

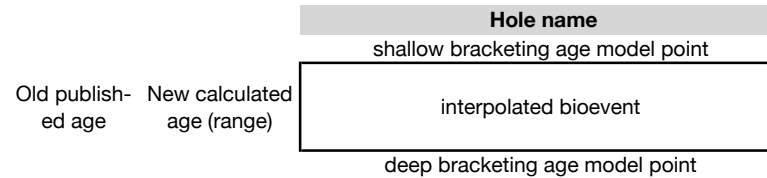
Appendix 1. Miocene bioevent calibrations per ODP/DSDP Hole, arranged according to region. Regional ages are a reflection of the individual site/hole range, using the most reliable calibrations (see chapter "Materials and Methods - Sources of Error"). Ages in bold are considered most reliable. Ages of global sequences of Hardenbol et al. (1998) are according to the updates in Ogg and Luginowski (2008). Depths in bold are the actual sampling level of the bioevent (contra overlying/underlying samples). For calculation details of updated ages see Appendix 3.

Notes

- a *Fossil Group: PF = Planktonic Foraminifer; CN = Calcareous nannofossil; BO = Bolboform alga; DC = Dinoflagellate Cyst or Acritarch; MD = Marine Diatom; RA = Radiolarian*
- b *Event type: LO = Last uphole Occurrence; FO = First uphole Occurrence*
- c *C-Subchrons = Cande & Kent (1995); Lourens et al. (2004); Nannoplankton Zones: CN = Okada & Bukry (1980); NN = Martini (1971); Planktonic foraminiferal Zones: N of Blow (1969)*
- d Warm water PF influx of *N. dutertrei* (and *Globorotalia menardii*) marks deglaciation and glacio-eustatic sealevel rise 5.548-5.445 Ma, Atlantic Morocco (Hilgen et al. 2007 and references therein)
- e End of Messinian glaciation with deglaciation period from TG12 (5.548 Ma) to TG9 (5.445 Ma) in Hilgen et al. 2007. Bracketed by two calcareous 'biogenic bloom' peaks at Site 982 (Diester-Haass et al. 2005)
- f Corresponds to the *Globorotalia margaritae* acme identified in Atlantic Morocco during peak glacials TG20 and TG22, 5.75 and 5.79 Ma (Hilgen et al. 2007 and references therein)
- g Messinian glaciation 6.3-5.5 with peak glacials TG20 and TG22 in C3r, with astronomical ages of 5.75 and 5.79 Ma (Site 982 in Hilgen et al. 2007)
- h Section interval based on their published range charts
- i Increase in *N. pachyderma* (s) suggests a decrease in sea-surface temp. to minimum at 6.2 Ma. Extensive dissolution possibly due to increased AABW. Glaciation preceding MSC. Sinistral-dextral pulse cyclicity with periodicity of ~ 125 kya (Turco et al., 2001).
- j Possibly connected to Late Miocene global $\delta^{13}C$ shift, Arthur et al. (1989). This coiling change is a marker for the Mio./ Plio. boundary in temperate zonation of Poore (1979). Top of "lower" *N. atlantica* (d) Zone of Spiegler and Jansen (1989).
- k Possibly corresponds to "Tor2" sequence boundary of Hardenbol et al. 1998 (9.22 Ma) and/or Miller event Mi-7.
- l Believed to be a good marker for the Miocene/Pliocene boundary (see Manum et al. 1989)
- m The rare spot occurrence at 326.49mbsf (347.08 mcd) is here assumed to be contamination
- n The juxtaposition of the LO *P. mayeri* with the FO *N. acostaensis* has been observed at a number of North Atlantic sites, suggesting a widespread hiatus or diachrony (Ogg and Luginowski 2008).
- o May correspond to the Tor1 maximum transgression of the early Tortonian immediately following the Ser4/Tor1 global sequence boundary of Hardenbol et al. 1998 (= 10.51-11.8)
- p Top of a warm water assemblage in Spezzaferri (1998)
- q Hardground + benthic foram. faunal change = strengthening of bottom currents and initiation of NADW (Wei and Paleo-Alampay 1997)

- r ?Coincident with Mi6 glaciation of Miller et al. (1991) and Ser4/Tor1 global sequence boundary of Hardenbol et al. (1998) = 11.8 (Ogg and Lugowski, 2008)
- s The two rare spot occurrences of *Globorotalia praescitula* higher in the core are probably reworked.
- t Incorrectly labelled depth in Flower (1999)
- u Condensed section
- v Misprint in Munsterman and Brinkhuis (2004) where C5r was written as C5Cr.
- w In agreement with Louwye (2005) and based on the overlap of standard zones identified in this member, the bolboformid zonal designation to the *B. metzmacheri* Zone by Spiegler (2001) is rejected.
- x De Verteuil and Norris (1996) believed all Upper Miocene occurrences to be reworked.
- y Reworked according to Williams and Manum (1999)
- z Synonymy with *Diatom* sp. 4 of King (1983) according to Mitlehner (1995)
- æ Steininger et al. (1997) claims an 'approximate' LO at 34 m, however, Zevenboom (1996) finds it throughout the section.
- ø FO *Ectosphaeridium burdigalensis* may be delayed in the North Sea (Dybkaer and Rasmussen 2007).
- å The genus *Homotryblium* is known to be largely environmentally controlled (Dybkaer 2004)
- ab De Verteuil and Norris (1996) believe this record to be reworked.
- ac FO *Ectosphaeropsis burdigalensis* may be delayed in the North Sea (Dybkaer and Rasmussen 2007)

Key to understanding layout:



Age			Code ^a	Bioevent or Hiatus ^b	High-latitude						Low lat.	Reference	Note
Region Age	Age by Hole	Age Range ±			Region	Previous Age	Updated Age Range (This study)	Calibration basis	Depth	Sed. Rate			
	Ave. or total range	Range spread from ave.		<i>Mid to high-latitude North Atlantic</i> 35°-50° N subtropical - temperate <i>High-latitude Northern North Atlantic</i> 50°-63° N temperate - subpolar <i>Nordic Seas & North Sea</i> 63°-70° subpolar <i>Arctic</i> 70°-80° N polar	by ODP/DSDP report from GTS-1985/'95	by ODP/DSDP Hole, from interpolation via ATNTS2004	(Magneto-subchrons, Standard Zone, MIS, or bioevent in ATNTS2004)	(A,B,C etc. Holes indicated by letter prefix)	Ave. SR	linear interpolation, ATNTS-2004 magnetochronology	ATNTS-2004 in Lourens et al. 2004		
Ma	Ma	Ma		FO = first occurrence; LO = last occurrence	Ma	Ma	"=" interpreted equivalence (not observed directly)	mbsf / (mcd)	m/myr	Ma	Ma	+ Lourens et al. (2004)	See page 1

5.3	5.32	0.00	DC	<i>LO Hystrichosphaeropsis pontiana</i>	5.32	Hole 642B (Vøring Plateau)			Bleil 1989	
						C3n.4n/C3r	84.11-84.40	5.235		
						C3r	85.51-85.75	5.32		Mudie 1989
						C3r/C3An.1n	97.11-97.41	6.033		Bleil 1989
	5.79	1.14			4.65-6.93	Hole 643A (Vøring Plateau)			Bleil 1989	
						C3n.1n/C3n.1r	59.37-59.75	4.300		
						"=C3r"	60.95- 71.77	5.79		Mudie 1989
						C4r.1n/C4r.2r	77.66-78.06	8.300	Bleil 1989	
76.0	(3.74)	0.40	BO	<i>LO common Bolboforma intermedia</i>	~ 3.6	Hole 608 (Kings Trough)			Clement and Robinson 1989	
						(Reworked?) 3.35-4.12	C2An.2r (Mammoth) to C2An.3n (Gauss); NN16/NN17	98.40- 114.68		18.78

