RANGES AND AGES

The ranges and ages of 150 species of Radiolaria are summarized in this section in three ways.

1. We have prepared three graphic range charts, one for the low-latitude Neogene, one for the low-latitude Paleogene, and one for the middle-latitude Neogene. Species are arranged in order of morphotypic last appearances. The letter “m” at either end of a range denotes a morphotypic first or last appearance; the letter “e” denotes an evolutionary transition.

2. For the middle Miocene to Holocene we have prepared a chart of reported low-latitude absolute ages. “Tm” denotes a morphotypic last appearance, “Bm” denotes a morphotypic first appearance, and an arrow indicates an evolutionary transition. Ages that are shaded were considered by the original authors to be unreliable. The absolute ages used are in accordance with the chronostratigraphy of Berggren et al. (1985). For further information see the original reports.

3. The radiolarian events shown on the zonal description sheets have been summarized in a single chart. A dash in front of the event (or group of events) separates it in time from the event(s) above and below. Events separated by semicolons are approximately synchronous. The first and last appearance of a taxon is indicated as “Bm” (earliest morphotypic appearance) and “Tm” (latest morphotypic appearance) and an evolutionary transition is shown with an arrow. “Morphotypic” and “evolutionary” limits, as applied in the zonal definitions, are explained in Riedel and Sanfilippo (1971, p. 1530)

Table 1. Low-latitude Neogene radiolarian ranges.

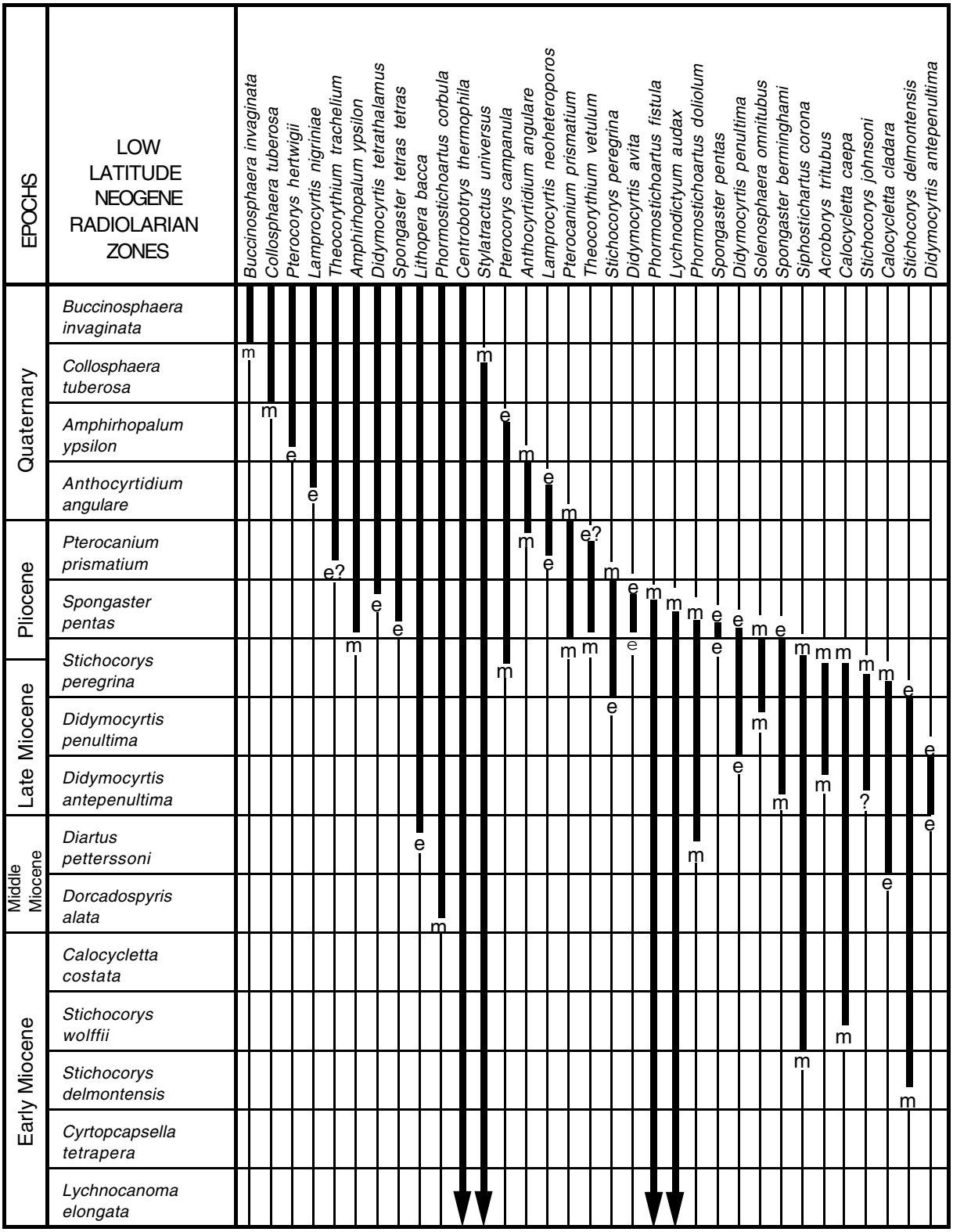
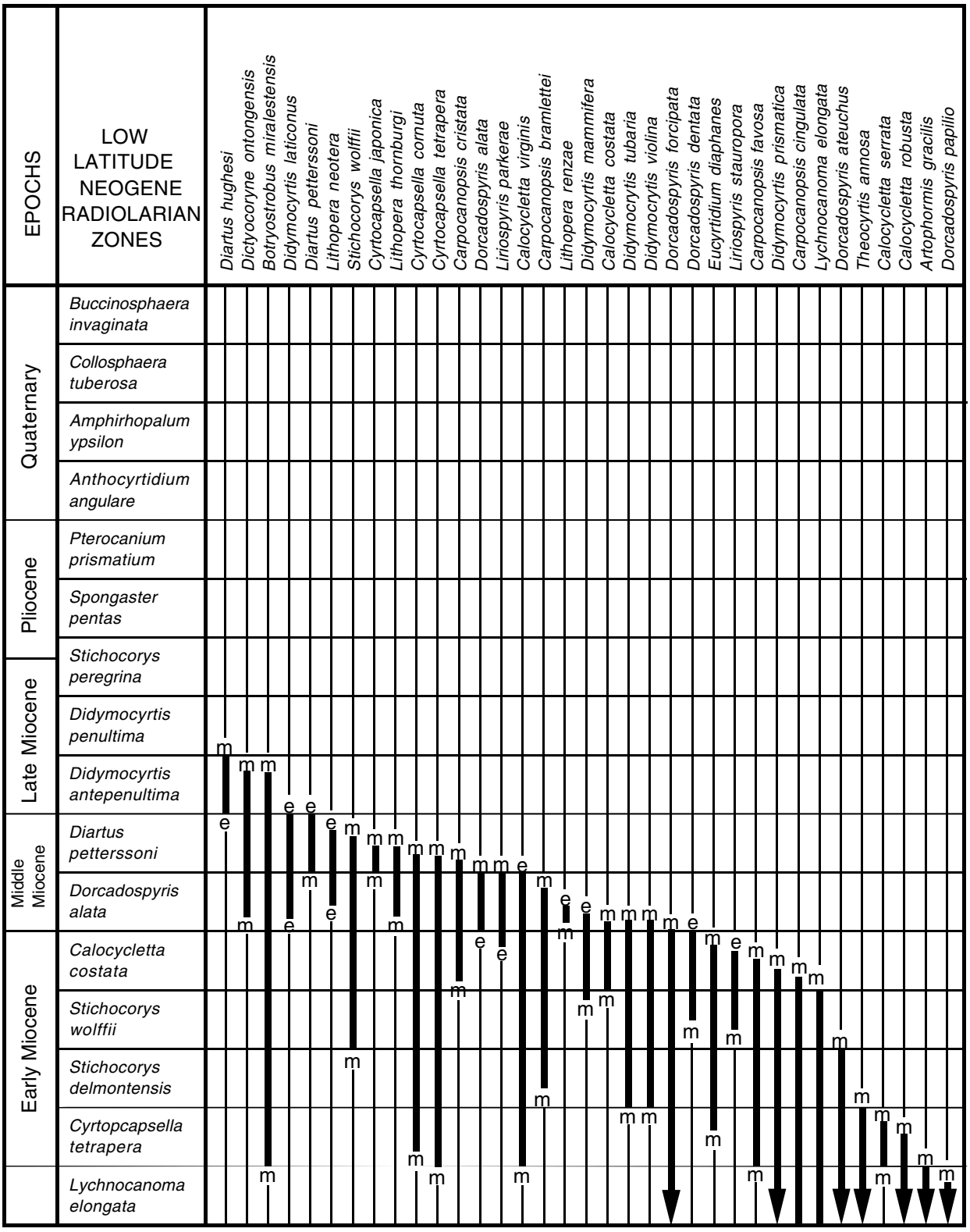


