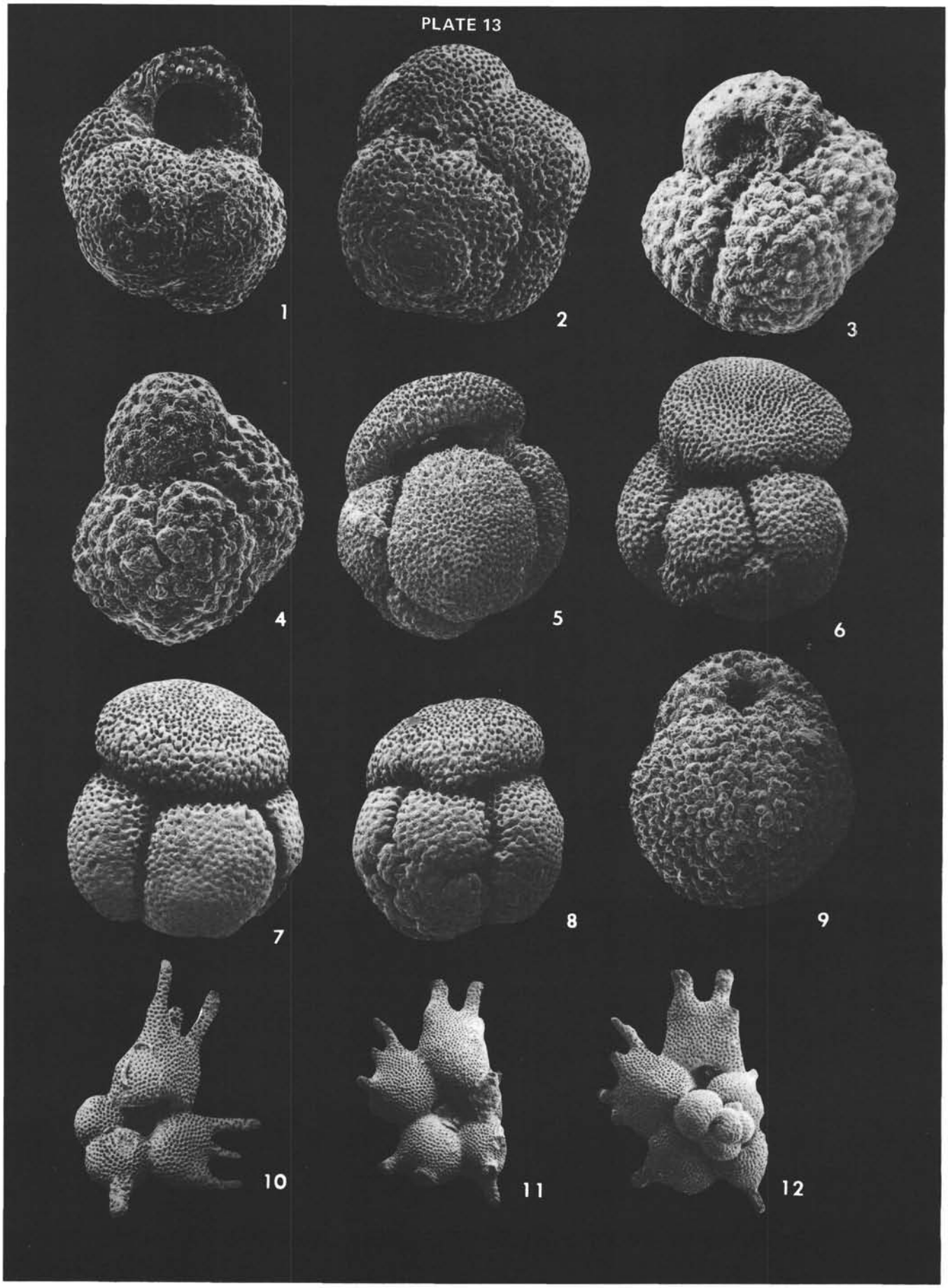

PLATE 14

Figures 1-2 *Globigerinoides mitra* Todd. Site 200, Core 9, core catcher; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
1. Umbilical view, X 85.
2. Spiral view, X 80.

Figures 3-4 *Globigerinoides obliquus extremus* Bolli and Bermudez. Site 200, Core 3, Section 2; *Globorotalia multicamerata-Pulleniatina obliquiloculata* Zone; Pliocene.
3. Umbilical view, X 135.
4. Spiral view, X 130.

Figures 5-6 *Globigerinoides obliquus obliquus* Bolli. Site 200, Core 7, core catcher; N15-N16 of Blow; late Miocene.
5. Umbilical view, X 130.
6. Spiral view, X 135.

Figure 7 *Globigerinoides pyramidalis* van den Broeck; Umbilical view X90. Site 200, Core 2, Section 2; *Globorotalia tosaensis* Zone; upper Pliocene.

Figures 8-9 *Globigerinoides ruber* d'Orbigny. Site 200, Core 1, Section 1, *Globorotalia truncatulinoides* Zone; Pleistocene.
8. Umbilical view, X 125.
9. Spiral view, X 125.

Figures 10-12 *Globigerinoides sacculifer* (Brady). Site 200, Core 3, core catcher, *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
10. Umbilical view, X 57.
11. Umbilical view, X 55.
12. Spiral view, X 60.

PLATE 14

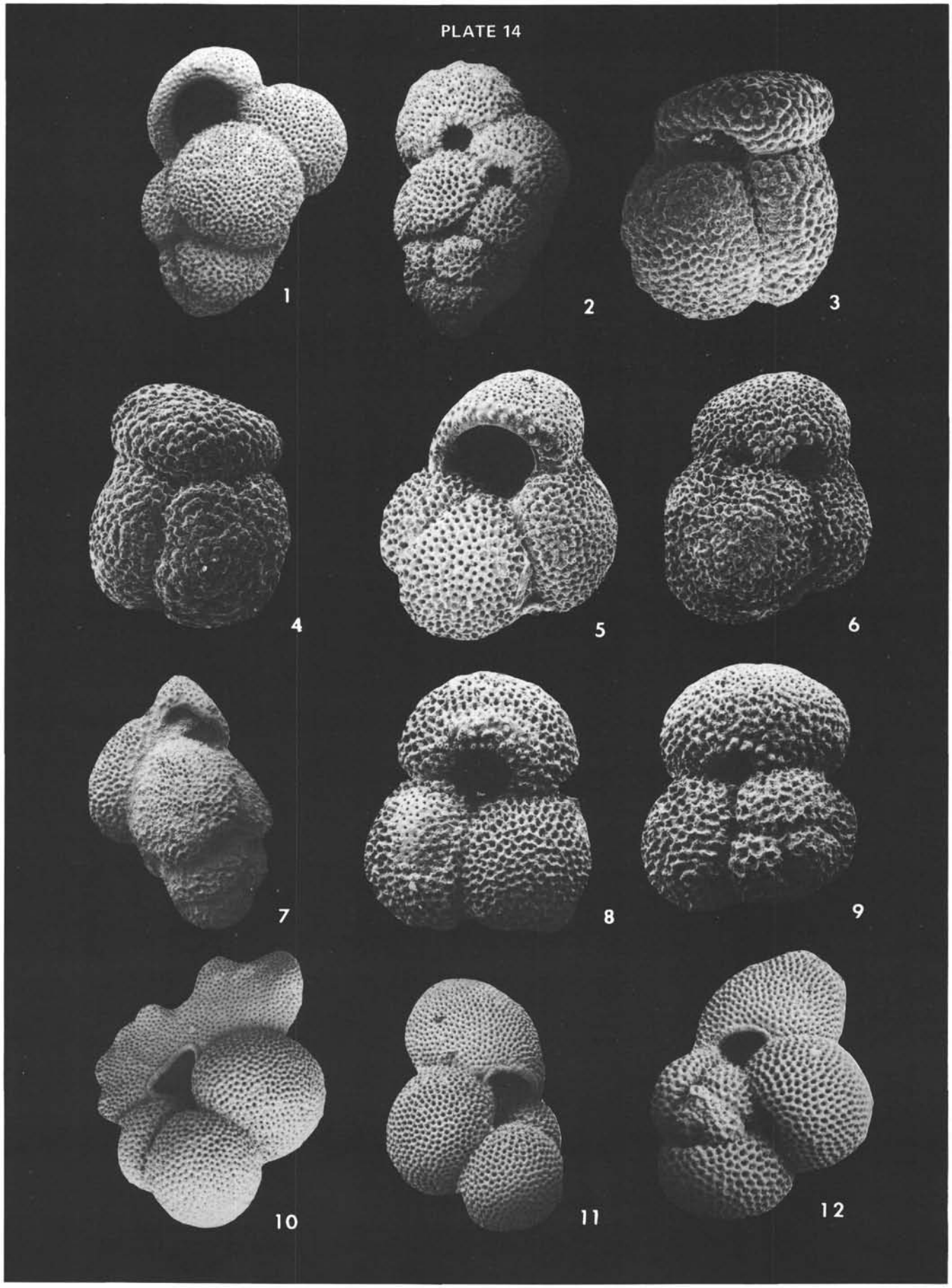

PLATE 15

Figures 1-2 *Globigerinoides sicanus* de Stephani. Site 200, Core 9, core catcher; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
1. Umbilical view, X 81.
2. Spiral view, X 79.

Figures 3-5 *Globigerinoides subquadratus* Bronnimann. Site 200, Core 10, core catcher (Hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
3. Umbilical view, X 130.
4. Spiral view, X 185.
5. Side view, X 118.

Figures 6-9 *Globigerinoides trilobus* (Reuss). Site 200, Core 10, core catcher (Hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
6. Umbilical view, X 130.
7. Spiral view, X 130.
8. Umbilical view, X 120.
9. Spiral view, X 120.

Figures 10-12 *Globoquadrina altispira* (Cushman and Jarvis). Site 200, Core 10, core catcher (Hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
10. Umbilical view, X 82.
11. Spiral view, X 82.
12. Side view, X 82.

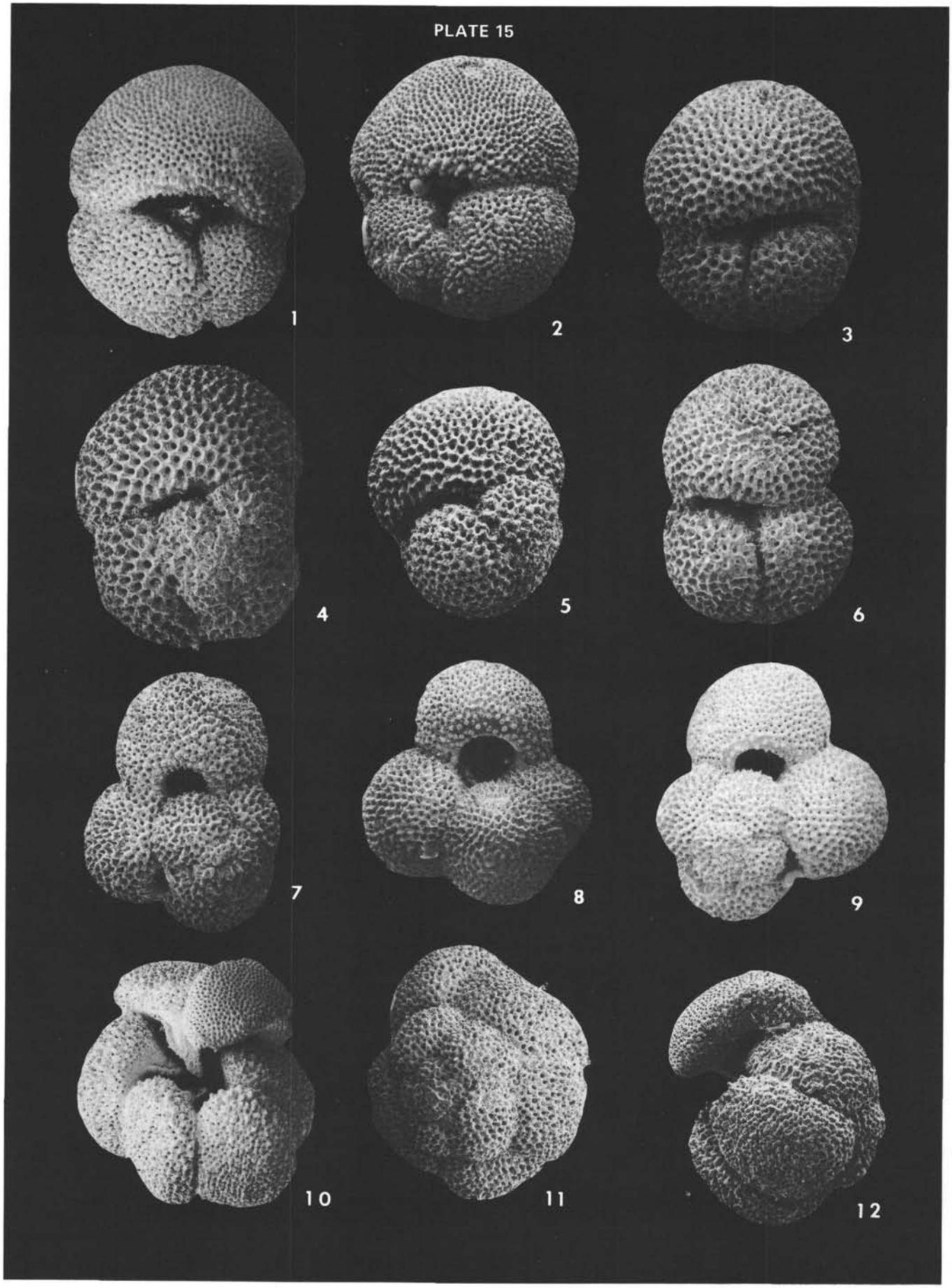
PLATE 15
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PLATE 16