5.6	5.59	0.00	MD	FO abundant <i>Thalassiosira</i> spp. (Acme of <i>T. praeoestrupii</i> , <i>T. tetraoestrupii</i> , <i>T. baldaufi</i> with greater than 1 hundred thousand valves per gram dry sediment)	5.34	~5.6	Hole 552A (Rockall Plateau)			
							LAD D.	123.40-	5.59	Bleil 1989
							<i>quinqueramus</i>	128.40		
							CN9/CN10;	124.7	-	~ 5.6
							NN11/NN12			Boden 1992 e
							LAD D.	123.40-	5.59	Bleil 1989
							<i>quinqueramus</i>	128.40		
5.5	5.51	0.01	MD	FO abundant <i>Thalassiosira</i> spp. (Acme of <i>T. praeoestrupii</i> , <i>T. tetraoestrupii</i> , <i>T. baldaufi</i> with greater than 4 million valves per gram dry sediment)	5.00	5.50-5.52	Hole 642B (Vøring Plateau)			
							C3n.4n/C3r	84.11-84.40	5.235	Bleil 1989
							C3r (Gilbert)	88.7	16.30	5.51
							C3r/C3An.1n	97.11-97.41	6.033	Bleil 1989
5.7	5.50-5.65	-	PF	FO <i>Globorotalia margaritae</i>	5.58-5.71	(extrapolated) 5.50-5.65	Hole 607 (Central North Atlantic)			
							C3n.3r/C3n.4n	208.58-213.08	4.997	
							C3n.4n/C3r	222.94-224.31	5.235	
							(= C3r)	239-244	5.58	6.08 (S. Atl.)
5.8	(3.45)	0.04	PF	FO <i>Globorotalia margaritae</i>		(reworked?) 3.31; 3.41-3.48	Hole 981A (Feni Drift)			
							C2r.2r/C2An.1n	165.00	2.581	
								215.63	69.49; 58.65	3.31; 3.45
							i) CN10/CN11 (as LO <i>Amaurolithus primus</i>); ii) FO <i>Globorotalia puncticulata</i>	i) 297.60-299.10; ii) 272.79-282.29	i) 4.5; ii) 4.5	6.08 (S. Atl.)
							Hole 982B (Rockall Plateau)			
							orbitally tuned isotope record	(254.350)	7.364	Hodell et al. 2001
							(Contamination ?) 7.48	236.69 (257.28)	7.48	6.08 (S. Atl.) Flower 1999
							orbitally tuned isotope record	(259.050)	7.551	Hodell et al. 2001
							Hole 116 (Rockall Plateau)			

5.7-5.9

	(9.58)	1.00			(Contamination ?) 8.58-10.57	mid-N16 Zone of Blow 1969	213.50-215.00	ave. = 9.575	6.08 (S. Atl.)			
	5.78-6.37	-			5.50-5.68	B: 5.78-6.37; 6.95-7.31	337.46-339.18; C3r/C3An.1n B329.69-331.22	6.733; B: 6.033	6.08 (S. Atl.)	f		
	24.76; 5.36	0.05; 0.08			5.28-5.44	(extrapolated) 4.72-4.81	342-351; B326-336	20.63; B: 14.41	6.08 (S. Atl.)			
							345.93-347.50; B345.87-346.94	7.140				
							Hole 611 (Gardar Drift)					
							C2r.1n/C2r.2r	72.18-73.68	2.148			
							C2r.2r/C2An.1n	110.58-112.08	2.581	6.08 (S. Atl.)		
							Hole 907A (Iceland Sea)					
							C2Ar/C3n.1n	70.50	4.187	Channell et al. (1999)		
	5.91	0.09	MD	<i>FO Thalassiosira jacksonii</i>	5.6	5.82-6.00	C3r (Gilbert)	87.3-89.2	10.29	5.91	Koc and Scherer (1996)	g
							C3r/C3An.1n	89.50	6.033	Channell et al. (1999)		
							Hole 642B (Vøring Plateau)					
							C3n.4n/C3r	84.11-84.40	5.235	Bleil 1989		
	5.74	0.01			5.2 (as first common occurrence)	5.73-5.75	C3r (Gilbert)	92.50	16.30	5.74	Boden 1992	g
							C3r/C3An.1n	97.11-97.41	6.033	Bleil 1989		
							Hole 982B (Rockall Plateau)					

	5.06	0.03			5.35	5.03-5.09	C3n.4n (upper Thvera)	82.73	11.47	5.06	Boden 1992
							C3n.4n/C3r	84.41-85.11		5.235	Bleil 1989
6.6			HIATUS	Upper Miocene Hiatus (calcite near-barren interval)	6.6-7.6 Ma enhanced dissolution connected to "Late Miocene global deltaC13 shift" at Site 982 (Diester-Haass et al. 2005). Base is possibly coincident with						
							Hole 608 (Kings Trough)				
							C2An.3n/C2Ar	109.31-109.99		3.596	Clement and Robinson 1989
10.9	(4.5)	0.50	BO	Disappearance <i>Bolboforma clodiusi</i>	(Reworked?) 4.01-5.00			116.36-134.12	17.16	4.50	Spiegler and Mueller 1992
							C3Ar/C3Bn	170.09-170.86		7.140	Clement and Robinson 1989
							Hole 982B (Rockall Plateau)				
							orbitally tuned isotope record	(284.460)		8.901	Shipboard Scientific Party 1996; Hodell et al. 2001
	10.88	0.00				10.88	near NN7/NN8	369.59 (390.18)		10.88	Spiegler 1999
							LO <i>Coccolithus miopelagicus</i>	376.85 (397.44)		11.02 (S.Atl)	Shipboard Scientific Party 1996
							Hole 116 (Rockall Plateau)				
	9.56	0.02			9.53-9.58		i) Middle to lower N16 Zone of Blow 1969; ii) upper NN9 of Martini 1971	309.48-312.79		i) ave. = 9.575 ; ii) 9.53 -10.55	ii) Spiegler 1999; i) Loughton et al. 1975
							Hole 552A (Rockall Plateau)				
							LO <i>Discoaster tamalis</i>	44.22-44.92		2.80 (S.Atl)	Backman 1984
76.7	(3.43)	0.20	BO	Disappearance <i>Bolboforma clodiusi</i>	(Reworked?) 3.25-3.60		near NN15/NN16 (3.7)	54.15-65.50	23.76	3.43	Murray 1984
							LO <i>Reticulofenestra pseudoumbilica</i>	63.90-68.00		3.70 (S.Atl)	Backman 1984
							Hole 555 (Rockall Plateau)				