Table 1 (continued).



Notes. A first or last morphotypic appearance = m. An evolutionary transition = e.

Table 2. Low-latitude Paleogene radiolarian ranges.

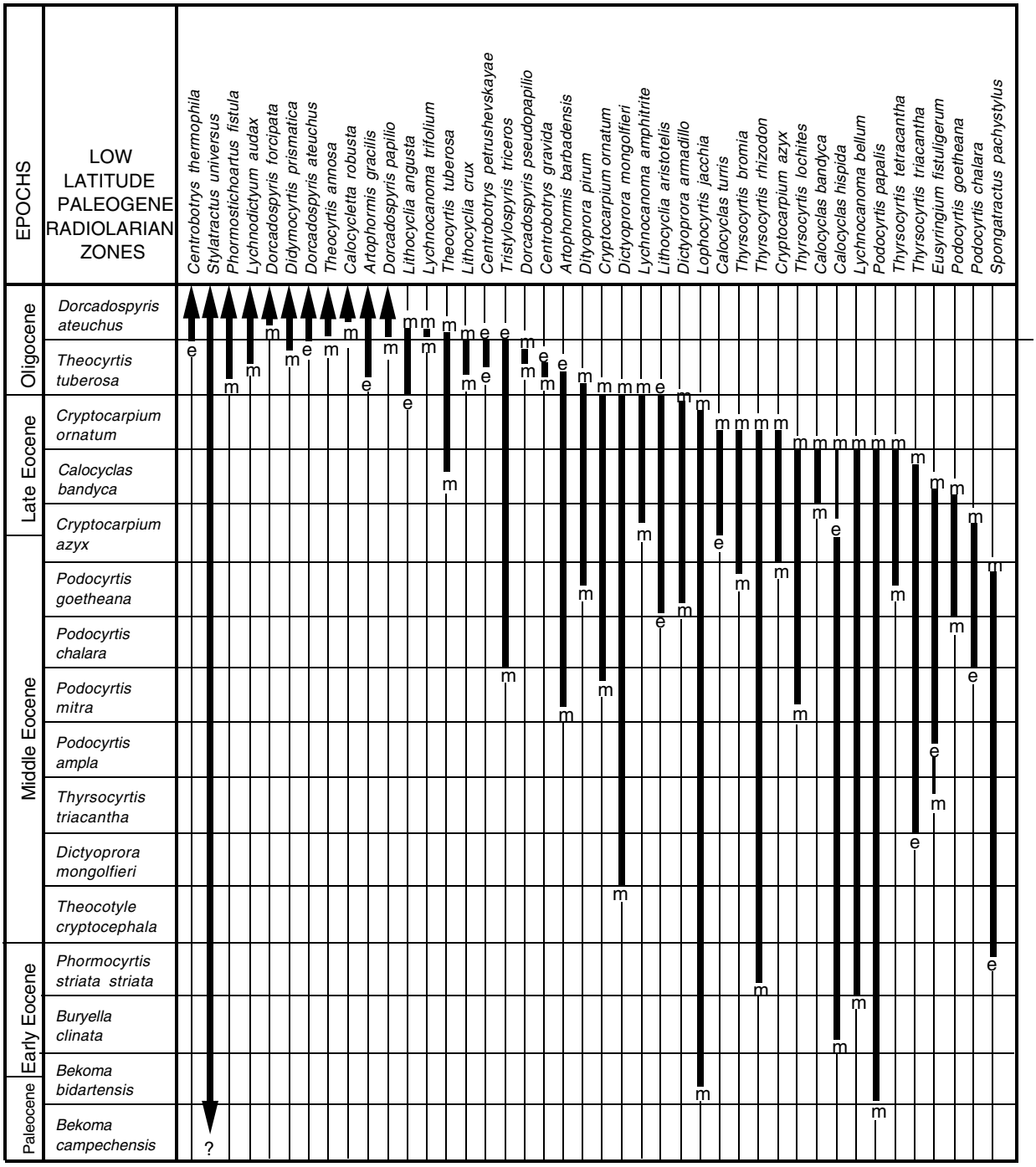
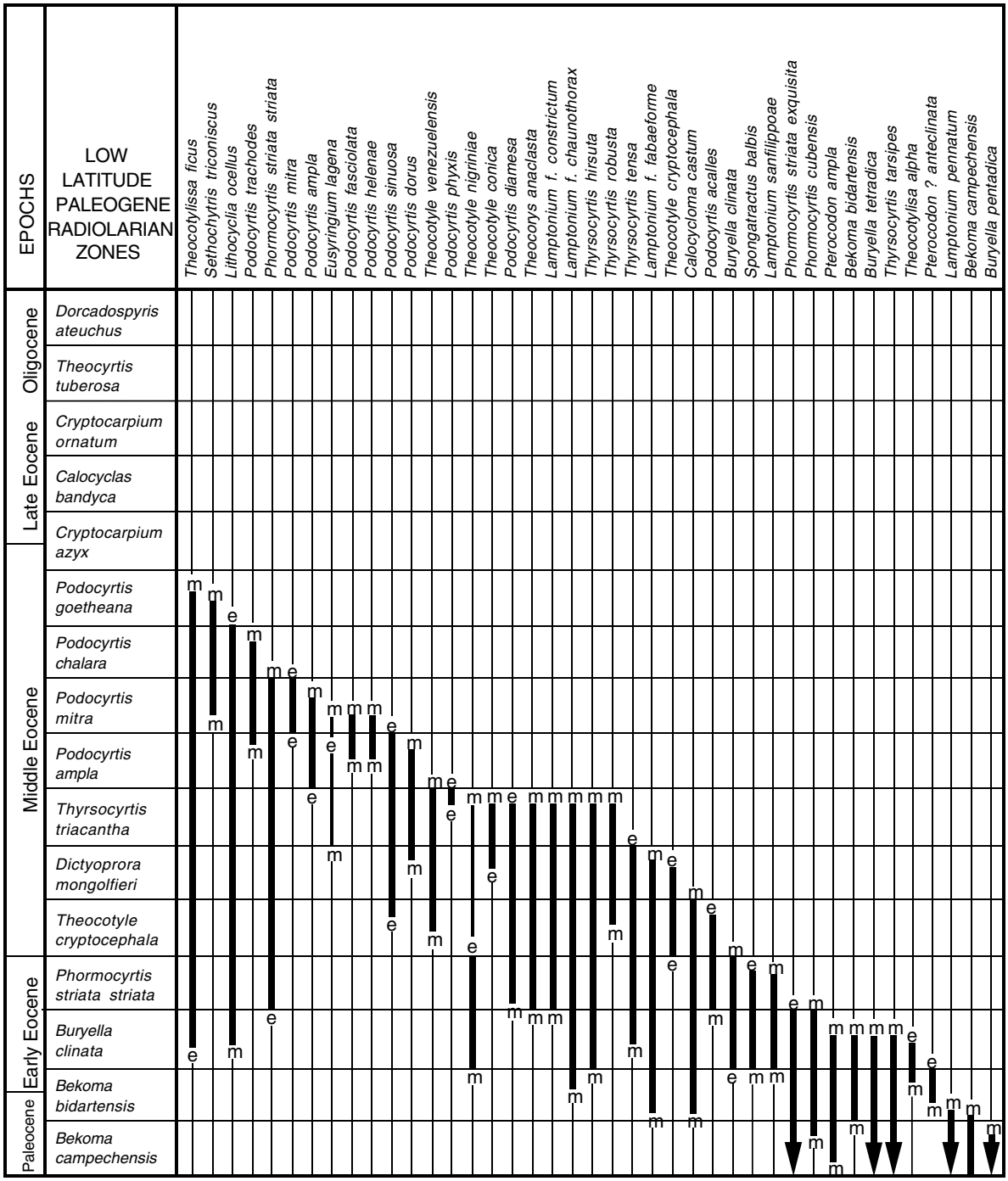
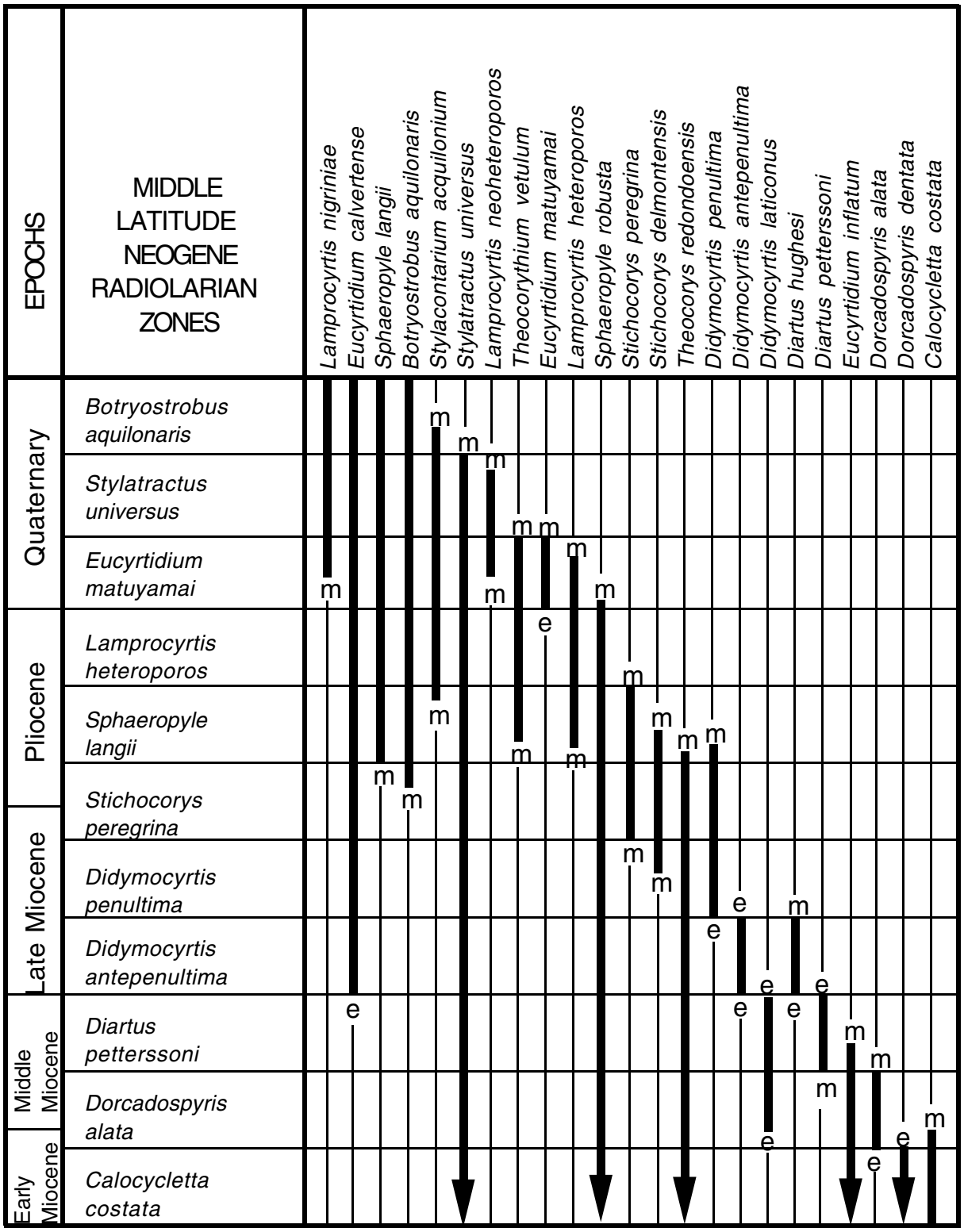