Figures 1-3 *Globoquadrina baroemoenensis* (LeRoy). Site 200, Core 10, core catcher (Hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
1. Umbilical view, X 88.
2. Spiral view, X 85.
3. Side view, X 82.

Figures 4-6 *Globoquadrina dehiscens* (Chapman, Parr and Collins). Site 200, Core 7, core catcher; N15-N16 of Blow; late Miocene.
4. Umbilical view, X 120.
5. Spiral view, X 125.
6. Side view, X 120.

Figures 7-9 *Globoquadrina langhiana* Cita and Gelati. Site 200, Core 10, core catcher (soft material); *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
7. Umbilical view, X 120.
8. Spiral view, X 140.
9. Side view, X 135.

Figures 10-12 *Globoquadrina larmeui obesa* Akers. Site 200, Core 9, Section 3; *Globigerinoides sicanus - Globigerinatella insueta* Zone; early Miocene.
10. Umbilical view, X 76.
11. Spiral view, X 76.
12. Side view, X 79.

PLATE 16

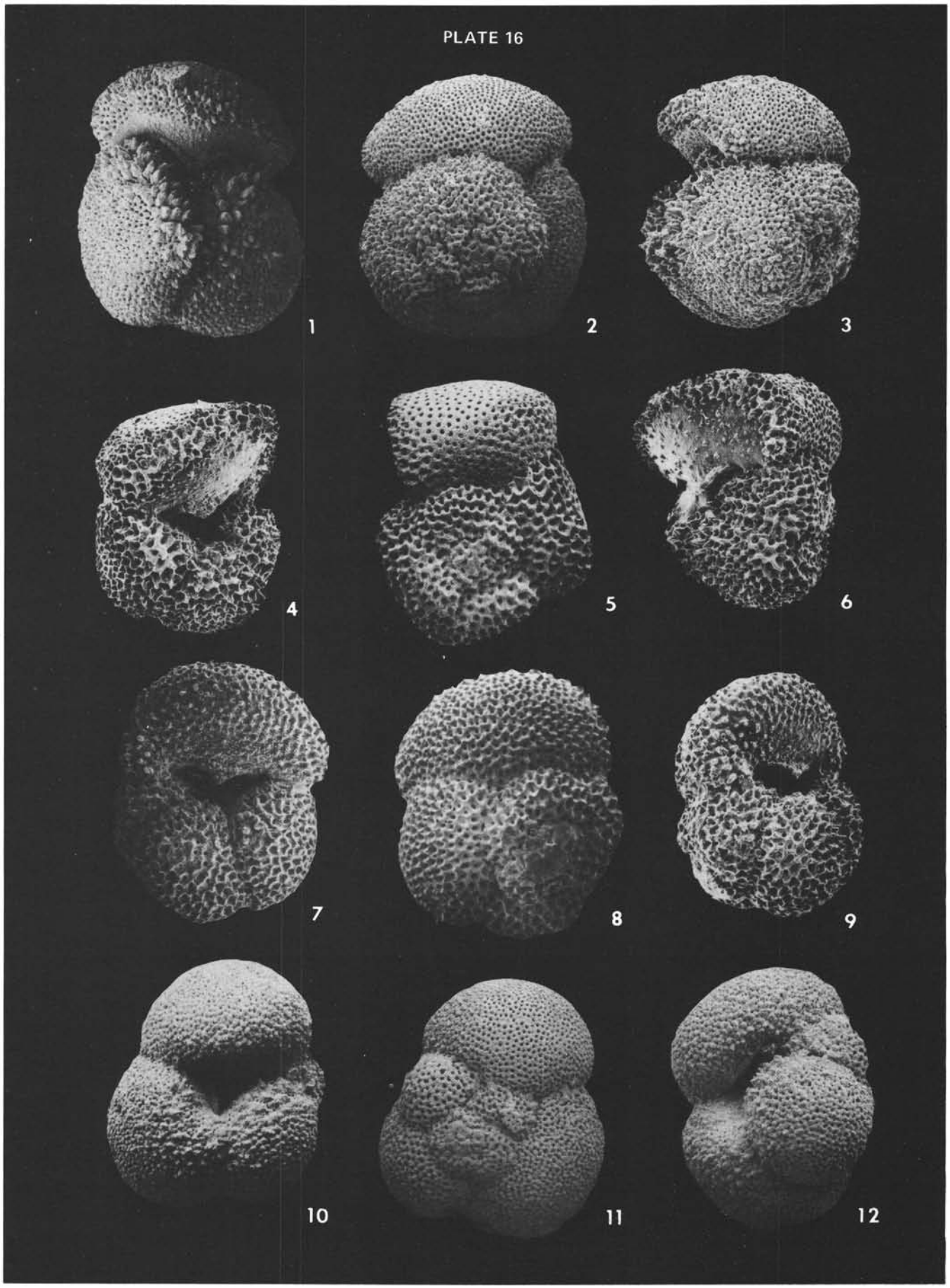

PLATE 17

Figures 1-3 *Globoquadrina praedehiscens* Blow and Banner. Site 200, Core 10, core catcher (Hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
1. Side view, X 90.
2. Spiral view, X100.
3. Umbilical view, X 98.

Figures 4-6 *Globorotalia acostaensis* Blow. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
4. Umbilical view, X 165.
5. Spiral view, X 165.
6. Side view, X 150.

Figures 7-9 *Globorotalia acuta* Toulmin. Site 199, Core 8, Section 1 (107 cm); *Globorotalia velascoensis* Zone; late Paleocene.
7. Umbilical view, X 100.
8. Spiral view, X 95.
9. Side view, X 115.

Figures 10-12 *Globorotalia aequa* Cushman and Renz. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
10. Umbilical view, X 150.
11. Spiral view, X 140.
12. Side view, X 150.

PLATE 17

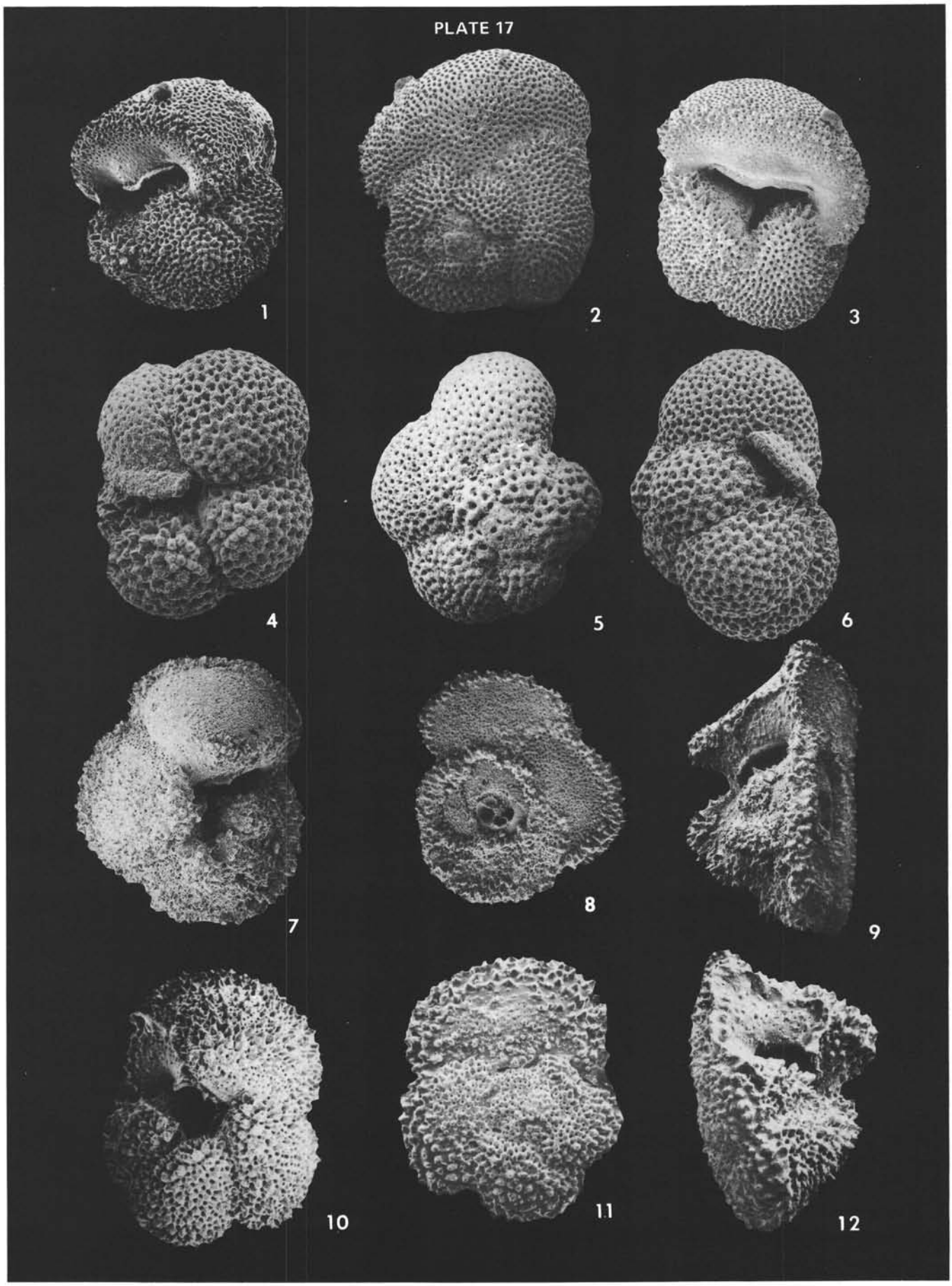

PLATE 18

Figures 1-3 *Globorotalia apanthesma* Loeblich and Tappan. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
1. Umbilical view, X 100.
2. Spiral view, X 135.
3. Side view, X 135.

Figures 4-6 *Globorotalia aragonensis* Nuttall. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
4. Umbilical view, X 87.
5. Side view, X 98.
6. Spiral view, X 82.

Figures 7-9 *Globorotalia archeomenardii* Bolli. Site 200, Core 9, Section 2; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
7. Umbilical view X155.
8. Spiral view, X 170.
9. Side view, X185.

Figures 10-12 *Globorotalia bermudezi* (Bolli). Site 200, Core 9, Section 1 (top); *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
10. Umbilical view, X 100.
11. Spiral view, X 100.
12. Side view, X 100.