6.5	(3.79)	1.10	PF	LO <i>Globorotalia miotumida</i> (<i>conomiozea</i>) group	(Reworked?) 2.73-4.85	NN18/NN19 (as LO <i>Discoaster brouweri</i>)	18.81-20.31	1.93 (S.Atl)	Backman 1984
						near NN11/NN12 (5.59)	(Subtop) 23.28	2.63 3.79	Murray 1984
						NN11/NN12 (as LO <i>Discoaster quinqueramus</i>)	24.40-33.90	5.58 (S.Atl)	Backman 1984
	Hole 554; 554A (Rockall Plateau)								
	NN11/NN12 (as LO <i>Discoaster quinqueramus</i>)	53.50-56.05				5.58 (S.Atl)	Backman 1984		
	?near CN9a/CN9b (= mid-NN11) (5.35)	62.95-72.11				10.73 6.65	Murray 1984		
6.65	0.14	-	PF	LO <i>Globorotalia miotumida</i> (<i>conomiozea</i>) group	(Reworked?) ~4.6	FO common <i>D. surculus</i> (as FO <i>D. surculus</i>)*	76.00-85.50	7.79 (Berggren et al. 1995)	Backman 1984
						Hole 606A (Central North Atlantic)			
						C3n.2n/C3n.2r	171.28-172.78	4.631	Clement and Robinson 1986
(as LO <i>Globorotalia conomiozea</i>)	171.80-173.30	~4.6				6.52 (E. Med) Weaver and Clement 1986 h			
Hole 609, 609B (Northeast North Atlantic)									
C3An.1r/C3An.2n	345.93-347.50; B: 345.87-346.94	6.436				Clement and Robinson 1986			
= C3An.2n (as LO <i>Globorotalia conoidea</i> and LO <i>Globorotalia conomiozea</i>)	347.80-349.30; B: 348.10-349.60	~6.5	6.52 (E. Med) Weaver and Clement 1986 h						
Hole 610A (Feni Drift)									

6.8-7.2

6.8-7.2	(4.6)	0.00	PF	LO <i>Globorotalia miotumida</i> (conomiozea) group	(Reworked?) 4.60	C3n.1r/C3n.2n	190.28- 192.38		4.493		Clement and Robinson 1986				
	6.77	0.00				C3n.2n (as LO <i>Globorotalia conomiozea</i>)	194.40- 195.90		4.60	6.52 (E. Med)	Weaver and Clement 1986 ^h				
						C3n.2n/C3n.2r	195.38- 196.88		4.631		Clement and Robinson 1986				
						Hole 611C (Gardar Drift)									
	7.30	0.00				C3An.2n/C3Ar	339.44- 340.53		6.733		Clement and Robinson 1986				
						C3Ar (as LO <i>Globorotalia conomiozea</i>)	341.80- 343.30	74.0	6.77	6.52 (E. Med)	Weaver and Clement 1986 ^h				
						C3Ar/C3Bn	369.01- 371.20		7.140		Clement and Robinson 1986				
						Hole 982A (Rockall Plateau)									
						orbitally tuned isotope record	(250.050)		7.283		Hodell et al. 2001				
	7.15	0.00				7.30	(as LO <i>Globorotalia conomiozea</i>)	226.91 (251.10)	54.76	7.30	6.52 (E. Med)	Flower 1999			
orbitally tuned isotope record			(252.350)		7.325		Hodell et al. 2001								
Hole 982B (Rockall Plateau)															
orbitally tuned isotope record			(243.070)		7.138		Hodell et al. 2001								
7.15; 7.47			i) as LO <i>Globorotalia conoidea</i> ; ii) as LO <i>Globorotalia conomiozea</i>	224.02 (243.47); 235.19 (255.78)		7.15; 7.47	6.52 (E. Med)	Flower 1999							
Hole 116 (Rockall Plateau)															
			orbitally tuned isotope record	(259.050)		7.551		Hodell et al. 2001							

				C3Br.1n/C3Br.2r	382.93-384.35	7.285	Clement and Robinson 1989
				C3Br.2n/C3Br.3r	384.35-385.42	7.489	Clement and Robinson 1989
(8.64)	0.80		6.84-7.24	(extrapolated) 7.84-9.44	386.80-395.63	8.64	Weaver and Clement 1986
				Hole 982B (Rockall Plateau)			
				orbitally tuned isotope record	(254.350)	7.364	Hodell et al. 2001
7.51	0.03		7.10-7.12	7.48-7.54	236.69 (257.28)-238.19 (258.78)	7.51	Flower 1999
				orbitally tuned isotope record	(259.050)	7.551	Hodell et al. 2001
				Hole 918D (Irminger Basin)			
				strontium ⁸⁷ Sr/ ⁸⁶ Sr ratio: 0.708992	505.39	6.02	Israelson and Spezzaferri 1998 + McArthur et al. 2001
5.8	0.20		(Delayed?) 5.6-6.0	near CN9/CN10 nannofossil boundary	505.38	5.8	Spezzaferri 1998
				CN9/CN10 as LO <i>D. quinqueramus</i>	506.04-506.85	5.58 (S.Atl)	Wei 1998
				Hole 646B (Labrador Sea)			
				C4r.2r/C4An	680.06-682.01	8.769	Baldauf et al. 1989
				C4An/C4Ar.1r	702.85-708.39	9.098	Clement et al. 1989
(9.55)	0.10		8.75-8.9	(Extrapolated) 9.48-9.62	739.28	9.55	Aksu and Kaminski 1989 j
				Hole 642B (Vøring Plateau)			
				C3An.2n/C3Ar	113.11-113.52	6.733	Bleil 1989

7.4-7.9	6.70-7.87	-	PF	<i>Neogloboquadrina atlantica</i> dex sin coiling change (= Disappearance <i>Neogloboquadrina atlantica</i> (dextral); FO <i>Neogloboquadrina atlantica</i> (sinistral)); <i>Influx Orbulina universa</i> ; Increase in <i>Globigerina bulloides</i>	6.0-6.2 age assumption in Spiegel and Jansen 1989	6.70-7.87	(both events are separated by a barren interval, therefore coiling change datum level may be dissolved away)	112.76 (s)-124.85 (d)	7.28	Spiegler and Jansen 1989	
								C5AAn/C5AAr			176.93-177.91
Hole 642C (Vøring Plateau)											
								C3An.1r/C3An.2n	106.41-107.11	6.436	Bleil 1989
	6.77-7.37	-	PF		6.0-6.2 age assumption in Spiegel and Jansen 1989	6.77-7.37	(both events separated by a barren interval, therefore coiling change datum level may be dissolved away)	112.15 (s)-123.04 (d)	7.07	Spiegler and Jansen 1989	
								C3Bn/C3Br.1r			119.61-120.41
?4.6	(4.11)	0.00	PF	<i>FO Globorotalia cf. crassula</i>	(Above base?) 4.11	Hole 606 (Central North Atlantic)					
						C2An.3n/C2Ar	121.68-123.18	3.596	Clement and Robinson 1986		
						C2Ar	148.00-149.50	4.11	Weaver and Clement 1986 ^h		
							C2Ar/C3n.1n	151.97-153.47	4.187	Clement and Robinson 1986	
	Hole 607 (Central North Atlantic)										
							C2An.3n/C2Ar	144.38-145.88	3.596	Clement and Robinson 1986	
(4.16)	0.01		PF		(Above base?) 4.15-4.17	C2Ar	173.70-175.20	4.16	Weaver and Clement 1986 ^h		
						C2Ar/C3n.1n	174.68-177.41	4.187	Clement and Robinson 1986		
						Hole 609 (Northeast North Atlantic)					

7.6	(4.56)	0.00	PF	<i>FO Globorotalia cf. crassula</i>		C3n.1r/C3n.2n	264.60- 265.99	4.493	Clement and Robinson 1986
					(Above base?) 4.56	C3n.2n	268.00- 269.50	4.56	Weaver and Clement 1986 ^h
						C3n.2n/C3n.2r	271.97- 273.47	4.631	Clement and Robinson 1986
						Hole 610A (Feni Drift)			
						C3n.2r/C3n.3n	196.88- 198.38	4.799	Clement and Robinson 1986
						(Above base?) > 4.8	199.58- 199.81 (base hole!)	> 4.8	Weaver and Clement 1986 ^h
						-	-	-	
						Hole 611C (Gardar Drift)			
						C2An.2n/C2An.2r	155.28- 157.41	3.207	Clement and Robinson 1986
						(Above base?) 3.58-3.61	176.80- 177.06	3.59	Weaver and Clement 1986 ^h
				C3n.1r/C3n.2n	224.56- 225.76	4.493	Clement and Robinson 1986		
				Hole 982B (Rockall Plateau)					
				orbitally tuned isotope record	(259.050)	7.551	Hodell et al. 2001		
7.59		0.00			239.69 (260.28)	7.59	Flower 1999		
				orbitally tuned isotope record	(266.160)	7.770	Hodell et al. 2001		
				Hole 609 (Northeast North Atlantic)					
				C3r/C3An.1n	330.91- 333.08	6.033			
				C3An.2n/C3Ar	345.93- 347.50	6.733			