Table 2 (continued).



Notes. A first or last morphotypic appearance = m. An evolutionary transition = e.

Table 3. Middle-latitude Neogene radiolarian ranges.



Notes. A first or last morphotypic appearance = m. An evolutionary transition = e.

Table 4 A–F. Low-latitude absolute ages. **(A)** Indian Ocean—Quaternary and Pliocene (continued on next page).

EPOCH	RADIOLARIAN EVENT		literature	Indian Ocean							
				MD 81-357	MD 81-369	MD 81-374	MD 81-375	RC 14-22	VM 29-40	VM 34-53	DSDP 214
			source	1	1	1	1	1	1	1	2, 3
Quaternary	Bm	*Buccinosphaera invaginata*									
	Tm	*Stylatractus universus*				0.46 0.49		0.45 0.47		0.37 0.41	
	Bm	*Collosphaera tuberosa*				0.42 0.46		0.57 0.59		0.41 0.47	
	Tm	*Pterocorys campanula*			0.75 0.78	0.72 0.77		0.73 0.76			
	Bm	*Pterocorys hertwigii*			0.81 0.84			0.82 0.84			0.7 1.0
	Tm	*Anthocyrtidium angulare*			0.99 1.02			1.01 1.04			0.9 1.0
	Bm	*Lamprocyrtis nigriniae*			1.02 1.04			1.04 1.07			
	Tm	*Lamprocyrtis neoheteroporos*			1.09 1.12			1.10 1.13			
Pliocene	Tm	*Pterocanium prismatium*			1.54 1.56	1.27 1.37		1.52 1.55			1.6 1.7
	Bm	*Anthocyrtidium angulare*			1.63 1.64	1.46 1.56	1.63 1.80	1.59 1.62			1.7 1.8
	Tm	*Theocorythium vetulum*			1.86 1.89	1.81 1.89		1.81 1.85			1.7 1.8
	Bm	*Lamprocyrtis neoheteroporos*			2.51 2.54	2.29 2.31	2.41 2.44				
	Bm	*Theocorythium trachelium*			2.54 2.56	2.39 2.42	2.44 2.56		2.46 2.54		2.4 2.5
	Tm	*Stichocorys peregrina*			2.62 2.64	2.46 2.59	2.63 2.68		2.62 2.70		2.6 2.7
	Ev	*D. avita* *-> D. tetrathalamus*									
	Tm	*Phormostichoartus fistula*			3.26 3.28		3.23 3.26		3.23 3.30		3.3 3.4
	Tm	*Lychnodictyum audax*			3.33 3.35		3.29 3.32		3.30 3.37		3.3 3.4
	Tm	*Phormostichoartus doliolum*			3.53 3.55		3.50 3.55		3.51 3.58		3.4 3.5
	Bm	*Amphirhopalum ypsilon*		3.73 3.76	3.78 3.80		3.73 3.80		3.74 3.82		3.6 3.7
	Tm	*Spongaster pentas*		3.70 3.73	3.80 3.81		3.73 3.80		3.74 3.82		3.5 3.6
	Bm	*Spongaster tetras tetras*		3.70 3.73	3.83 3.85		3.73 3.80		3.74 3.82		3.6 3.7
	Ev	*D. penultima* *-> D. avita*									
	Bm	*Theocorythium vetulum*									
	Tm	*Spongaster berminghami*		3.76 3.78	3.85 3.87		3.80 3.85				3.8 3.9

Table 4 (continued). (B) Pacific Ocean—Quaternary and Pliocene (continued on next page).