PLATE 18

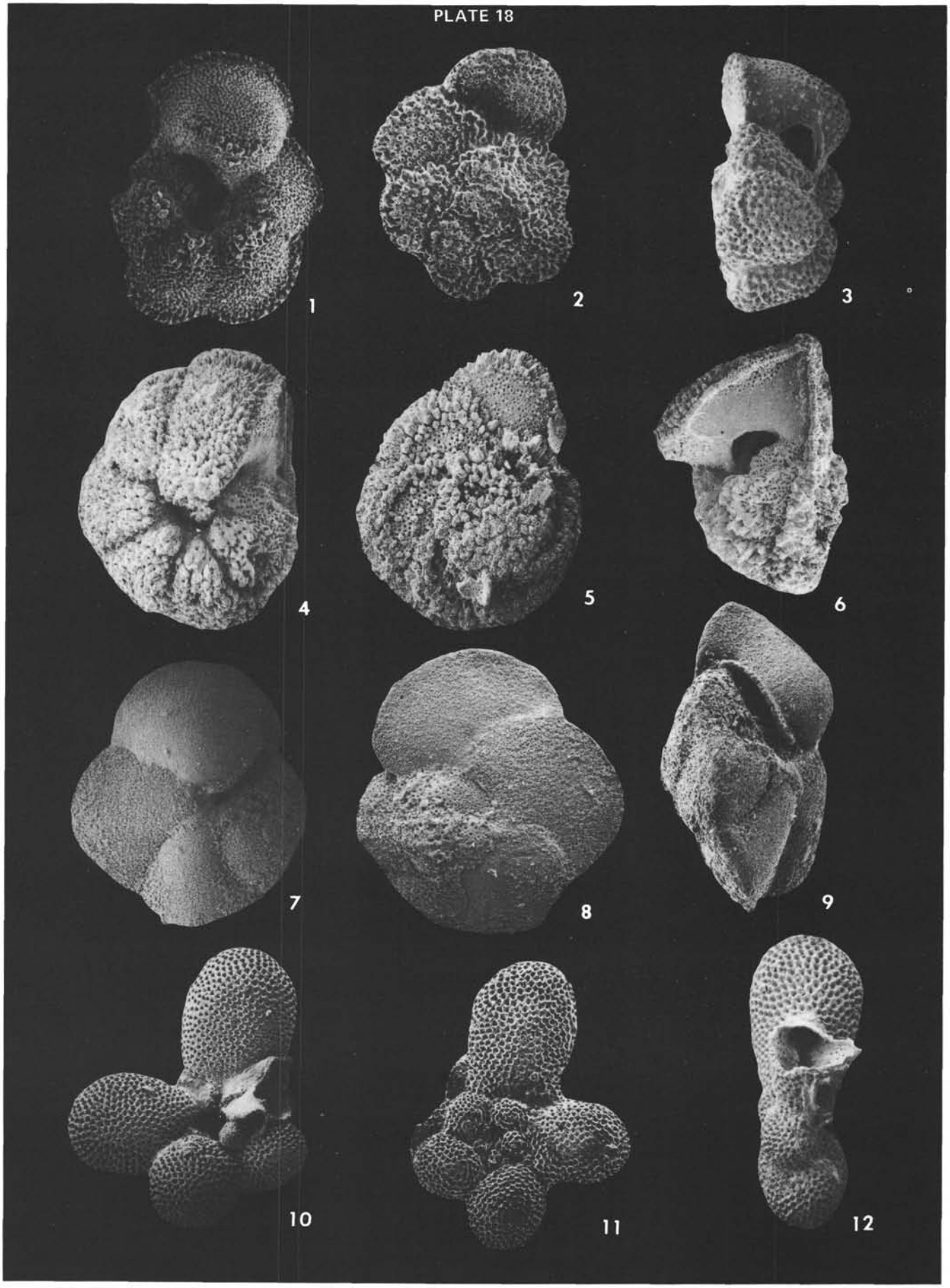

PLATE 19

Figures 1-3 *Globorotalia caucasica* Glaessner. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
1. Umbilical view, X 70.
2. Spiral view, X 68.
3. Side view, X 70.

Figures 4-6 *Globorotalia centralis* Cushman and Bermudez. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
4. Umbilical view, X 100.
5. Spiral view, X 71.
6. Side view, X 105.

Figures 7-9 *Globorotalia* aff. *collactea* Finlay. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
7. Umbilical view, X 160.
8. Spiral view, X 135.
9. Side view, X 165.

Figures 10-12 *Globorotalia continuosa* Blow. Site 200, Core 9, Section 3; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
10. Umbilical view, X180.
11. Spiral view, X 165.
12. Side view, X 185.

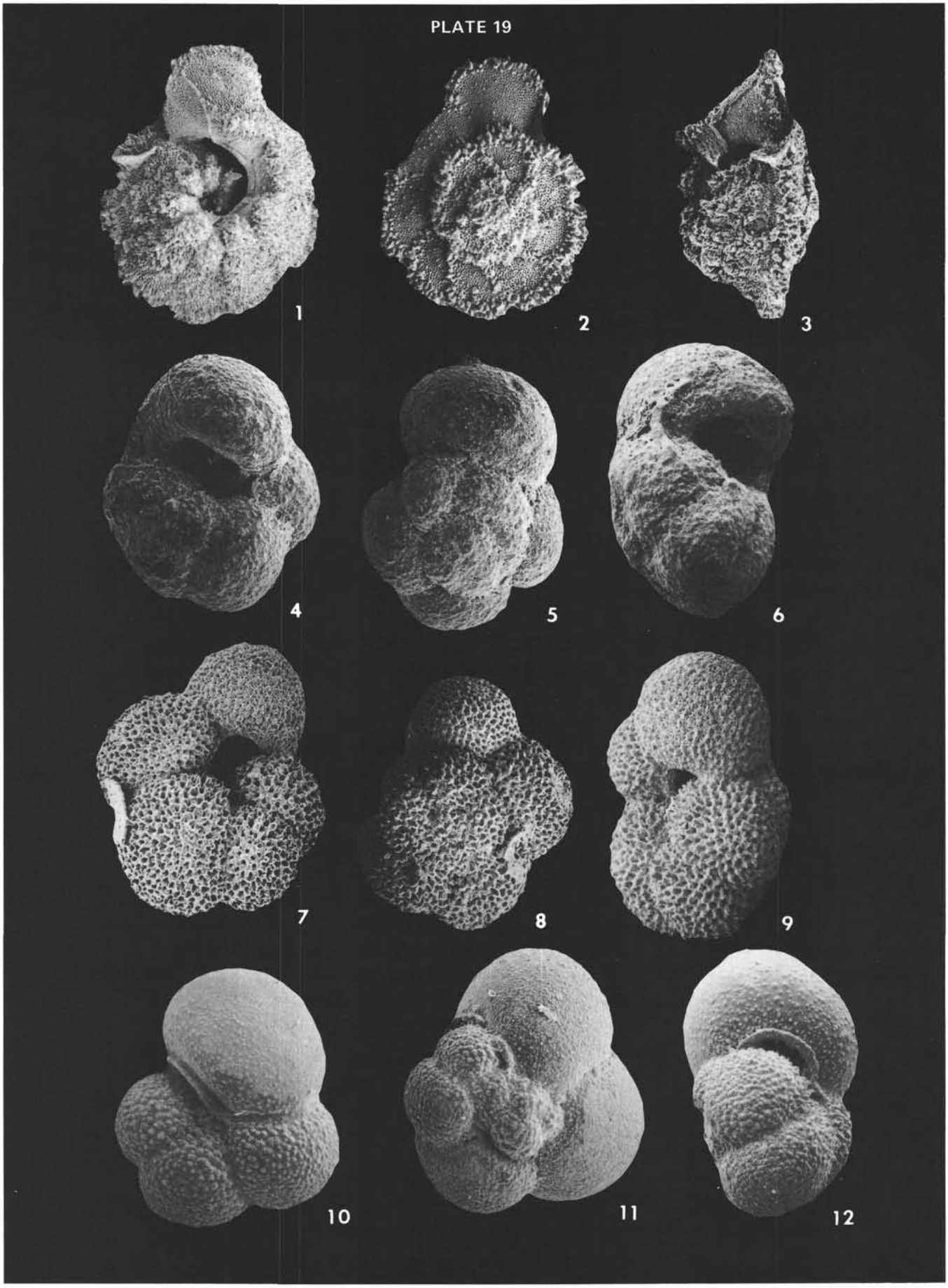
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PLATE 20

Figures 1-3 *Globorotalia crassaformis* (Galloway and Wissler). Site 200, Core 3, core catcher; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
1. Umbilical view, X 100.
2. Spiral view, X 100.
3. Side view, X 90.

Figures 4-6 *Globorotalia cultrata* (d'Orbigny). Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
4. Umbilical view, X 70.
5. Spiral view, X 65
6. Side view, X 80.

Figures 7-9 *Globorotalia dutertrei* d'Orbigny. Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.
7. Umbilical view, X 105.
8. Spiral view, X 105.
9. Side view, X 80.

Figures 10-11 *Globorotalia fimbriata* (Brady). Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.
10. Umbilical view, X 57.
11. Spiral view, X 57.

PLATE 20

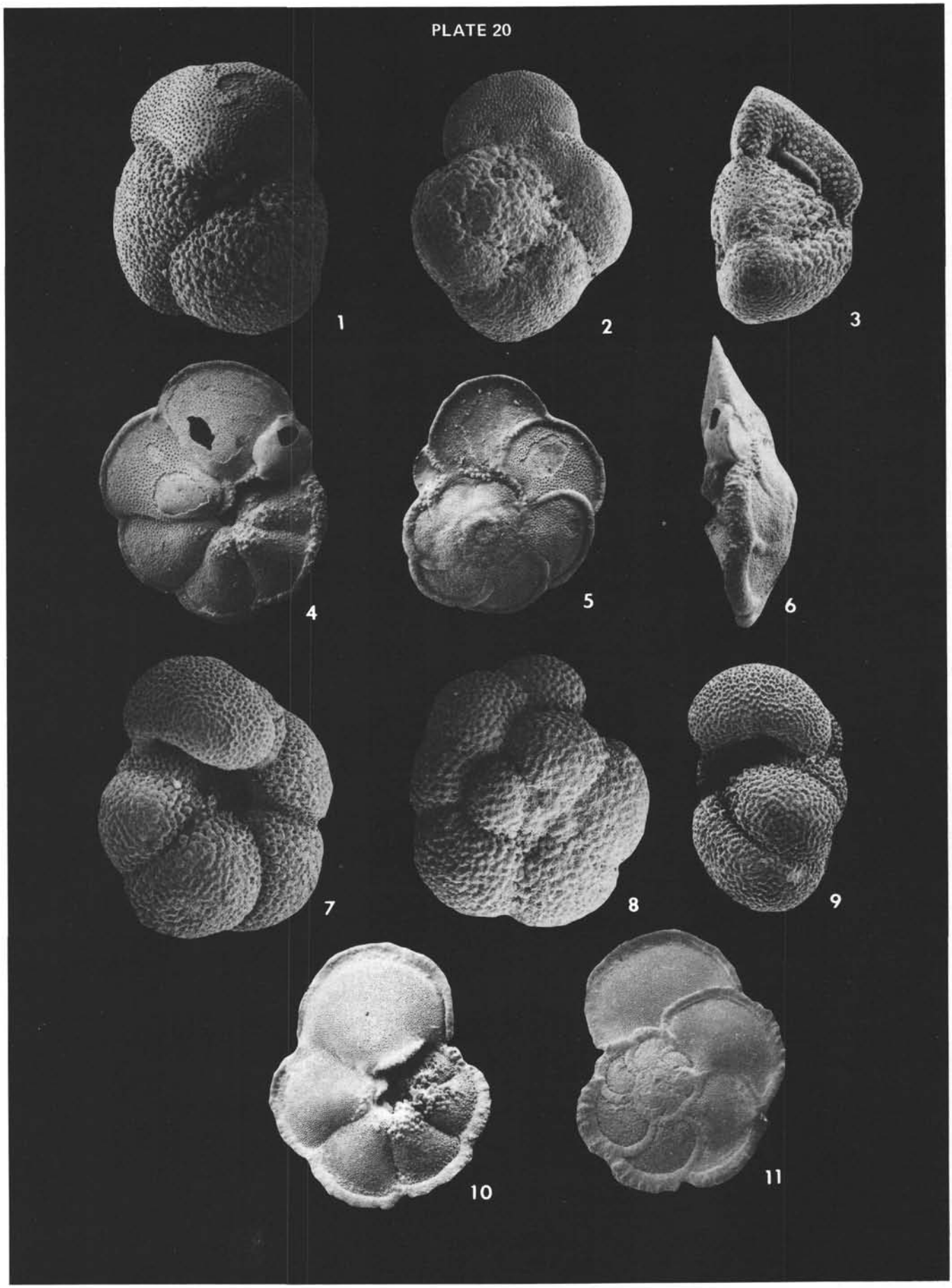

PLATE 21

Figures 1-3 *Globorotalia flexuosa* Koch. Site 200, Core 3, Section 2; *Globorotalia multicamerata-Pulleniatina obliquiloculata* Zone; Pliocene.
1. Umbilical view, X 50.
2. Spiral view, X 50.
3. Edge view, X 50.