7.7	7.98	0.02	PF	FO <i>Globorotalia miotumida</i> (<i>conomiozea</i>) group	(extrapolated) 7.95-8.00	(as FO G. <i>conomiozea</i>)	372.10-373.60	7.98	7.89 (E. Med.)	Weaver and Clement 1986	h
							Hole 610E (Feni Drift)				
							C4n.1n/C4n.1r	300.66-302.16	7.642		
	7.66	0.00	PF	FO <i>Globorotalia miotumida</i> (<i>conomiozea</i>) group	7.66	C4n.1r (as FO G. <i>conomiozea</i>)	304.40-305.90	7.66	7.89 (E. Med.)	Weaver and Clement 1986	h
							C4n.1r/C4n.2n	312.04-312.63	7.695		
							Hole 611C (Gardar Drift)				
							C3Br.1n/C3Br.2r	374.12-375.65	7.285		
	7.34	0.01			7.33-7.36	C3Br.2r (as FO G. <i>conomiozea</i>)	377.19-377.49	7.34	7.89 (E. Med.)	Weaver and Clement 1986	h
							C3Br.2r/C3Br.2n	381.41-382.93	7.454		
							Hole 982B (Rockall Plateau)				
							orbitally tuned isotope record	(259.050)	7.551		Hodell et al. 2001
	7.69	0.00			7.69	(as FO G. <i>conomiozea</i>)	242.95 (263.54)	7.69	7.89 (E. Med.)	Flower 1999	
							orbitally tuned isotope record	(266.160)	7.770		Hodell et al. 2001
							Hole 116 (Rockall Plateau)				
	(~10.6)	-			(Contamination ?) 8.58-10.57	?lower N16 of Blow 1969 (as FO consistent) <i>Globorotalia conoidea</i> and FO <i>Globorotalia conomiozea</i>	266.78-268.28	~ 10.6	7.89 (E. Med.)	Poore and Berggren 1975; Loughton et al. 1975	
							Mazzapiedi Section (NW Italy)				

7.7; 9.9

10.68

0.45

DC

LO Labyrinthodinium truncatum

10.23-11.13

C3An.2n/C3Ar

113.11-113.52

6.733

Bleil 1989

147.68-157.40

10.68

Mudie 1989

C5AAn/C5AAr

176.93-177.91

13.183

Bleil 1989

Hole 643A (Voring Plateau)

C4An/C4Ar.1r

90.56-91.06

9.098

Bleil 1989

9.14-10.65

90.82-100.70

9.90

Manum et al. 1989

C5AAn/C5AAr

116.06-116.36

13.183

Bleil 1989

Onshore Neuenhaus boreholes (Southern North Sea)

Within the "Tor3 Sequence" of Munsterman and Brinkhuis 2004. (? possibly coincides with the Tor 2 maximum flooding surface of Hardenbol et al. 1998)

Breda Formation

7.72 (Tor 2 mfs according to Ogg and Lugowski 2008)

Munsterman and Brinkhuis 2004; Ogg and Lugowski 2008

Gram borehole, Gram (Onshore Denmark, North Sea Basin)

uppermost Hodde Formation 29.0 m below surface

Piasecki 1980

Hole 905A (U.S. East Coast Atlantic)

NN11a/NN11b subzonal boundary of Martini 1971 (as FO *Amaurolithus* spp. with FO *A. delicatus*)

477.86

7.42

Gartner and Shyu 1996

7.72

-

7.7	7.66	0.00	DC	LO <i>Hystrichosphaeropsis obscura</i>	7.65-7.66	may be approximately equivalent to top C4n (7.528) according to Verteuil and Norris (1996) (Same level as LO L. truncatum)	489.85-490.26	7.66	de Verteuil and Norris 1996; de Verteuil 1996
						LO <i>Minylitha convalis</i>	542.59	8.68 (Lourens et al. 2004)	Gartner and Shyu 1996
7.1-7.6	7.31	0.24	DC	LO <i>Hystrichosphaeropsis obscura</i>	7.07-7.56	Hole 555 (Rockall Plateau)			
						NN11/NN12 (as LO <i>Discoaster quinquaramus</i>)	24.40-33.90	5.58 (S.Atl)	Backman 1984
						NN11	(72.02) 91.00-92.45	7.31	Edwards 1984
						approximately at NN10/NN11 as FO <i>Discoaster quinquaramus</i>	109.64-133.29	8.11	Backman 1984; Berggren et al. 1995
8.9	(5.10)	0.08	DC	LO <i>Hystrichosphaeropsis obscura</i>	Reworked? 5.01-5.18	Hole 642C (Vøring Plateau)			
						C3n.3n/C3n.3r	81.66-82.01	4.896	Bleil 1989
							(65.00) 82.50-84.00	5.10	Manum et al. 1989
						C3n.4n/C3r	84.11-84.40	5.235	Bleil 1989
						Hole 643A (Vøring Plateau)			
					8.56-9.13	C4r.1n/C4r.2r	77.66-78.06	8.300	Bleil 1989
							81.71-90.82	8.85	Mudie 1989
						C4Ar.1r/C4Ar.1n	93.26-93.66	9.312	Bleil 1989
						Hole 905A (U.S. East Coast Atlantic)			

7.7	7.66	0.00	DC	<i>LO Spiniferites pseudofurcatus</i>	7.65-7.66	NN11a/NN11b subzonal boundary of Martini 1971 (as FO <i>Amaurolithus</i> spp. with FO <i>A. delicatus</i>)	477.86	7.42	Gartner and Shyu 1996
						may be approximately equivalent to top C4n (7.528) according to Verteuil and Norris (1996) (Same level as LO L. truncatum)	489.85-490.26	7.66	de Verteuil and Norris 1996; de Verteuil 1996
						LO <i>Minylitha convalis</i>	542.59	8.68	Gartner and Shyu 1996
7.9	7.91	0.05	PF	<i>LO (?Disappearance) Globorotalia juanai; Disappearance Globorotalia scitula; Influx Globorotalia conoidea; FO frequent Globigerinita glutinata</i>	7.86-7.96	Hole 982B (Rockall Plateau)			
						orbitally tuned isotope record	(267.260)	7.809	Hodell et al. 2001
							247.69 (268.28)-249.48 (270.07)	7.91	Flower 1999
			orbitally tuned isotope record	(270.860)	8.003	Hodell et al. 2001			
8.4	8.42	0.00	PF	Base acme dominant <i>Globigerina bulloides</i> ; Influx <i>Sphaeroidinellopsis kochi</i> ; Influx <i>Globigerina eamesi</i>	8.42	Hole 982B (Rockall Plateau)			
						orbitally tuned isotope record	(275.660)	8.353	Hodell et al. 2001
							256.47 (277.06)	8.42	Flower 1999
			orbitally tuned isotope record	(279.060)	8.517	Hodell et al. 2001			
						Metochia Section, Gavdos Island (Mediterranean)			