EPOCH	RADIOLARIAN EVENT		Pacific Ocean		
			Western	Central	Eastern
		literature	DSDP 586/289	DSDP 573	DSDP 503A
		source	2, 3	2, 3	3
Quaternary	Bm	*Buccinosphaera invaginata*			
	Tm	*Stylatractus universus*			
	Bm	*Collosphaera tuberosa*		0.6 0.7	
	Tm	*Pterocorys campanula*	0.4 0.6	0.7 1.1	
	Bm	*Pterocorys hertwigii*	0.6 0.9	0.6 0.8	
	Tm	*Anthocyrtidium angulare*	0.8 0.9	1.1 1.2	1.1 1.2
	Bm	*Lamprocyrtis nigriniae*	1.0 1.1	1.1 1.2	1.4 1.5
	Tm	*Lamprocyrtis neoheteroporos*	1.1 1.4	1.1 1.2	
Pliocene	Tm	*Pterocanium prismatium*	1.4 1.5	1.6 1.7	1.5 1.6
	Bm	*Anthocyrtidium angulare*	1.4 1.5	1.7 1.8	1.4 1.5
	Tm	*Theocorythium vetulum*		1.3 1.4	1.1 1.2
	Bm	*Lamprocyrtis neoheteroporos*	2.9 3.0	3.0 3.3	
	Bm	*Theocorythium trachelium trachelium*	1.4 1.5	1.4 1.5	1.5 1.6
	Tm	*Stichocorys peregrina*	2.5 2.6	2.6 2.7	2.7 2.9
	Ev	*D. avita* -> *D. tetrathalamus*			
	Tm	*Phormostichoartus fistula*	3.2 3.3	3.2 3.3	3.2 3.3
	Tm	*Lychnodictyum audax*	3.4 3.5		3.4 3.5
	Tm	*Phormostichoartus doliolum*	3.5 3.6	3.5 3.6	3.5 3.6
	Bm	*Amphirhopalum ypsilon*	3.5 3.6	3.7 3.8	3.6 3.7
	Tm	*Spongaster pentas*	3.4 3.5	3.2 3.3	3.0 3.1
	Bm	*Spongaster tetras tetras*	3.6 3.7	3.8 3.9	3.7 3.8
	Ev	*D. penultima* -> *D. avita*			
	Bm	*Theocorythium vetulum*			
	Tm	*Spongaster berminghami*	4.2 4.3	4.5 4.6	3.9 4.0

Table 4 (continued). (C) Indian Ocean—Late Miocene (continued on next page).

EPOCH	RADIOLARIAN EVENT		literature	Indian Ocean							
				MD 81-357	MD 81-369	MD 81-374	MD 81-375	RC 14-22	VM 29-40	VM 34-53	DSDP 214
			source	1	1	1	1	1	1	1	2, 3
Late Miocene	Bm	*Spongaster pentas*		4.20 4.23	4.23 4.24		4.29 4.34				4.2 4.3
	Bm	*Pterocanium prismatium*									5.7 5.8
	Tm	*Solenosphaera omnitubus omnitubus*		4.36 4.39							4.7 4.8
	Tm	*Siphostichartus corona*									5.0 5.1
	Bm	*Pterocorys campanula*									
	Tm	*Acrobotrys tritubus*									5.3 5.4
	Tm	*Calocycletta caepa*									
	Tm	*Stichocorys johnsoni*									5.7 5.8
	Tm	*Calocycletta cladara*									
	Ev	*S. delmontensis -> S. peregrina*									6.1 6.7
	Bm	*Solenosphaera omnitubus omnitubus*									6.3 6.5
	Ev	*D. antepenultima -> D. penultima*									
	Tm	*Diartus hughesi*									7.1 7.2
	Tm	*Dictyocoryne ontongensis*									
	Bm	*Acrobotrys tritubus*									7.7 7.8
	Tm	*Botryostrobus miralestensis*									8.1 8.2
	Bm	*Spongaster berminghami*									7.9 8.0
	Ev	*D. laticonus -> D. antepenultima*									

Table 4 (continued). **(D)** Pacific Ocean—Late Miocene (continued on next page).

EPOCH	RADIOLARIAN EVENT			Pacific Ocean		
				Western	Central	Eastern
			literature	DSDP 586/289	DSDP 573	DSDP 503A
			source	2, 3	2, 3	3
Late Miocene	Bm	*Spongaster pentas*		4.4 4.7	5.0 5.1	5.5 5.6
	Bm	*Pterocanium prismatium*		4.9 5.0	4.7 4.8	4.2 4.3
	Tm	*Solenosphaera omnitubus omnitubus*		4.3 4.6	4.9 5.0	4.7 4.8
	Tm	*Siphostichartus corona*			5.1 5.2	4.9 5.0
	Bm	*Pterocorys campanula*				
	Tm	*Acrobotrys tritubus*		5.2 5.3	5.5 5.6	5.3 5.5
	Tm	*Calocycletta caepa*		6.2 6.6	5.6 5.7	5.5 5.6
	Tm	*Stichocorys johnsoni*		5.5 5.6	5.8 5.9	5.9 6.0
	Tm	*Calocycletta cladara*				
	Ev	*S. delmontensis -> S. peregrina*		5.9 6.2	6.1 6.3	6.3 6.5
	Bm	*Solenosphaera omnitubus omnitubus*		6.4 6.8	6.7 6.8	6.4 6.5
	Ev	*D. antepenultima -> D. penultima*				
	Tm	*Diartus hughesi*		6.9 7.1	7.0 7.1	6.7 6.8
	Tm	*Dictyocoryne ontongensis*				
	Bm	*Acrobotrys tritubus*		7.7 7.9	7.1 7.2	>6.8
	Tm	*Botryostrobus miralestensis*		8.0 8.3	7.3 7.4	
	Bm	*Spongaster berminghami*		7.9 8.0	7.4 7.5	
	Ev	*D. laticonus -> D. antepenultima*				

Table 4 (continued). **(E)** Indian Ocean—Middle Miocene (continued on next page).