Figures 4-6 *Globorotalia formosa formosa* Bolli. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
4. Umbilical view, X 100.
5. Spiral view, X 100.
6. Edge view, X 112.

Figures 7-9 *Globorotalia formosa gracilis* Bolli. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
7. Umbilical view, X 120.
8. Spiral view, X 110.
9. Side view, X 125

Figures 10-12 *Globorotalia* n. sp. Site 200, Core 9, Section 1; *Orbulina suturalis* Zone; middle Miocene.
10. Umbilical view, X 130.
11. Spiral view, X 115.
12. Side view, X 125.

PLATE 21

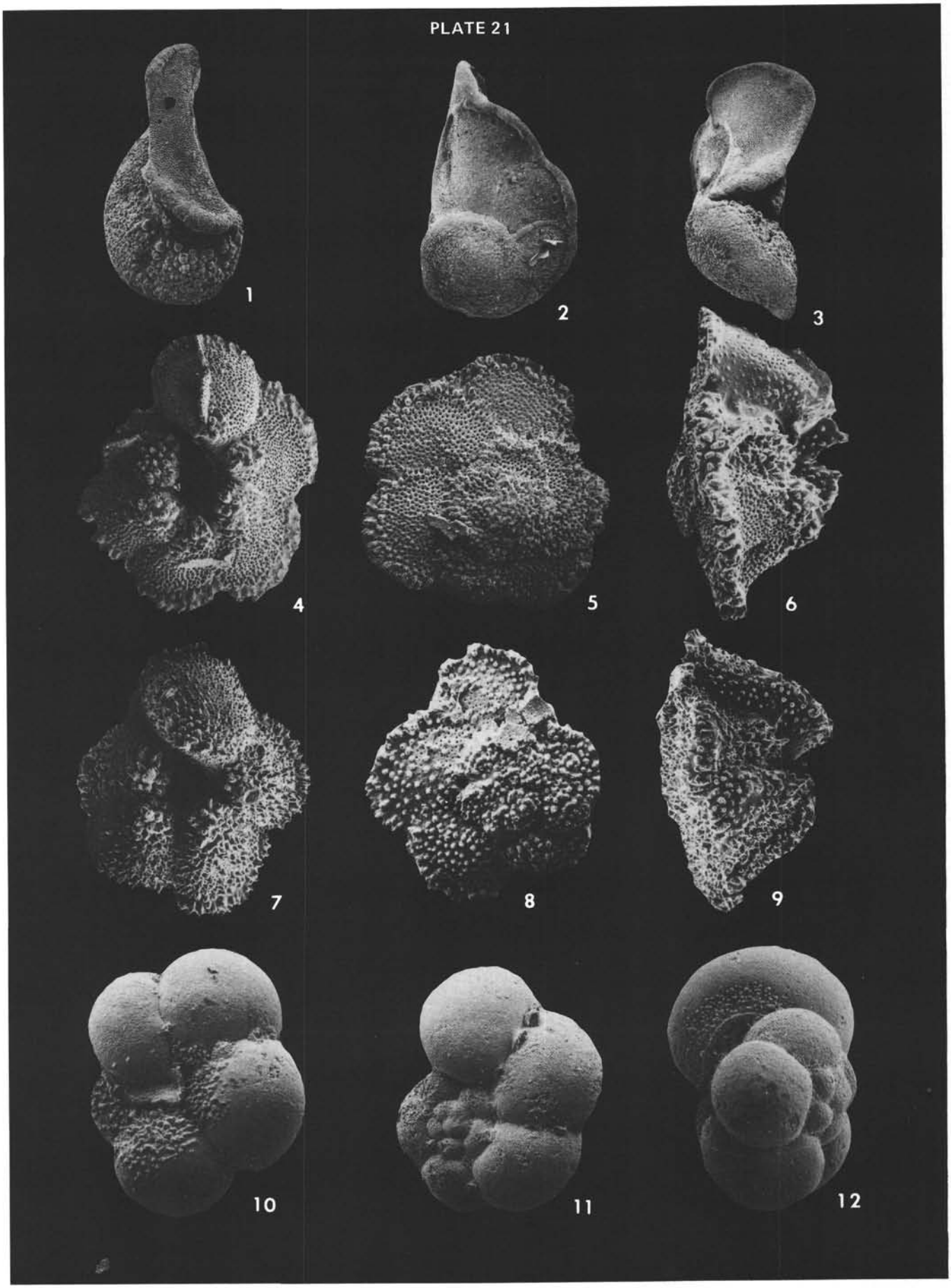

PLATE 22

Figures 1-3 *Globorotalia hirsuta* (d'Orbigny). Site 200, Core 3, core catcher; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
1. Umbilical view, X 85.
2. Spiral view, X 90.
3. Side view, X 103.

Figures 4-6 *Globorotalia hispicidaris* Loeblich and Tappan. Site 199, Core 8, Section 1 (107 cm); *Globorotalia velascoensis* Zone; late Paleocene.
4. Umbilical view, X 105.
5. Spiral view, X 100.
6. Side view, X 105.

Figures 7-9 *Globorotalia humerosa* Takayanagi and Saito. Site 200, Core 3, Section 3; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
7. Umbilical view, X 87.
8. Spiral view, X 80.
9. Side view, X 87.

Figures 10-12 *Globorotalia imitata* Subbotina. Site 199, Core 8, Section 1 (107 cm); *Globorotalia velascoensis* Zone; late Paleocene.
10. Umbilical view, X 265.
11. Spiral view, X 265.
12. Side view, X 265.

PLATE 22

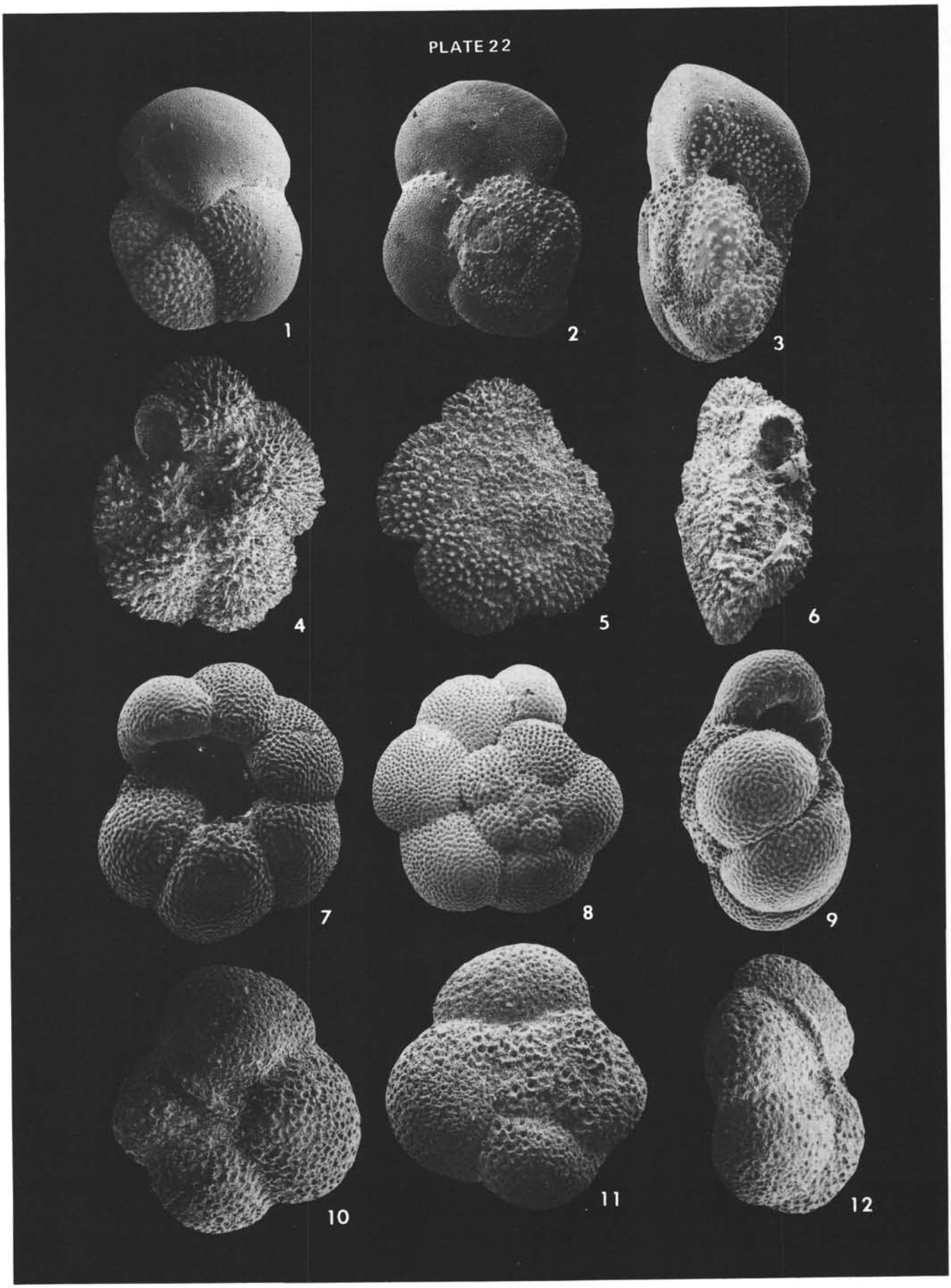

PLATE 23

Figures 1-3 *Globorotalia inflata* (d'Orbigny). Site 200, Core 2, core catcher; *Globorotalia tosaensis* Zone; late Pliocene.
1. Umbilical view, X 95.
2. Spiral view, X 85.
3. Side view, X 85.

Figures 4-6 *Globorotalia laevigata* Bolli. Site 199, Core 10, Section 2 (37-38 cm); *Globorotalia pseudomenardii* Zone; late Paleocene.
4. Umbilical view, X 105.
5. Spiral view, X 112.
6. Side view, X 125.

Figures 7-9 *Globorotalia lehneri* Cushman and Jarvis. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
7. Umbilical view, X 95.
8. Spiral view, X 110.
9. Side view, X 100.

Figures 10-12 *Globorotalia lensiformis* Subbotina. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
10. Umbilical view, X 160.
11. Spiral view, X 150.
12. Side view, X 185.