8.8-9.1	9.5	9.5; 9.76	0.00; 0.06	BO	LO (consistent) <i>Bolboforma metzmacheri</i> ; Decrease <i>Bolbofoma laevis</i>	9.5; 9.70-9.81	i) re-calibrated isotope record; ii) Equivalent to LO <i>Discoaster hamatus</i> (as LO common <i>B. laevis</i> to LO (consistent) <i>B. metzmacheri</i> and FO <i>B. intermedia</i>)	206.09-206.77	i) 9.5; ii) 9.76	Spiegler and Mueller 1992 + This study	h
							FO <i>Discoaster hamatus</i>	223.69-225.66	10.55 (S.Atl)	Baldauf et al. 1986	
							Hole 408 (West Reykjanes Ridge)				
				BO	LO (consistent) <i>Bolboforma metzmacheri</i> ; Decrease <i>Bolbofoma laevis</i>	5.6-8.3	NN11 (As LO (consistent) <i>B. metzmacheri</i> ; Decrease <i>B. laevis</i>)	134.27	5.59-8.29 in Lourens et al. 2004		
							Hole 555 (Rockall Plateau)				
		(5.94)	0.12			(Reworked?) 5.82-6.06	NN11/ <i>Discoaster quinqueringus</i>	24.40-33.90	5.58 (S.Atl)	Backman 1984	
							NN11	40.63- 43.50	5.94		
							approximately NN9-10/ <i>Discoaster quinqueringus</i>	109.64-133.29	8.11	Backman 1984, Berggren et al. 1995	
							Hole 552A (Rockall Plateau)				
							C2An.3n/C2Ar	56.60	3.596		
	10.23		0.01			10.21-10.24	NN9 - NN10 (8.29-10.55)	158.45- 163.66	10.23	Backman 1984, Murray 1986	
							NN7-8/ <i>Discoaster quinqueringus</i>	163.66-168.65	10.55 (S.Atl)		
							Hole 982B (Rockall Plateau)				
							orbitally tuned isotope record	(279.060)	8.517	Hodell et al. 2001	

8.7

8.77
~9.5
8.99
~9.1
(8.10)

0.00
-
0.05
-
0.05

BO

LO (consistent) *Bolboforma metzmacheri*;
Decrease *Bolbofoma laevis*

7.7	8.77	262.09 (282.68)	8.77	Spiegler (1999)
		orbitally tuned isotope record	8.901	Hodell et al. 2001
		Hole 116 (Rockall Plateau)		
9.53-10.55	?upper NN9	266.05- 309.48	~ 9.5	
		Hole 918D (Irminger Basin)		
		strontium isotope ratio: 0.708970; 0.708955	516.93	6.48; 6.99 (ave. = 6.735)
		Israelson and Spezzaferri 1998 + McArthur et al. 2001		
8.94-9.03	CN9-CN7 (As LO (consistent) <i>Bolboforma metzmacheri</i> + LO <i>Bolbofoma laevis</i>)	551.40- 552.90	8.99	Spiegler and Mueller 1992
		strontium isotope ratio: 0.708903; 0.708927	552.36	9.52; 8.48 (ave. = 9.00)
		Israelson and Spezzaferri 1998 + McArthur et al. 2001		
		Hole 646B (Labrador Sea)		
		C4An/C4Ar.1r	702.85- 708.39	9.098
~ 9.1	(As spot occurrence only)	703.50- 704.03	~9.1	Pallant and Kaminski 1989
		-	-	-
		Hole 642B (Vøring Plateau)		
		C3An.2n/C3Ar	113.11- 113.52	6.733
	(Underlies barren interval - sub-top?) 8.06- 8.15	126.2-127.7	8.10	Qvale and Spiegler 1989
		C5AAAn/C5AAr	176.93- 177.91	13.183
		Hole 642C (Vøring Plateau)		
		C3Bn/C3Br.1r	119.61- 120.41	7.212
				Bleil 1989

						(342.16) 350.00- 351.50		Harland 1979	
						Hole 905A (U.S. East Coast Atlantic)			
						NN11a/NN11b subzonal boundary of Martini 1971 (as FO <i>Amaurolithus</i> spp. with FO <i>A.</i> <i>delicatus</i>)	477.86	7.42	Gartner and Shyu 1996
						LO <i>Minylitha</i> <i>convallis</i>	542.59	8.68	Gartner and Shyu 1996
					(Extrapolated) 8.92	near calcareous nannofossil zonal boundary NN10/NN11 (8.29) of Martini 1971	554.91	8.92	de Verteuil and Norris 1996; de Verteuil 1996; Shipboard Scientific Party 1994d
						Hole 555 (Rockall Plateau)			
						NN11/NN12 (as LO <i>Discoaster</i> <i>quinqeramus</i>)	24.40-33.90	5.58 (S.Atl)	Backman 1984
7.7	7.74	0.28	DC	LO <i>Palaeocystodinium</i> <i>golzowense</i>	7.46-8.02	106.50- 107.66	7.74	Edwards 1984	
						approximately NN9- 10/NN11 (as FO <i>Discoaster</i> <i>quinqeramus</i>)	109.64- 133.29	8.11	Backman 1984, Berggren et al. 1995
						Hole 645E (Baffin Bay)			
						(625.90) 641.00- 641.61			Head et al. 1989b
						Hole 643A (Vøring Plateau)			
10.2	10.20	0.04	DC	LO <i>Palaeocystodinium</i> <i>golzowense</i>	9.80-10.61	C4Ar.1n/C4Ar.2r 95.56-95.86	9.409	Bleil 1989	
						97.10-100.61	10.20	Manum et al. 1989	

						C5ADn/C5ADr	116.06-116.36	14.581	Bleil 1989	
						Hole 918D (Irminger Basin)				
						i) strontium 87Sr/86Sr isotope ratio: 0.708915; ii) CN9/CN10 as LO <i>D. quinqueramus</i>	i) 553.86 ; ii) 506.04- 506.85	i) 9.08; ii) 5.58 (S.Atl)	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001	
8.9-9.4	9.28-9.39	-	HIATUS	<i>Upper Miocene calcareous hiatus (calcite near-barren interval)</i>	9.28-9.39		570.70- 7580.30	i) 9.28- 9.39 ; ii) (8.11- 8.45)	Spezzaferri 1998	k
						i) strontium 87Sr/86Sr isotope ratio: 0.708903; ii) CN6/CN7	i) 590.94; ii) 633.10- 634.08	i) 9.52; ii) 10.55 (S.Atl)	Wei 1998	
						Hole 982B (Rockall Plateau)				
						orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001	
	8.93- 9.35	-			8.93-9.35		(286)-(308.34)	8.93- 9.35	Flower 1999 + This study	
						LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996	
						Hole 982B (Rockall Plateau)				
						orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001	
							287.75 (308.34)	9.35	Flower 1999	
						LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996	
						Hole 642C (Vøring Plateau)				
9.4	9.35	0.00	PF	<i>LO consistently common Neogloboquadrina acostaensis and N. atlantica (dextral) (= Top first/lowermost acme N. acostaensis)</i>	9.35					
						C3Bn/C3Br.1r	119.61- 120.41	7.212	Bleil 1989	