EPOCH	RADIOLARIAN EVENT		literature	Indian Ocean							
				MD 81-357	MD 81-369	MD 81-374	MD 81-375	RC 14-22	VM 29-40	VM 34-53	DSDP 214
			source	1	1	1	1	1	1	1	2, 3
Middle Miocene	Ev	*D. petterssoni -> D. hughesi*									8.3 8.5
	Ev	*L. neotera -> L. bacca*									9.0 9.3
	Tm	*Stichocorys wolffii*									
	Tm	*Cyrtocapsella japonica*									10.0 10.3
	Tm	*Lithopera thornburgi*									
	Tm	*Cyrtocapsella cornuta*									11.6 11.9
	Tm	*Cyrtocapsella tetrapera*									
	Tm	*Carpocanopsis cristata*									9.8 10.0
	Bm	*Phormostichoartus doliolum*									11.1 11.9
	Tm	*Dorcadospyris alata*									10.6 10.8
	Tm	*Liriospyris parkerae*									
	Bm	*Cyrtocapsella japonica*									
	Bm	*Diartus petterssoni*									10.6 10.8
	Tm	*Carpocanopsis bramlettei*									8.5 8.7
	Ev	*L. renzae -> L. neotera*									
	Ev	*D. mammifera -> D. laticonus*									
	Bm	*Lithopera thornburgi*									
	Bm	*Phormostichoartus corbula*									
	Tm	*Calocycletta virginis*									
	Bm	*Dictyocoryne ontongensis*									
	Tm	*Calocycletta costata*									

Notes: An arrow indicates an evolutionary transition (Ev). Ages that are shaded were considered by the original authors to be unreliable.

1. Caulet et al., 1993
2. Johnson et al., 1989
3. Johnson and Nigrini, 1985

Table 4 (continued). (F) Pacific Ocean—Middle Miocene.

EPOCH	RADIOLARIAN EVENT		Pacific Ocean		
			Western	Central	Eastern
		literature	DSDP 586/289	DSDP 573	DSDP 503A
		source	2, 3	2, 3	3
Middle Miocene	Ev	*D. petterssoni* -> *D. hughesi*	8.2 8.5	7.6 7.7	
	Ev	*L. neotera* -> *L. bacca*	8.6 8.7	8.0 8.1	
	Tm	*Stichocorys wolffii*	8.1 8.2	8.0 8.1	
	Tm	*Cyrtocapsella japonica*		8.9 9.1	
	Tm	*Lithopera thornburgi*			
	Tm	*Cyrtocapsella cornuta*	11.4 11.5	11.6 11.8	
	Tm	*Cyrtocapsella tetrapera*	11.8 12.1	11.6 11.8	
	Tm	*Carpocanopsis cristata*	9.5 10.1	9.9 10.1	
	Bm	*Phormostichoartus doliolum*	11.0 11.3	8.0 8.1	
	Tm	*Dorcadospyris alata*	11.8 12.0	13.5 13.7	
	Tm	*Liriospyris parkerae*			
	Bm	*Cyrtocapsella japonica*			
	Bm	*Diartus petterssoni*	11.0 11.3	12.5 12.7	
	Tm	*Carpocanopsis bramlettei*	13.1 13.3	14.8 14.9	
	Ev	*L. renzae* -> *L. neotera*	< 12.1 12.3	< 11.6 11.8	
	Ev	*D. mammifera* -> *D. laticonus*			
	Bm	*Lithopera thornburgi*			
	Bm	*Phormostichoartus corbula*			
	Tm	*Calocycletta virginis*	13.7 13.8	15.0 15.1	
	Bm	*Dictyocoryne ontongensis*			
	Tm	*Calocycletta costata*	14.5 14.6	15.0 15.1	

Notes. "Tm" denotes a morphotypic last appearance, "Bm" denotes a morphotypic first appearance. An arrow indicates an evolutionary transition. Ages that are shaded were considered by the original authors to be unreliable. The absolute ages used are in accordance with the chronostratigraphy of Berggren et al. (1985). For further information see the original reports.

1. Caulet et al., 1993
2. Johnson et al., 1989
3. Johnson and Nigrini, 1985

Table 5. Low latitude radiolarian events. See table note.

Epoch	Zones	Low Latitude Radiolarian Events
Quaternary	*Buccinosphaera invaginata*	
		Bm *Buccinosphaera invaginata*
	Collosphaera tuberosa	Tm *Stylatractrus universus*
		Bm *Collosphaera tuberosa*
	Amphirhopalum ypsilon	Tm *Pterocorys campanula*
		Bm *Pterocorys hertwigii*
		Tm *Anthocyrtidium angulare*
	Anthocyrtidium angulare	Bm *Lamprocyrtis nigriniae*
		Tm *Lamprocyrtis neoheteroporos*
		Tm *Pterocanium prismatium*
Pliocene	*Pterocanium prismatium*	Bm *Anthocyrtidium angulare*
		Tm *Theocorythium vetulum*
		Bm *Lamprocyrtis neoheteroporos*
		Bm *Theocorythium trachelium trachelium*
		Tm *Stichocorys peregrina*
	Spongaster pentas	*Didymocyrtis avita -> Didymocyrtis tetrathalamus*
		Tm *Phormostichoartus fistula*
		Tm *Lychnodictyum audax*
		Tm *Phormostichoartus doliolum*
		Bm *Amphirhopalum ypsilon*
		Spongaster pentas -> Spongaster tetras tetras
		Didymocyrtis penultima -> Didymocyrtis avita; Bm *Theocorythium vetulum*
		Bm *Pterocanium prismatium;* Tm *Solenosphaera omnitubus omnitubus;* Tm *Solenosphaera omnitubus procera*
		Spongaster berminghami* -> *Spongaster pentas
Late Miocene	*Stichocorys peregrina*	Tm *Siphostichartus corona;* Bm *Pterocorys campanula*
		Tm *Acrobotrys tritubus;* Tm *Calocycletta caepa*
		Tm *Stichocorys johnsoni*
		Tm *Calocycletta cladara*
		Stichocorys delmontensis* -> *Stichocorys peregrina
	Didymocyrtis penultima	Bm *Solenosphaera omnitubus omnitubus;* Bm *Solenosphaera omnitubus procera*
		Didymocyrtis antepenultima -> Didymocyrtis penultima
		Tm *Diartus hughesi*
	Didymocyrtis antepenultima	Tm *Dictyocoryne ontongensis;* Bm *Acrobotrys tritubus;*
		Tm *Botryostrobus miralestensis*
		Bm *Spongaster berminghami*
		Didymocyrtis laticonus -> Didymocyrtis antepenultima
		Diartus petterssoni* -> *Diartus hughesi

Table 5 (continued).