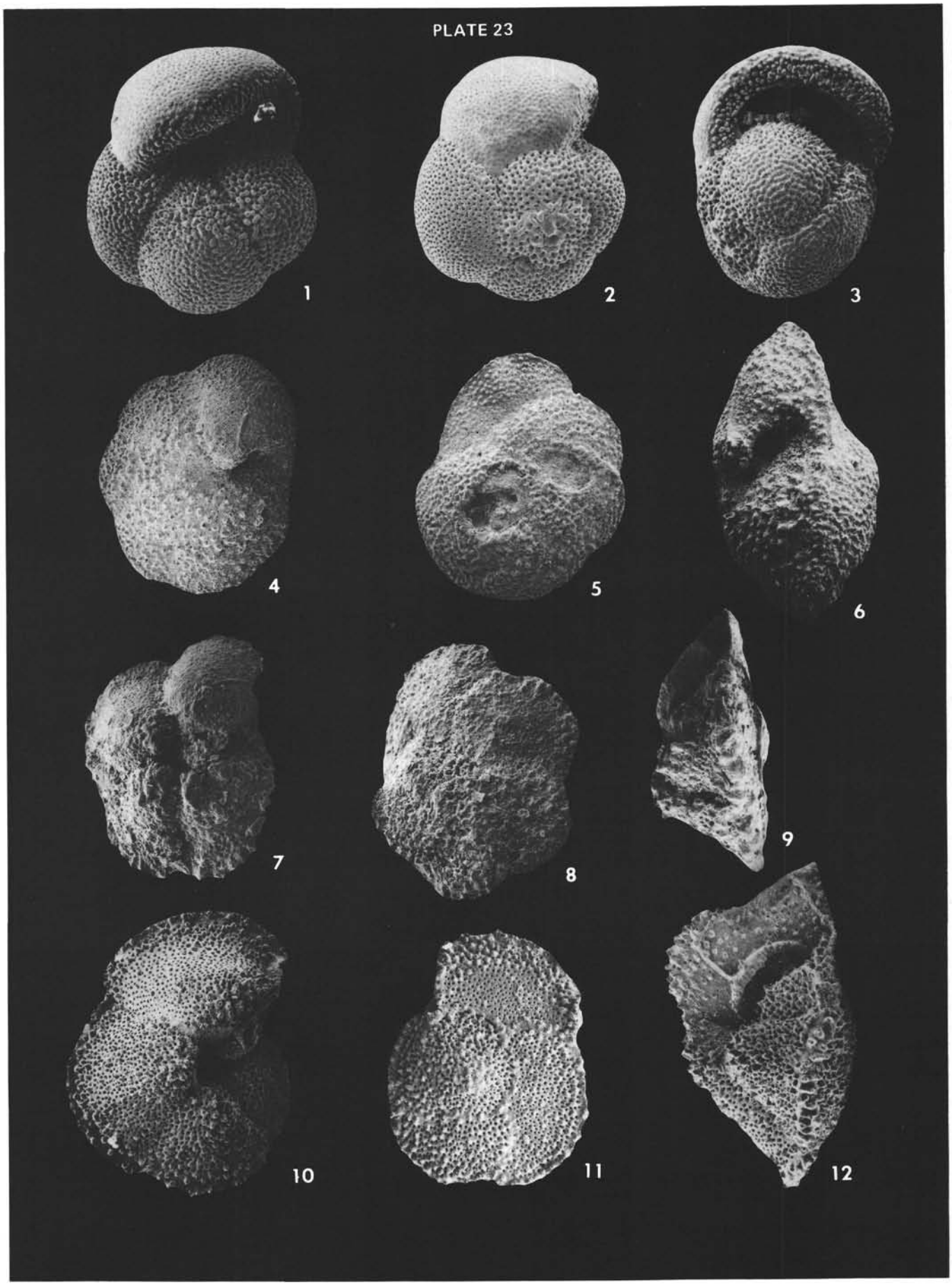
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PLATE 24

Figures 1-4 *Globorotalia margaritae* Bolli and Bermudez. Site 200, Core 3, Section 3; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.

1. Umbilical view, X 140.
2. Umbilical view, X 85.
3. Spiral view, X 85.
4. Side view, X 97.

Figures 5-7 *Globorotalia marginodentata* Subbotina. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.

5. Umbilical view, X 90.
6. Spiral view, X 90.
7. Side view, X 90.

Figures 8-10 *Globorotalia marksi* Martin. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.

8. Umbilical view, X 112.
9. Spiral view, X 112.
10. Side view, X 112.

Figures 11-13 *Globorotalia menardii* (Parker, Jones and Brady). Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

11. Umbilical view, X 95.
12. Spiral view, X 100.
13. Side view, X 104.

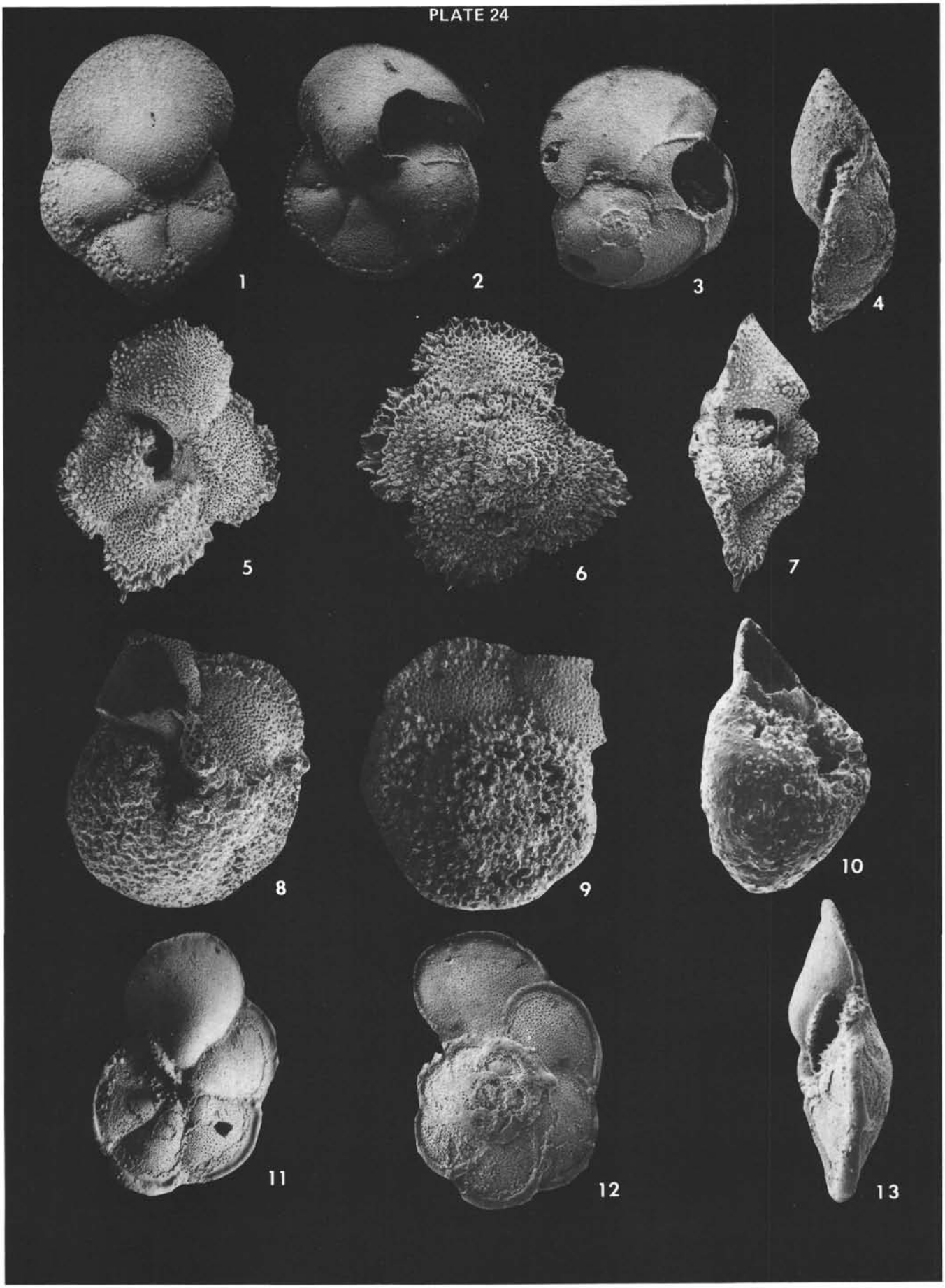
PLATE 24
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PLATE 25

Figures 1-3 *Globorotalia merotumida* Blow and Banner. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

1. Umbilical view, X 120.
2. Spiral view, X 105.
3. Side view, X 110.

Figures 4-6 *Globorotalia miocenica* Palmer. Site 200, Core 5, core catcher; *Globorotalia plesiotumida* Zone; late Miocene.

4. Umbilical view, X 100.
5. Spiral view, X 75.
6. Side view, X 120.

Figures 7-9 *Globorotalia multicamerata* Cushman and Jarvis. Core 200, Core 4, Section 1; *Globorotalia tumida-Sphaeroidinellopsis subdehiscens paenodehiscens* Zone; Pliocene.

7. Umbilical view, X 72.
8. Spiral view, X 78.
9. Side view, X 82.

PLATE 25

PLATE 26

Figures 1-3 *Globorotalia naussi* Martin. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
1. Umbilical view, X 185.
2. Spiral view, X 175.
3. Side view, X 175.

Figures 4-6 *Globorotalia occlusa* Loeblich and Tappan. Site 199, Core 10, Section 2 (37-38 cm); *Globorotalia velascoensis* Zone; late Paleocene.
4. Umbilical view, X 160.
5. Spiral view, X 175.
6. Side view, X 170.

Figures 7-9 *Globorotalia peripheroronda* Blow and Banner. Site 200, Core 9, core catcher; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
7. Umbilical view, X 115.
8. Spiral view, X 102.
9. Side view, X 135.

Figures 10-12 *Globorotalia plesiotumida* Blow and Banner. Site 200, Core 5, core catcher; *Globorotalia plesiotumida* Zone; late Miocene.
10. Umbilical view, X 70.
11. Spiral view, X 70.
12. Side view, X 72.

PLATE 26

PLATE 27

Figures 1-3 *Globorotalia pseudomenardii* Bolli. Site 199, Core 10, Section 2 (37-38 cm); *Globorotalia pseudomenardii* Zone; late Paleocene.

1. Umbilical view, X 135.
2. Spiral view, X 135.
3. Side view, X 150.

Figures 4-6 *Globorotalia pseudopachyderma* Cita, Premoli Silva, and Rossi. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

4. Umbilical view, X 200.
5. Spiral view, X 180.
6. Side view, X 200.

Figures 7-9 *Globorotalia pseudoscitula* Glaessner. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.

7. Umbilical view, X 220.
8. Spiral view, X 220.
9. Side view, X 260.

Figures 10-12 *Globorotalia quetra* Bolli. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.