10.8	10.75	0.04	PF	<i>LO consistently common Neogloboquadrina acostaensis</i>	10.70-10.79		~155	10.75	Spiegler and Jansen 1989
						C5AA _n /C5AA _r	178.61-179.41	13.183	Bleil 1989
						Hole 982B (Rockall Plateau)			
						orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001
9.5	9.46	0.00	PF	<i>FO (consistent) Globorotalia juanai</i>	9.46		293.61 (314.20)	9.46	Flower 1999 m
						LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996
						Hole 918D (Irminger Basin)			
						i) CN9/CN10 as LO <i>D. quinquerramus</i> ;	i) 506.04-506.85; ii) 590.94	i) 5.58 (S.Atl); ii) 9.52	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
9.5	9.52	0.00	PF	<i>FO Neogloboquadrina humerosa</i>	8.4 8.86-8.90; 9.52		590.93	i) 8.88; ii) 9.52	Spezzaferri 1998
						CN6/CN7	633.10-634.08	10.55 (S.Atl)	Wei 1998
						Hole 982B (Rockall Plateau)			
						orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001
9.9	9.86	0.00	PF	Disappearance of <i>Neogloboquadrina pachyderma</i> (dextral) (= top of 'Miocene N. pachyderma (d) Acme')	9.86		315.15 (335.74)	9.86	Flower 1999
						LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996
						Hole 608 (Kings Trough)			
						LO <i>Discoaster hamatus</i>	203.12-206.47	9.69 (S.Atl)	Baldauf et al. 1986

9.7	9.7; 9.97	0.00; 0.06	BO	FO <i>Bolboforma metzmacheri</i> ; Increase in <i>Bolbofoma laevis</i>	9.7; 9.91-10.03	i) re-calibrated oxygen isotope chronology (this study); 2) ?upper NN9 (9.53-10.55)	211.27	i) 9.7; 2) 9.97	Spiegler and Mueller 1992						
						FO <i>Discoaster hamatus</i>	223.69-225.66	10.55 (S.Atl)	Baldauf et al. 1986						
Hole 982B (Rockall Plateau)															
9.8; 10.2	10.17	0.01	BO	FO <i>Bolboforma metzmacheri</i> ; Increase in <i>Bolbofoma laevis</i>	10.16-10.19	orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001						
							330.99-332.49 (351.58-353.08)	10.17	Spiegler 1999						
						LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996						
						Hole 116 (Rockall Plateau)									
						~ 10	?mid- NN9	314.03-359.92	9.53-10.55 in Lourens et al. 2004	Spiegler and Mueller 1992					
Hole 408 (West Reykjanes Ridge)															
8.88	0.43				~ 9.5	NN10/NN9	165.19-171.73	9.53 in Lourens et al. 2004	Spiegler and Mueller 1992						
						Hole 555 (Rockall Plateau)									
						approximately NN9-10/NN11 (as FO <i>Discoaster quinqueramus</i>)	109.64-133.29	8.11	Backman 1984, Berggren et al. 1995						
					8.45-9.31	?mid- NN9	138.50-140.47	8.88	Spiegler and Mueller 1992						

						NN6/NN7 (as LO <i>Cyclicargolithus</i> <i>abisectus</i> (C. <i>floridanus</i> grp.))	235.30- 243.00	13.33 (S.Atl)	Backman 1989
						Hole 918D (Irminger Basin)			
						i) CN9/CN10 as LO <i>D. quinquerramus</i> ;	i) 506.04-	i) 5.58	Wei 1998;
						ii) strontium	506.85; ii)	(S.Atl);	Israelson and
						isotope ratio:	590.94	ii) 9.52	Spezzaferri
						0.708903			1998 +
									McArthur et al.
									2001
	9.75	0.02			9.24-9.26; 9.73- 9.76	CN9 - CN7	599.60- 601.10	9.25; 9.75	Spezzaferri 1998
						CN6/CN7	633.10- 634.08	10.55 (S.Atl)	Wei 1998
						Hole 642B (Vøring Plateau)			
						C3An.2n/C3Ar	113.11- 113.52	6.733	Bleil 1989
					(Overlies barren interval = above base?) 8.06-		126.2- 127.7	8.10	Qvale and Spiegler 1989
					8.15				
						C5AAn/C5AAr	176.93- 177.91	13.183	Bleil 1989
						Hole 642C (Vøring Plateau)			
						C3Bn/C3Br.1r	119.61- 120.41	7.212	Bleil 1989
					(Overlies barren interval = above base?) 7.71-		124.5- 126.2	7.75	Qvale and Spiegler 1989
					7.80				
						C5AAn/C5AAr	178.61- 179.41	13.183	Bleil 1989
						Hole 643A (Vøring Plateau)			
						C4r.2r/C4An	82.66-83.06	8.769	Bleil 1989
					8.90-8.92		86.20	8.91	Qvale and Spiegler 1989
						C4An/C4Ar.1r	90.56-91.06	9.098	Bleil 1989
						Hole 608 (Kings Trough)			

10.0	10.00	0.03	BO	<i>LO Bolboforma capsula</i>	9.97-10.03	<i>LO Discoaster hamatus</i>	203.12-206.47	9.69 (S.Atl)	Baldauf et al. 1986
						?upper NN9	211.27-212.79	10.00	Spiegler and Mueller 1992
						<i>FO Discoaster hamatus</i>	223.69-225.66	10.55 (S.Atl)	Baldauf et al. 1986
10.0-10.2	10.17	0.01	BO	<i>LO Bolboforma capsula</i>	10.16-10.19	Hole 982B (Rockall Plateau)			
						orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001
							330.99-332.49	10.17	Spiegler 1999
							(351.58-353.08)		
						<i>LO Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996
						Hole 116 (Rockall Plateau)			
	?mid- NN9	314.03-359.92	ave. = 10.04						
10.1	10.04	0.51	BO	<i>LO Bolboforma capsula</i>	9.53-10.55	Hole 408 (West Reykjanes Ridge)			
10.5	10.04	0.51	BO	<i>LO Bolboforma capsula</i>	9.53-10.55	NN9 (As spot occurrence only)	173.68	ave. = 10.04	
						Hole 608 (Kings Trough)			
						<i>LO Discoaster hamatus</i>	203.12-206.47	9.69 (S.Atl)	Baldauf et al. 1986
10.1	10.12	0.06	BO	<i>LO Bolboforma robusta</i>	10.07-10.18	?mid- NN9	214.87	10.12	Spiegler and Mueller 1992
						<i>FO Discoaster hamatus</i>	223.69-225.66	10.55 (S.Atl)	Baldauf et al. 1986
						Hole 982B (Rockall Plateau)			
10.5	10.49	0.00	BO	<i>LO Bolboforma robusta</i>	10.49	orbitally tuned isotope record	(284.460)	8.901	Hodell et al. 2001
							348.79 (369.38)	10.49	Spiegler 1999
						<i>LO Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996
Hole 116 (Rockall Plateau)									

10.5	10.50	-		9.53-10.55	?lower NN9 (As spot occurrence in Spiegler 1999 restudy)	366.99	~ 10.5	Spiegler and Mueller 1992
	10.00	0.02	PF	FO <i>Neogloboquadrina acostaensis</i> ; Reappearance common <i>N. continuaosa</i>	9.46	9.98-10.01	Hole 982B (Rockall Plateau)	
						orbitally tuned isotope record	(284.460)	8.901
					(as both the FO and the consistently common FO of <i>N. acostaensis</i>)	321.39 (341.98)- 323.03 (343.62)	10.00	Flower 1999 n
					LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl.)	Shipboard Scientific Party 1996
					Hole 918D (Irminger Basin)			
					i) CN9/CN10 as LO <i>D. quinqueramus</i> ; ii) strontium 87Sr/86Sr isotope ratios: 0.708878, 0.708870, 0.708894	i) 506.04-506.85; ii) 621.16-621.66	i) 5.58 (S.Atl); ii) 10.24, 10.50, 9.78 (ave. 10.173)	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
10.48; 10.77	0.02; 0.01			Above base according to Spezzaferri (1998), true FO absent due to hiatus	10.46-10.50; 10.76-10.78	631.73	10.48; 10.77	Spezzaferri 1998