Epoch	Zones	Low Latitutude Radiolarian Events
Late Miocene	*Diartus petterssoni*	*Lithopera neotera -> Lithopera bacca*
		Tm *Stichocorys wolffii*
		Tm *Cyrtocapsella japonica;* Tm *Lithopera thornburgi*
Middle Miocene		Tm *Cyrtocapsella cornuta;* Tm *Cyrtocapsella tetrapera*
		Tm *Carpocanopsis cristata*
		Bm *Phormostichoartus doliolum*
		Tm *Dorcadospyris alata;* Tm *Liriospyris parkerae;* Bm *Cyrtocapsella japonica; Calocycletta virginis -> Calocycletta cladara*
		Bm *Diartus petterssoni*
	Dorcadospyris alata	Tm *Carpocanopsis bramlettei*
		Lithopera renzae -> Lithopera neotera
		Didymocyrtis mammifera -> Didymocyrtis laticonus
		Bm *Lithopera thornburgi;* Bm *Phormostichoartus corbula;* Bm *Dicytyocoryne ontongensis*
		Tm *Calocycletta costata;* Tm *Didymocyrtis tubaria;* Tm *Didymocyrtis violina;* Tm *Dorcadospyris forcipata*
		Dorcadospyris dentata* -> *Dorcadospyris alata
Early Miocene	*Calocycletta costata*	Tm *Eucyrtidium diaphanes*
		Liriospyris stauropora -> Liriospyris parkerae
		Tm *Carpocanopsis favosa*
		Tm *Didymocyrtis prismatica*
		Tm *Carpocanopsis cingulata;* Bm *Carpocanopsis cristata*
		Tm *Lychnocanoma elongata*
		Bm *Calocycletta costata*
	Stichocorys wolffii	Bm *Didymocyrtis mammifera*
		Bm *Calocycletta caepa*
		Bm *Dorcadospyris dentata*
		Bm *Liriospyris stauropora*
		Tm *Dorcadospyris ateuchus;* Bm *Siphostichartus corona*
		Bm *Stichocorys wolffii*
	Stichocorys delmontensis	Bm *Didymocyrtis tubaria;* Bm *Didymocyrtis violina;* Bm *Stichocorys delmontensis;* Bm *Carpocanopsis bramlettei*
		Tm *Theocyrtis annosa*
	Cyrtocapsella tetrapera	Tm *Calocycletta serrata*
		Tm *Calocycletta robusta*
		Bm *Carpocanopsis favosa*
		Bm *Cyrtocapsella cornuta*
		Bm *Calocycletta serrata;* Bm *Calocycletta virginis;* Bm *Botryostrobus miralestensis*
		Bm *Cyrtocapsella tetrapera*
	Lychnocanoma elongata	Tm *Artophormis gracilis*
		Bm *Eucyrtidium diaphanes*
		Tm *Dorcadospyris papilio*
		Bm *Carpocanopsis cingulata*
		Bm *Lychnocanoma elongata*

Table 5 (continued).

Epoch	Zones	Low Latitude Radiolarian Events
Late Oligocene	*Dorcadospyris ateuchus*	Bm *Dorcadospyris forcipata;* Tm *Lychnocanoma trifolium*
		Bm *Calocycletta robusta*
		Bm *Dorcadospyris papilio*
		Tm *Lithocyclia angusta* (continuous)
		Bm *Lychnocanoma trifolium*
Early Oligocene		***Tristylospyris triceros* -> *Dorcadospyris ateuchus***
	Theocyrtis tuberosa	Bm *Theocyrtis annosa*
		Tm *Theocyrtis tuberosa*
		Tm *Lithocyclia crux*
		Centrobotrys petrushevskayae -> Centrobotrys thermophila
		Bm *Didymocyrtis prismatica;* Tm *Dorcadospyris pseudopapilio*
		Bm *Lychnodictyum audax*
		Centrobotrys gravida -> Centrobotrys petrushevskayae; Bm *Dorcadospyris pseudopapilio*
		Bm *Lithocyclia crux; Artophormis barbadensis -> Artophormis gracilis*
		Bm *Centrobotrys gravida*
		Tm *Dictyoprora pirum;* Bm *Phormostichoartus fistula*
		Tm *Cryptocarpium ornatum;* Tm *Dictyoprora mongolfieri;* Tm *Lychnocanoma amphitrite*
		Lithocyclia aristotelis* group -> *Lithocyclia augusta
Late Eocene	*Cryptocarpium ornatum*	Tm *Dictyoprora armadillo*
		Tm *Lophocyrtis jacchia*
		Tm *Calocyclas turris;* Tm *Thyrsocyrtis bromia;* Tm *Thyrsocyrtis rhizodon;* Tm *Cryptocarpium azyx*
		Tm *Thyrsocyrtis lochites;* Tm *Calocyclas bandyca;* Tm *Calocyclas hispida;* Tm *Lychnocanoma bellum;* Tm *Podocyrtis papalis*
		Tm *Thyrsocyrtis tetracantha*
	Calocyclas bandyca	Tm *Thyrsocyrtis triacantha*
		Bm *Theocyrtis tuberosa*
		Tm *Eusyringium fistuligerum*
		Tm *Podocyrtis goetheana*
		Bm *Calocyclas bandyca*
	Cryptocarpium azyx	Tm *Podocyrtis chalara*
		Bm *Lychnocanoma amphitrite*
		Calocyclas hispida -> Calocyclas turris
		Bm *Cryptocarpium azyx*
Middle Eocene	*Podocyrtis goetheana*	Tm *Spongatractus pachystylus*
		Bm *Thyrsocyrtis bromia*
		Bm *Thyrsocyrtis tetracantha;* Bm *Dictyoprora pirum;* Tm *Theocotylissa ficus*
		Tm *Sethochytris triconiscus*
		Bm *Dictyoprora armadillo*
		Lithocyclia ocellus group -> *Lithocyclia aristotelis* group
		Bm *Podocyrtis goetheana*

Table 5 (continued).