10. Umbilical view, X 97.
11. Spiral view, X 97.
12. Edge view, X 87.

PLATE 27

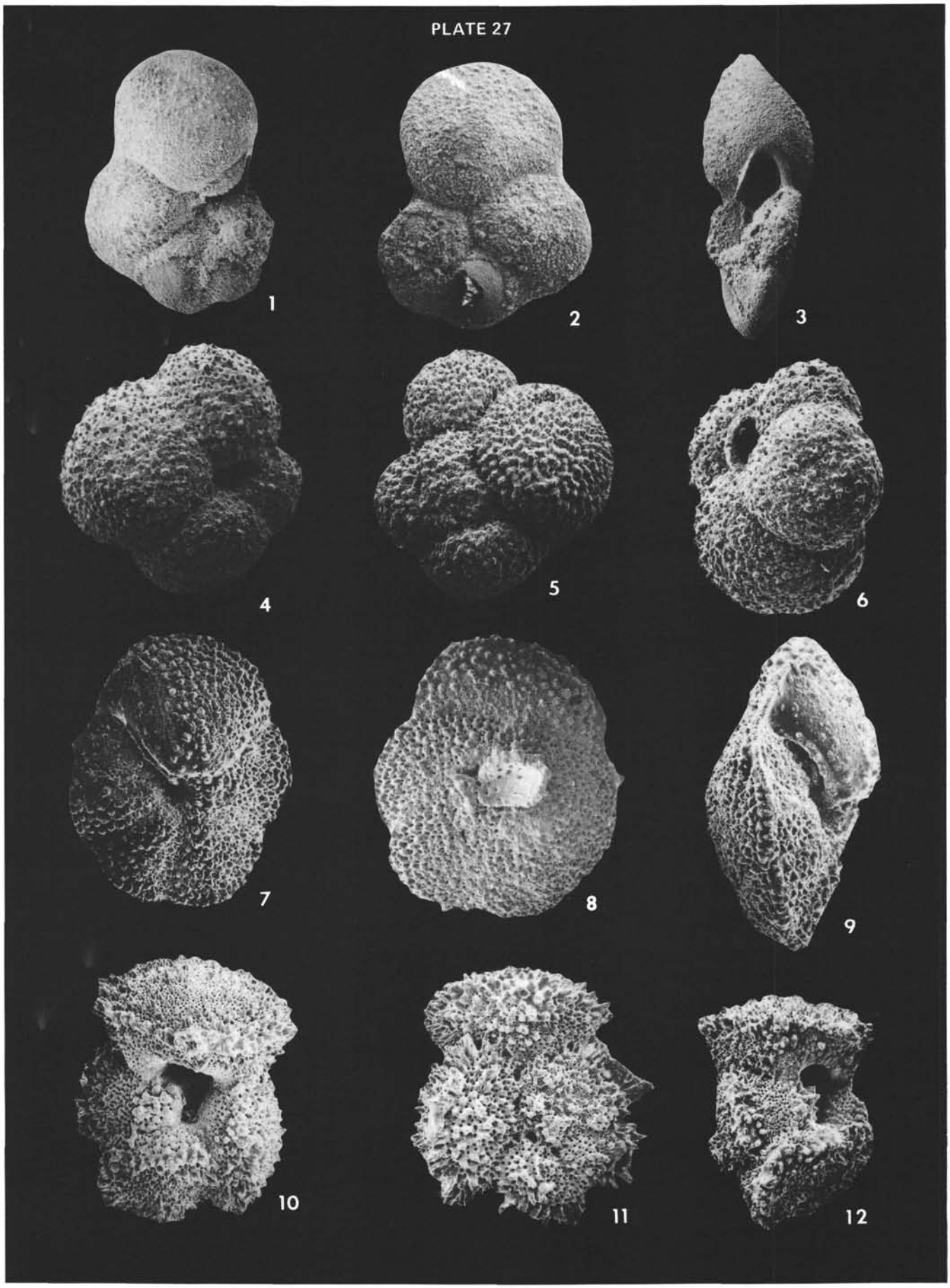

PLATE 28

Figures 1-3 *Globorotalia scitula* (Brady). Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.
1. Umbilical view, X 105.
2. Spiral view, X 105.
3. Side view, X 117.

Figures 4-6 *Globorotalia siakensis* Le Roy. Site 200, Core 10, core catcher (Hard limestone); *Globigerinatella insueta-Globigerinita dissimilis* Zone; early Miocene.
4. Umbilical view, X 140.
5. Spiral view, X 170.
6. Side view, X 170.

Figures 7-9 *Globorotalia spinulosa* Cushman. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
7. Umbilical view, X 100.
8. Spiral view, X 100.
9. Side view, X 118.

Figures 10-12 *Globorotalia subbotinae* Morozova. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
10. Umbilical view, X 135.
11. Spiral view, X 135.
12. Side view, X 125.

PLATE 28

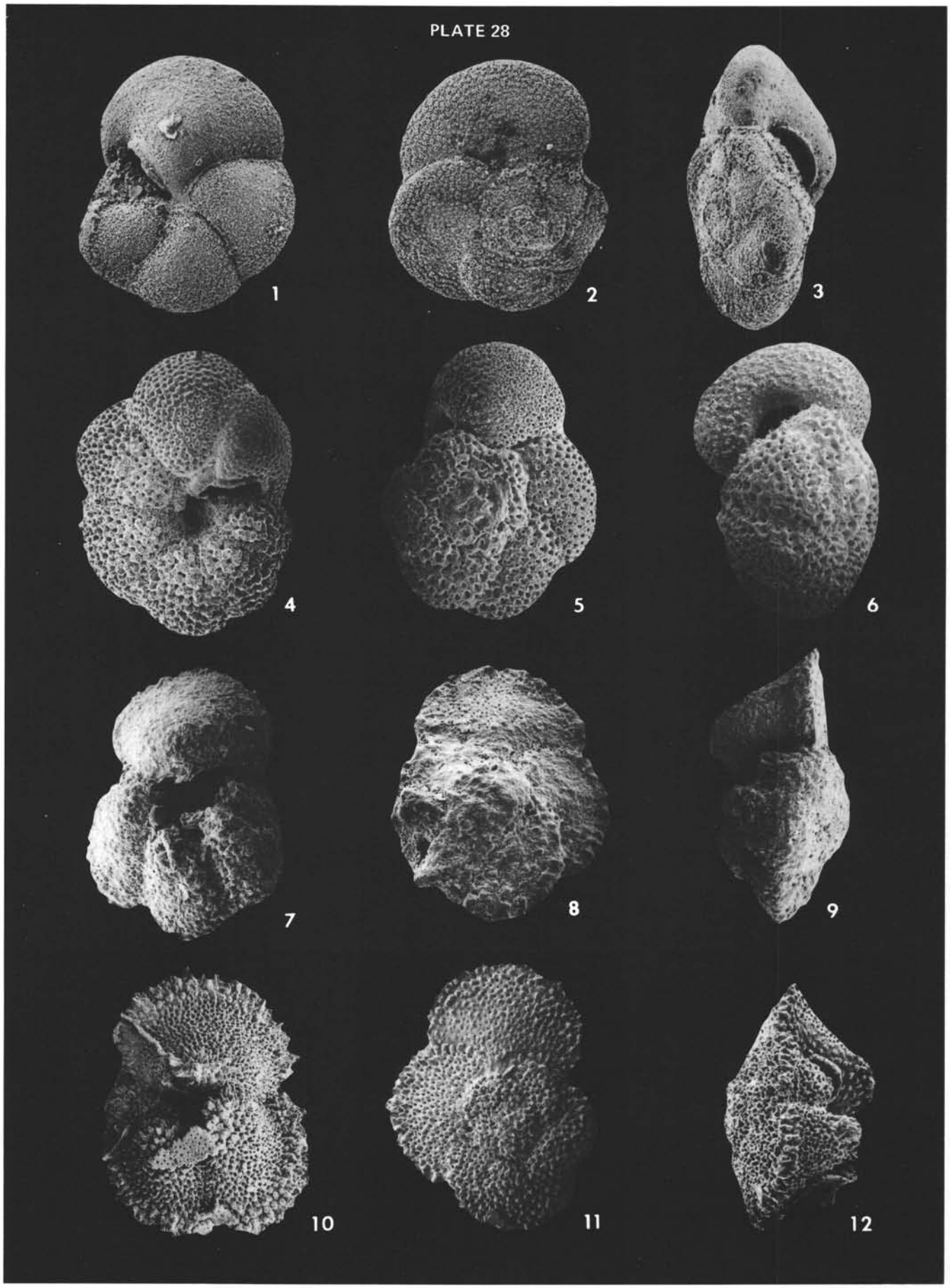

PLATE 29

Figures 1-3 *Globorotalia tosaensis* Takayanagi and Saito. Site 200, Core 2, Section 2; *Globorotalia tosaensis* Zone.
1. Umbilical view, X 125.
2. Spiral view, X 100.
3. Side view, X 115.

Figures 4-6 *Globorotalia troelseni* Loeblich and Tappan. Site 200A, Core 2, core catcher; *Globorotalia formosa formosa* Zone; early Eocene.
4. Umbilical view, X 190.
5. Spiral view, X 177.
6. Edge view, X 207.

Figures 7-9 *Globorotalia truncatulinoides* (d'Orbigny). Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.
7. Umbilical view, X 76.
8. Spiral view, X 74.
9. Side view, X 69.

Figures 10-12 *Globorotalia tumida* (Brady). Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.
10. Umbilical view, X 52.
11. Spiral view, X 53.
12. Edge view, X 58.

PLATE 29

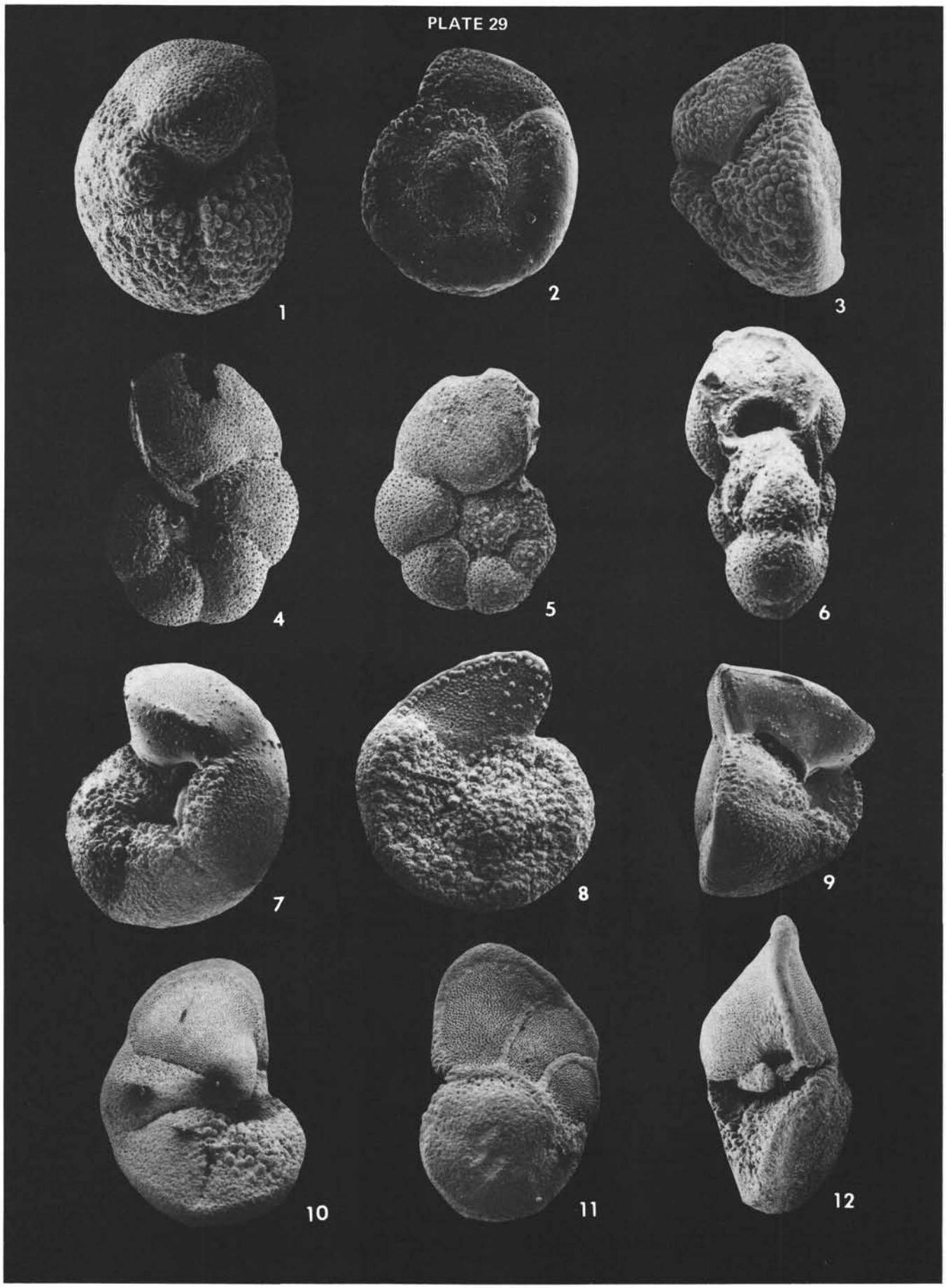

PLATE 30

Figures 1-3 *Globorotalia ungulata* Bermudez. Site 200, Core 3, core catcher; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; early Pliocene.
1. Umbilical view, X 98.
2. Spiral view, X 88.
3. Side view, X 95.

Figures 4-6 *Globorotalia velascoensis* Cushman. Site 199, Core 10, Section 2; *Globorotalia velascoensis* Zone; late Paleocene.
4. Umbilical view, X 98.
5. Spiral view, X 94.
6. Side view, X 106.