10.6-11.5	10.6-10.9	HIATUS	Middle/Late Miocene hiatus	10.6-10.9	The absence of standard nannoplankton zone NN8	10.55-10.89	Spiegler 1999	o
					Hole 918D (Irminger Basin)			
	10.6-11.5			10.6-11.5	1) Absence of standard planktonic foraminiferal Zone N15 of Blow (1969) or M12 of Berggren et al. (1985,1995)	10.57-11.47	1) Spezzaferri 1998; 2) Ogg and Lugowski 2008	n
> 10.8	> 10.08	PF	<i>LO Paragloborotalia mayeri</i> ; <i>FO (consistent) Globigerinita glutinata</i>	9.46 in Flower 1999	Hiatus causes artificially young interpolation (10.08)	326.49 (347.08)	10.08	n
							11.47 (S. Atl.) ; 12.07 (E. Med.)	
					LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996
					Hole 918D (Irminger Basin)			
					CN6/CN7	633.10-634.08	10.55 (S.Atl)	Wei 1998

11.1	10.07	0.01	PF	FO <i>Neogloboquadrina praeumerosa</i>	9.6 in Spezzaferri (1998)	10.06-10.08	CN9/CN10 as LO	506.04-506.85	5.58 (S.Atl)	Wei 1998
							"=CN7 (NN9)	621.15-621.63	10.07	Spezzaferri 1998
							CN6/CN7	633.10-634.08	10.55 (S.Atl)	Wei 1998
							Hole 642B (Vøring Plateau)			
							C3An.2n/C3Ar	113.11-113.52	6.733	Bleil 1989
	11.13	0.04	PF	FO <i>Neogloboquadrina praeumerosa</i>		11.09-11.17	"=C5r.2r"	~157	11.13	Spiegler and Jansen 1989
							C5AAAn/C5AAr	176.93-177.91	13.183	Bleil 1989
							Hole 642C (Vøring Plateau)			
							C3Bn/C3Br.1r	119.61-120.41	7.212	Bleil 1989
	10.93	0.04				10.88-10.97	same level as LO <i>P. mayeri</i>	156.70	10.93	Spiegler and Jansen 1989
							C5AAAn/C5AAr	178.61-179.41	13.183	Bleil 1989
11.0	11.03	0.02	PF	<i>Influx Globigerinoides trilobus; Influx Sphaeroidinellopsis disjuncta; LO Globorotalia miozea; Influx Globigerinoides quadrilobatus; Influx Globigerinoides immaturus; Influx Dentoglobigerina spp.; Influx "Globigerina" venezuelana; Influx Globorotalia scitula; Reappearance Neogloboquadrina pachyderma (sinistral); Influx Orbulina universa</i>		11.01-11.05	Hole 918D (Irminger Basin)			
							CN6/CN7	633.10-634.08	10.55 (S.Atl)	Wei 1998
							NN7	641.20-642.70	11.03	Spezzaferri 1998
							nannofossil LO <i>Sphenolithus heteromorphus</i>	685.77-685.87	13.53 (S.Atl)	Wei 1998
							Hole 982B (Rockall Plateau)			

13.2

13.31

0.12

PF

LO *Globigerinoides trilobus*; LO *Globigerinoides quadrilobatus*; LO *Catapsydrax stainforthi*; Influx *Dentoglobigerina* spp.; Influx *Orbulina universa*; FO consistently common *Globigerina bulloides* (= *Rasa* some G

13.18-13.43

LO *Coccolithus miopelagicus* (397.44)

11.02 (S.Atl)

Shipboard Scientific Party 1996

458.37 (478.96)-
467.67
(488.26)

13.31

Flower 1999

LO *Sphenolithus heteromorphus* (492.04)

13.53 (S.Atl)

Shipboard Scientific Party 1996

Hole 918D (Irminger Basin)

i) nannofossil LO *Sphenolithus heteromorphus*; ii) strontium ⁸⁷Sr/⁸⁶Sr isotope ratio: 0.708835

i) 685.77-685.87; ii) 697.07

i) 13.53 (S.Atl); ii) 12.07

i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001

i) 14.03-14.08; ii) (12.13-12.30)

Calcareous nannoplankton Zone NN5 of Martini (1971)

697.60-699.10

i) 14.05; ii) 12.22

Spezzaferri 1998

i) nannofossil FO *Sphenolithus heteromorphus*; ii) strontium ⁸⁷Sr/⁸⁶Sr isotope ratios: 708757

i) 785.50-787.00; ii) 726.01

i) 17.71 (S.Atl); ii) 15.42

i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001

LO (consistent) *Globigerinoides trilobus*

14.05; (12.22)

0.02; 0.08

PF

16.1

16.05

0.00

PF

Influx *Globigerinoides trilobus*

16.05

Hole 982B (Rockall Plateau)

LO *Sphenolithus heteromorphus* (492.04)

13.53 (S.Atl)

Shipboard Scientific Party 1996

528.32
(548.91)

16.05

Flower 1999

FO *Sphenolithus heteromorphus* (586.27)

17.71 (S.Atl)

Shipboard Scientific Party 1996

Hole 642B (Vøring Plateau)

16.2	16.23; (16.71)	0.01; 0.00	PF	<i>Influx Globigerinoides trilobus</i>	(Subtop) 16.21-16.24; 16.71	i) C5Br/C5Cn.1n; ii) Rb/Sr isotope ratios: 0.75318 - 0.72531; iii) Sr/Sr isotope ratio: 0.708662	i) 196.12-196.41; ii) 196.7; iii) 194.9	i) 15.974; ii) 16.0-16.7; iii) 16.88-17.11	i) Bleil 1989; ii) Smalley et al. 1989; iii) Smalley et al. 1989 + McArthur et al. 2001
						C5Cn.1n (as spot occurrence only)	199.11	16.23; 16.71	Spiegler and Jansen 1989
						C5Cn.3n/C5Cr	204.52-204.83	16.721	Bleil 1989
11.3-13.7			HIATUS	Mid/Late Miocene (near-)barren interval		Hole 918D (Irminger Basin)		Wei and Paleo-Alampay 1997; Spezzaferri 1998; Israelson and Spezzaferri 1998	q
						1) As glauconitic hardground, significant biosiliceous decrease and uphole decrease in tephra; 2) dissolution interval	1) 644; 2) 645.70-652.40		
11.2-12.4 (?to base Miocene on Vøring Pl.)	11.81-12.39		HIATUS	Mid/Late Miocene (near-)barren interval	11.81-12.39		163.3-170	12.10	Qvale and Spiegler 1989
						C5AA _n /C5AA _r	176.93-177.91	13.183	

11.23-12.23	-	PF		11.23-12.23	C5AAn/C5AAr	176.93-177.91	13.183	Bleil 1989
					Hole 642C (Vøring Plateau)			
					C3Bn/C3Br.1r	119.61-120.41	7.212	Bleil 1989
						159.3-170	11.73	Qvale and Spiegler 1989
		C5AAn/C5AAr	178.61-179.41	13.183	Bleil 1989			
12.66	-	PF	<i>Acme neogloboquadrina</i> group (excl. <i>iv. continua</i>); LO (consistent) <i>Globorotalia conoidea</i> ; Influx common <i>Turborotalita quinqueloba</i> ; Paracme <i>Globigerina bulloides</i> ; <i>Disanannarance Paragloborotalia maveri</i>	12.24-12.66	Hole 982B (Rockall Plateau)			Shipboard Scientific Party 1996
					LO <i>Coccolithus miopelagicus</i>	(397.44)	11.02 (S.Atl)	
					NN6	422.72 (443.31) - 438.64 (459.23)	12.45	Flower 1999 r
					LO <i>Sphenolithus heteromorphus</i>	(492.04)	13.53 (S.Atl)	Shipboard Scientific Party 1996
13.93	0.06	PF	<i>Top acme Globigerina praebulloides</i> ; "LO" <i>Praeorbulina glomerata</i> ; "LO" <i>Globoquadrina dehiscens</i> ; Influx common <i>Globorotalia miozea</i> ; LO <i>Globigerinoides trilobus</i>	13.86-13.99	Hole 982B (Rockall Plateau)			Shipboard Scientific Party 1996
					LO <i>Sphenolithus heteromorphus</i>	(492.04)	13.53 (S.Atl)	
					NN5	478.96 (499.55)- 481.89 (502.48)	13.93	Flower 1999; 1) Berggren et al. 1995, according to Ogg and Lugowski 2008
					FO <i>Sphenolithus heteromorphus</i>	(586.27)	17.71 (S.Atl)	Shipboard Scientific Party 1996
		Hole 918D (Irminger Basin)						
		CN6/CN7	633.10-634.08	10.55 (S.Atl)	Wei 1998			