Epoch	Zones	Low Latitude Radiolarian Events
Middle Eocene	*Podocyrtis chalara*	Tm *Podocyrtis trachodes*
		Tm *Phormocyrtis striata striata;* Bm *Tristylospyris triceros*
		Podocyrtis mitra* -> *Podocyrtis chalara
	Podocyrtis mitra	Bm *Cryptocarpium ornatum*
		Tm *Podocyrtis ampla*
		Tm *Eusyringium lagena;* Bm *Artophormis barbadensis;* Bm *Thyrsocyrtis lochites;* Bm *Sethochytris triconiscus;* Tm *Podocyrtis fasciolata;* Tm *Podocyrtis helenae*
		Podocyrtis sinuosa* -> *Podocyrtis mitra
	Podocyrtis ampla	Bm *Podocyrtis trachodes*
		Tm *Podocyrtis dorus*
		Eusyringium lagena -> Eusyringium fistuligerum
		Bm *Podocyrtis fasciolata;* Bm *Podocyrtis helenae*
		Tm *Theocotyle venezuelensis*
		Podocyrtis phyxis* -> *Podocyrtis ampla
	Thyrsocyrtis triacantha	Bm *Eusyrigium fistuligerum*
		Tm *Theocotyle nigriniae;* Tm *Theocotyle conica; Podocyrtis diamesa -> Podocyrtis phyxis;* Tm *Theocorys anaclasta;* Tm *Lamptonium fabaeforme constrictum;* Tm *Lamptonium fabaeforme chaunothorax;* Tm *Thyrsocyrtis hirsuta;* Tm *Thyrsocyrtis robusta*
		Thyrsocyrtis tensa -> Thyrsocyrtis triacantha
		Bm *Eusyringium lagena*
	Dictyoprora mongolfieri	Tm *Lamptonium fabaeforme fabeforme;* Bm *Podocyrtis dorus*
		Theocotyle cryptocephala-> Theocotyle conica
		Tm *Calocycloma castum*
		Bm *Dictyoprora mongolfieri*
	Theocotyle cryptocephala	*Podocyrtis acalles -> Podocyrtis sinuosa*
		Bm *Thyrsocyrtis robusta*
		Bm *Theocotyle venezuelensis*
		Tm *Buryella clinata*
		Theocotyle nigriniae* -> *Theocotyle cryptocephala
Early Eocene	*Phormocyrtis striata striata*	*Spongatractus balbis -> Spongatractus pachystylus*
		Tm *Lamptonium sanfilippoae*
		Bm *Thyrsocyrtis rhizodon*
		Bm *Podocyrtis diamesa*
		Bm *Lamptonium fabaefome constrictum; Phormocyrtis striata exquisita -> Phormocyrtis striata striata;* Bm *Podocyrtis acalles;* Tm *Phormocyrtis cubensis*
		Bm *Theocorys anaclasta*

Table 5 (continued).

Epoch	Zones	Low Latitude Radiolarian Events
Early Eocene	*Buryella clinata*	Tm *Pterocodon ampla;* Tm *Bekoma bidartensis;* Tm *Buryella tetradica;* Tm *Thyrsocyrtis tarsipes*
		Bm *Lithocyclia ocellus group;* Bm *Thyrsocyrtis tensa; Theocotylissa alpha -> Theocotylissa fiscus*
		Bm *Calocyclas hispida*
		Bm *Spongatractus balbis;* Bm *Lamptonium sanfilippoae;* Bm *Theocotyle nigriniae;* Bm *Thyrsocyrtis hirsuta*
		Pterocodon ? anteclinata* -> *Buryella clinata
	Bekoma bidartensis	Bm *Theocotylissa alpha*
		Bm *Lamptonium fabaeforme chaunothorax*
		Bm *Pterocodon ? anteclinata;* Bm *Lophocyrtis jacchia*
		Bm *Calocycloma castum; Lamptonium pennatum -> Lamptonium fabaeforme fabaeforme*
Paleocene		Bm *Podocyrtis papalis*
		Tm *Bekoma campechensis*
		Bm *Bekoma bidartensis*
	Bekoma campechensis	Bm *Phormocyrtis cubensis*
		Tm *Buryella pentadica*
		Bm *Pterocodon ampla*
		Bm *Bekoma campechensis*
	unzoned	Bm *Lamptonium pennatum;* Bm *Buryella pentadica*
		Bm *Buryella tetradica*
		Bm *Thyrsocyrtis tarsipes*

Note: Bold entries indicate zonal boundary markers.

Table 6. Middle latitude radiolarian events. See table note.

Epoch	Zones	Middle Latitude Radiolarian Events
Quaternary	*Botryostrobus aquilonaris*	
		Tm *Stylacontarium acquilonium*
		Tm *Stylatractus universus*
	Stylatractus universus	Tm *Lamprocyrtis neoheteroporos*
		Tm *Theocorythium vetulum*
		Tm *Eucyrtidium matuyamai*
	Eucyrtidium matuyamai	Tm *Lamprocyrtis heteroporos*
		Bm *Lamprocyrtis nigriniae*
		Bm *Lamprocyrtis neoheteroporos*
		Tm *Sphaeropyle robusta*
		Eucyrtidium calvertense* -> *Eucyrtidium matuyamai
Pliocene	*Lamprocyrtis heteroporos*	**Tm *Stichocorys peregrina***
	Sphaeropyle langii	Bm *Stylacontarium acquilonium*
		Tm *Stichocorys delmontensis*
		Bm *Lamprocyrtis heteroporos*
		Tm *Theocorys redondoensis*
		Bm *Sphaeropyle langii*
	Stichocorys peregrina	Bm *Botryostrobus aquilonaris*
Late Miocene		**Bm *Stichocorys peregrina***
	Didymocyrtis penultima	***Didymocyrtis antepenultima* -> *Didymocyrtis penultima***
	Didymocyrtis antepenultima	***Didymocyrtis laticonus* -> *Didymocyrtis antepenultima***
Middle Miocene	*Diartus petterssoni*	Tm *Eucyrtidium inflatum* ***Diartus petterssoni* -> *Diartus hughesi***
	Dorcadospyris alata	***Dorcadospyris dentata* -> *Dorcadospyris alata***
Early Miocene	*Calocycletta costata*	**Bm *Calocycletta costata***

Note: Bold entries indicate zonal boundary markers.