Figures 7-9 *Globorotalia wilcoxensis* Cushman and Ponton. Site 200A, Core 2, core catcher; *Globoratalia formosa formosa* Zone; early Eocene.
7. Umbilical view, X 110.
8. Spiral view, X 100.
9. Side view, X 110.

Figures 10-12 *Globorotaloides hexagona* (Natland). Site 200, Core 2, Section 2; *Globorotalia tosaensis* Zone; late Pliocene.
10. Umbilical view, X 160.
11. Spiral view, X 160.
12. Edge view, X 160.

PLATE 30

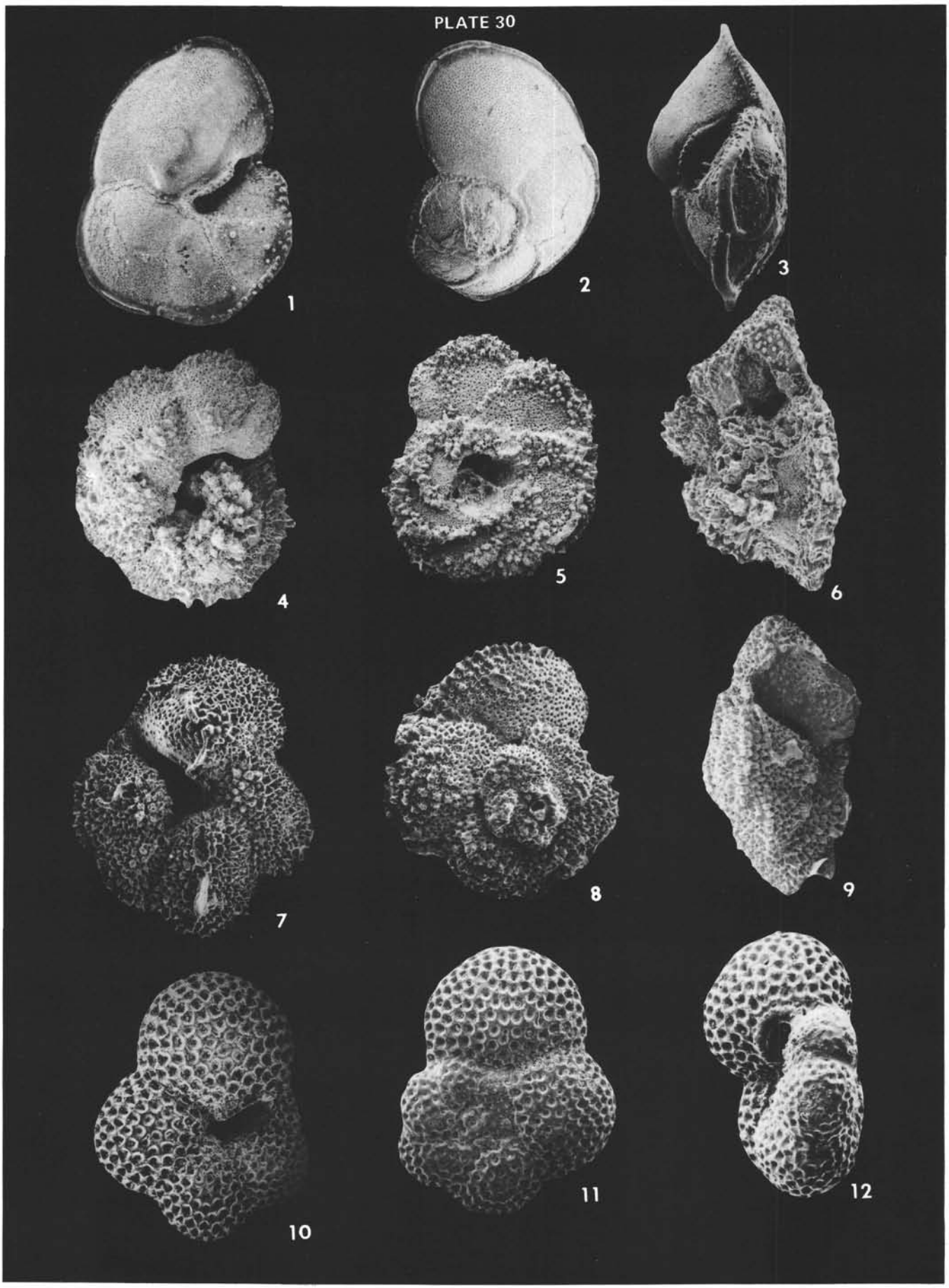

PLATE 31

Figures 1-2 — *Guembelitria irregularis* Morozova. Site 199, Core 10, Section 2; "*Globigerina*" *eugubina* Zone.
1. Umbilical view X 500.
2. Spiral view, X 550.

Figures 3, 6 — *Hantkenina alabamensis* Cushman. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.
3. Side view, X 75.
6. Edge view, X 92.

Figures 4-5 — *Hastigerina pelagica* (d'Orbigny). Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
4. Edge view, X 150.
5. Side view, X 150.

Figures 7-9 — *Hastigerna siphonifera* (d'Orbigny). Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.
7. Edge view, X 87.
8. Side view, X 90.
9. Edge view, X 82.

Figure 10 — *Orbulina suturalis* Bronnimann; X100. Site 200, Core 9, Section 1 (top); *Orbulina suturalis* Zone; middle Miocene.

Figure 11 — *Orbulina universa* d'Orbigny; X90. Site 200, Core 6, core catcher; *Globorotalia acostaensis-Globorotalia merotumida* Zone; late Miocene.

Figure 12 — *Orbulinoides beckmanni* (Saito); X75. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.

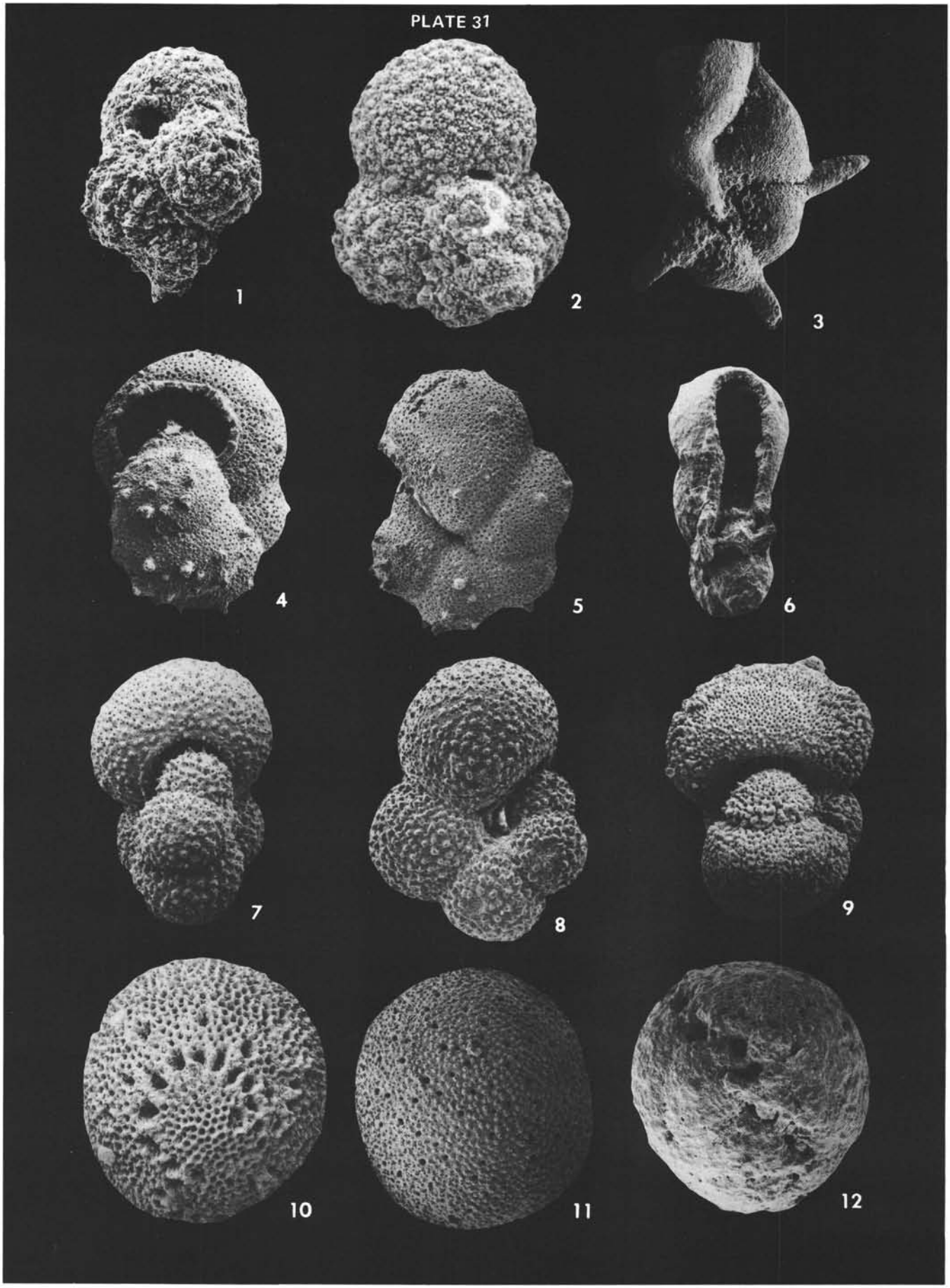
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PLATE 32

Figure 1 — *Praeorbulina glomerosa curva* (Blow); ×85. Site 200, Core 9, Section 2; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.

Figure 2 — *Praeorbulina glomerosa glomerosa* (Blow); ×100. Site 200, Core 9, Section 1; *Orbulina suturalis* Zone; middle Miocene.

Figures 3-4 — *Praeorbulina transistoria* (Blow). Site 200, Core 9, Section 5; *Globigerinoides sicanus-Globigerinatella insueta* Zone; early Miocene.
3. Spiral view, × 85.
4. Umbilical view, × 82.

Figures 5-7 — *Pullenilatina obliquiloculata* (Parker and Jones). Site 200, Core 3, core catcher; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
5. Umbilical view, × 107.
6. Spiral view, × 104.
7. Side view, × 100.

Figures 8-10 — *Pulleniatina primalis* Banner and Blow. Site 200, Core 5, core catcher; *Globorotalia plesiotumida* Zone; late Miocene.
8. Umbilical view, × 125.
9. Spiral view, × 117.
10. Side view, × 130.

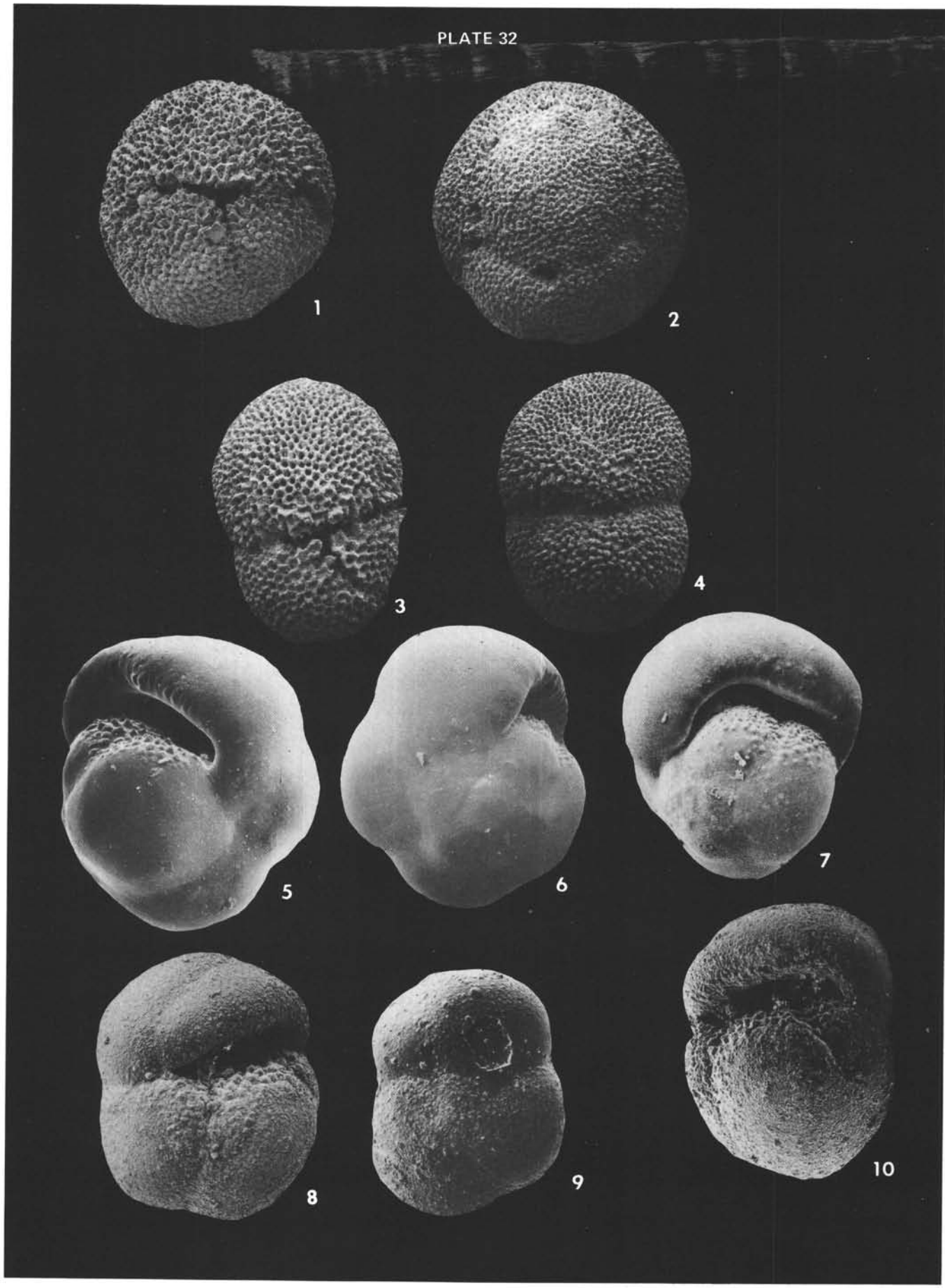
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PLATE 33

Figures 1-3 *Pulleniatina spectablis* Parker. Site 200, Core 3, Section 4; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone.

1. Umbilical view, X 89.
2. Spiral view, X 90.
3. Side view, X 100.

Figure 4-9 *Rugoglobigerina*? Site 199, Core 12; Campanian-Maastrichtian

PLATE 33

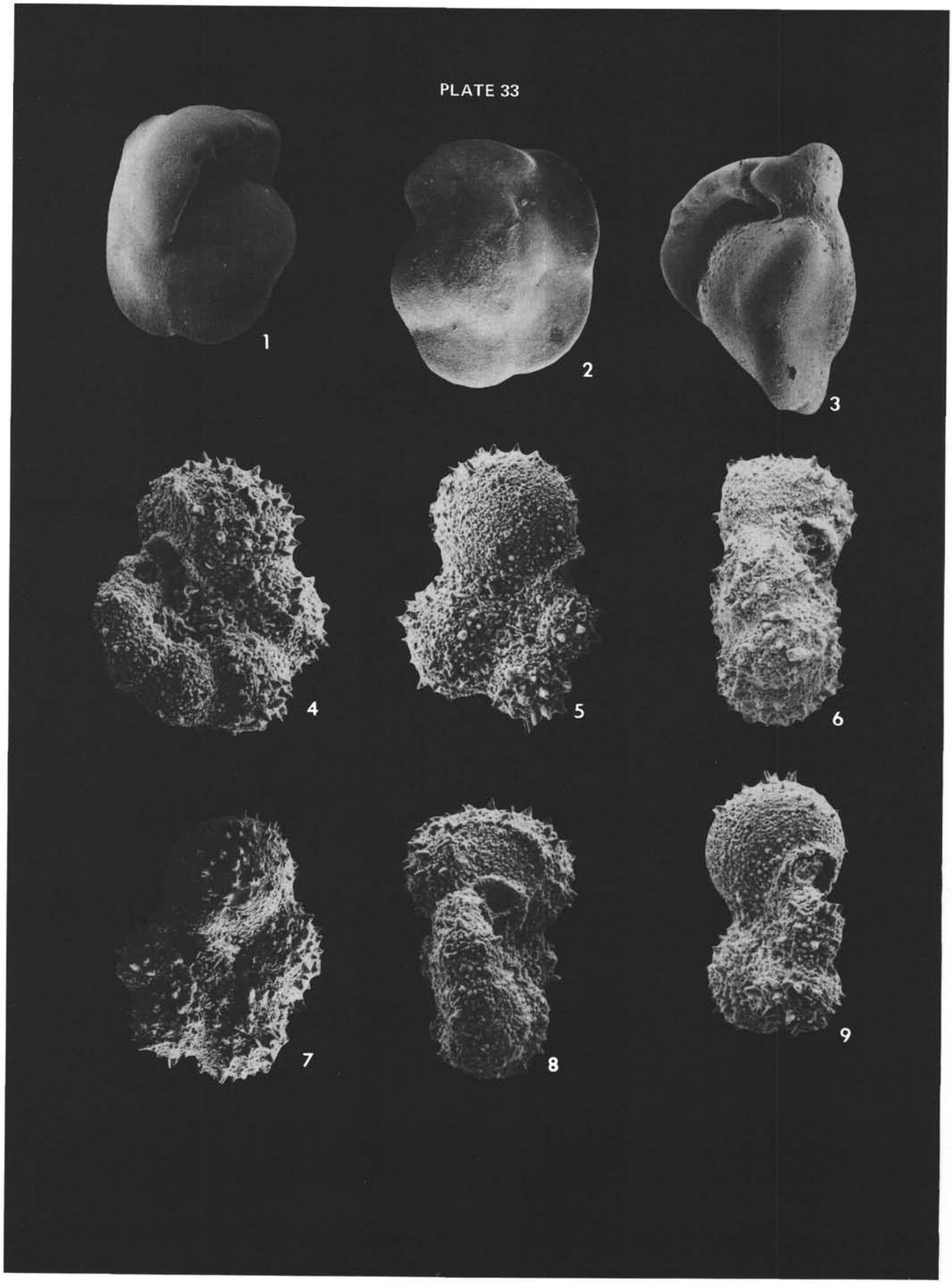

PLATE 34

Figures 1-2 *Sphaeroidinella dehiscens* (Parker and Jones). Site 200, Core 1, core catcher; *Globorotalia truncatulinoides* Zone; Pleistocene.
1. Umbilical view, X 64.
2. Spiral view, X 60.

Figures 3-5 *Sphaeroidinellopsis seminulina kochi* (Caudri). Site 200, Core 4, Section 3; *Globorotalia tumida-Sphaeroidinellopsis subdehiscens paenodehiscens* Zone; early Miocene.
3. Umbilical view, X 50.
4. Spiral view, X 50.
5. Side view, X 50.

Figures 6-7 *Sphaeroidinellopsis seminulina seminulina* (Schwager). Site 200, Core 6, core catcher; *Globorotalia acostaensis, Globorotalia merotumida* Zone; late Miocene.
6. Umbilical view, X 86.
7. Spiral view, X 72.

Figures 8-9 *Sphaeroidinellopsis subdehiscens* (Blow). Site 200, Core 3, Section 4; *Sphaeroidinella dehiscens-Globoquadrina altispira* Zone; Pliocene.
8. Umbilical view, X 130.
9. Spiral view, X 105.

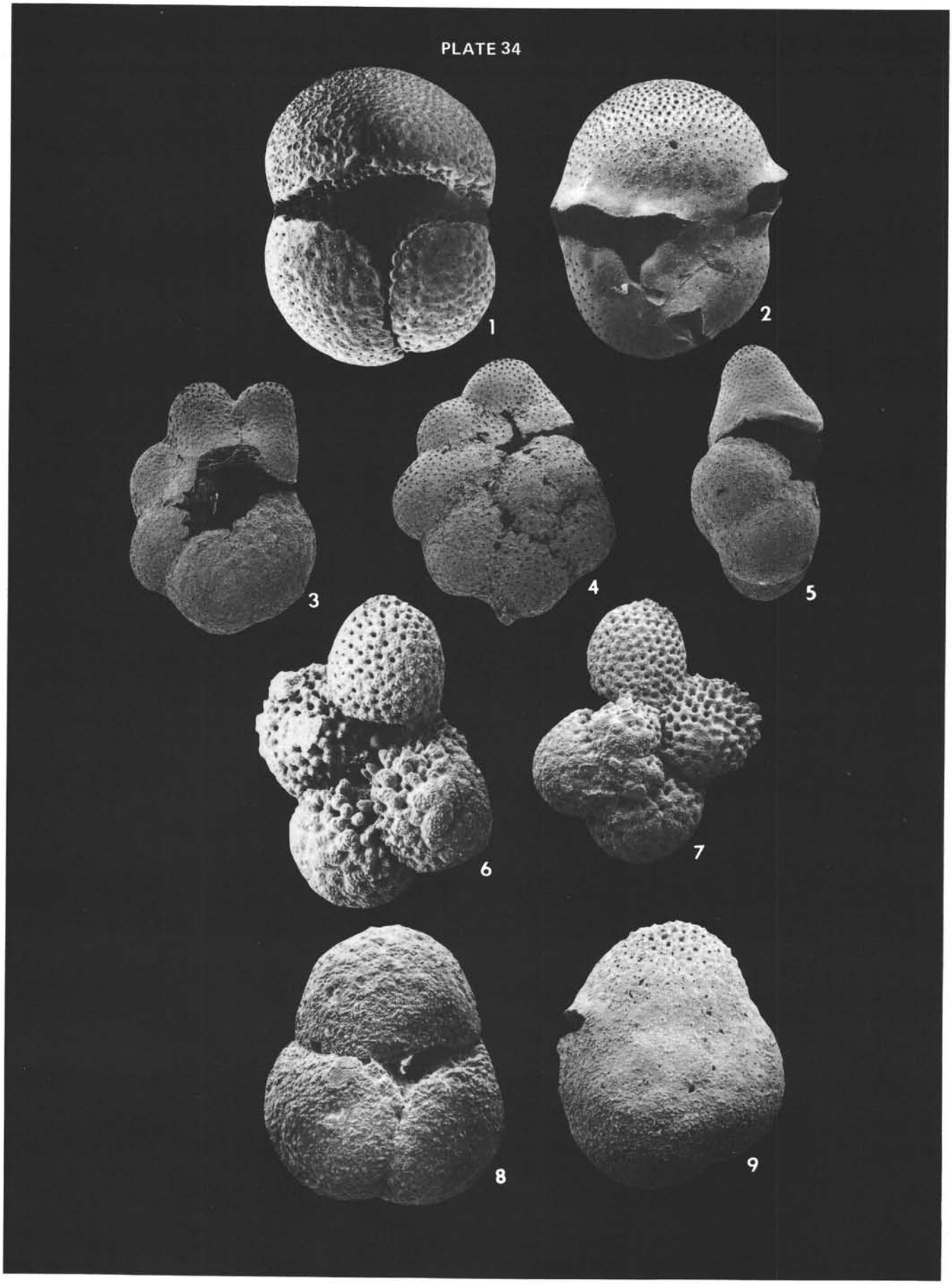
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PLATE 35

Figures 1-3 *Truncorotaloides rohri* Bronnimann and Bermudez. Site 202, Core 2, core catcher; *Orbulinoides beckmanni* Zone; middle Eocene.

1. Umbilical view, X 160.
2. Spiral view, X 160.
3. Side view, X 160.

Figures 4-6 *Truncorotaloides topilensis* (Cushman). Site 202, Core 2, core catcher, *Orbulinoides beckmanni* Zone; middle Eocene.

4. Umbilical view, X 135.
5. Spiral view, X 130.
6. Side view, X 135.

Figures 7-8 *Turborotalita humilis* (Brady). Site 200, Core 1, Section 1; *Globorotalia truncatulinoides* Zone; Pleistocene.

7. Umbilical view, X 275.
8. Spiral view, X 25.


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