13.8	?	(11.73)	0.09	PF	<p><i>LO Globorotalia praescitula</i>; "LO" <i>Globoquadrina dehiscens</i>; Influx <i>Globorotalia miozea</i>; Reappearance <i>Turborotalita quinqueloba</i>; Influx <i>Neogloboquadrina continuosa</i></p>	Reworked? (11.64-11.83)	652.40- 656.26	11.73	13.73 (S. Atl.)	Spezzaferri 1998	
							nannofossil LO <i>Sphenolithus heteromorphus</i>	685.77- 685.87	13.53 (S. Atl)	Wei 1998	
		14.24	0.05	PF	<p><i>LO (consistent) Globorotalia praescitula</i>; Reappearance <i>Turborotalita quinqueloba</i>; FO common <i>Globigerina bulloides</i>; FO <i>Orbulina universa</i>; FO <i>Globorotalia scitula</i>; FO <i>Globorotalia conoidea</i></p>	14.19-14.29	NN5	486.39 (506.98)- 488.67 (509.26)	14.24	13.73 (S. Atl.)	Shipboard Scientific Party 1996
							FO <i>Sphenolithus heteromorphus</i>	(586.27)	17.71 (S. Atl)	Shipboard Scientific Party 1996	
							Hole 116 (Rockall Plateau)				
						(Subtop?) ~ 13.5	Approximates NN5/NN6 zonal boundary of Martini 1971. Coincident with LO <i>Globorotalia peripheroronda</i> . (As LO <i>Globorotalia</i> <i>aff. zealandica</i> , LO <i>Globorotalia praescitula</i> s.s)	(?470) 509.00- 509.20	13.80 (S. Atl)	13.73 (S. Atl.)	Poore and Berggren 1975; Perch- Nielsen 1972
							Hole 918D (Irminger Basin)				
							nannofossil LO <i>Sphenolithus heteromorphus</i>	685.77- 685.87	13.53 (S. Atl)	Wei 1998	

14.04	0.08	PF	LO (consistent) <i>Globorotalia ex. gr. praescitula-zealandica</i> ; "FO" <i>Praeorbulina glomerosa</i> ; FO <i>Globorotalia scitula</i> ; Disappearance <i>Neogloboquadrina pachyderma (sinistral)</i>	13.96-14.12	NN5, near N8/N9	696.10- 700.08	14.04	13.73 (S. Atl.)	Spezzaferri 1998			
					nannofossil FO <i>Sphenolithus heteromorphus</i>	785.50- 787.00	17.71 (S.Atl)		Wei 1998			
12.29	0.5	PF	Reappearance (consistent) <i>G. praebulloides</i> (=Top paracme <i>Globigerina praebulloides</i>); Reappearance <i>G. ex gr. praescitula-zealandica</i>	Hole 918D (Irminger Basin)					12.29	Spezzaferri 1998	h	
					CN6/CN7	633.10- 634.08	10.55 (S.Atl)	Wei 1998				
				12.27-12.30	NN6	663.50- 664.50						
			nannofossil LO <i>Sphenolithus heteromorphus</i>	685.77- 685.87	13.53 (S.Atl)		Wei 1998					
14.65	0.03	PF	FO <i>Globigerina bulloides</i> ; FO <i>Orbulina suturalis</i>	Hole 982B (Rockall Plateau)					15.1*	Shipboard Scientific Party 1996	Shipboard Scientific Party 1996	
						LO <i>Sphenolithus heteromorphus</i>	(492.04)	13.53 (S.Atl)				
				14.95 in Flower 1999	14.61-14.68	NN5	495.89 (516.48)- 497.39 (517.98)	14.65				Flower 1999; * (Berggren et al. 1995, according to Ogg and Lugowski 2008)
						FO <i>Sphenolithus heteromorphus</i>	(586.27)	17.71 (S.Atl)				Shipboard Scientific Party 1996
			Hole 982B (Rockall Plateau)					Shipboard Scientific Party 1996				
		LO <i>Sphenolithus heteromorphus</i>	(492.04)	13.53 (S.Atl)								

Depth (m)	Interval (m)	Age (ka)	Stratigraphy	Age (ka)	Depth (m)	Interval (m)	Age (ka)	Reference		
16.3	16.25	0.07	PF Influx common <i>Sphaeroidinellopsis disjuncta</i> , LO <i>Globorotalia zealandica</i> ; FO <i>Praeorbulina glomerosa</i>	16.19-16.32	mid-NN4	531.35 (551.94)- 534.29 (554.88)	16.25	Flower 1999		
					FO <i>Sphenolithus heteromorphus</i>	(586.27)	17.71 (S.Atl)	Shipboard Scientific Party 1996		
				Hole 918D (Irminger Basin)						
					CN6/CN7	633.10- 634.08	10.55 (S.Atl)	Wei 1998		
11.03	0.02	PF LO (sporadic) <i>Sphaeroidinellopsis disjuncta</i> ; LO <i>Globigerinoides trilobus</i> ; LO <i>Globorotalia miozea</i> ; Influx <i>Globiaerinoidea quadrilobatus</i> :	11.01-11.05	(as spot occurrence only)	641.20- 642.84	11.03	Spezzaferri 1998			
				nannofossil LO <i>Sphenolithus heteromorphus</i>	685.77- 685.87	13.53 (S.Atl)	Wei 1998			
			Hole 982B (Rockall Plateau)							
				orbitally tuned isotope record	163.330	5.256	Hodell et al. 2001			
15.2	(5.27)	0.01	FO <i>Neogloboquadrina pachyderma (sinistral)</i> ; LO <i>Globoturborotalita woodi</i>	(Above base?)		163.95- 165.45	5.27	Flower 1999 t		
					orbitally tuned isotope record	166.930	5.303	Hodell et al. 2001		
				Hole 918D (Irminger Basin)						
					nannofossil LO <i>Sphenolithus heteromorphus</i>	685.77- 685.87	13.53 (S.Atl)	Wei 1998		
						(703.61) 725.20- 726.70 (763.20)	15.20	Spezzaferri 1998		
					CN2/CN3 as FO <i>Sphenolithus heteromorphus</i>	785.50- 787.00	17.71 (S.Atl)	Wei 1998		
9.0	8.78	0.01	PF FO <i>Neogloboquadrina pachyderma (sinistral)</i>	8.77-8.79	C4An	83.20	8.78	Spiegler and Jansen 1989		
					C4An/C4Ar.1r	90.56-91.06	9.098	Bleil 1989		

16.8; 17.1

9.03	0.04				Hole 642C (Vøring Plateau)			
				8.99-9.07	C3Bn/C3Br.1r	119.61-120.41	7.212	Bleil 1989
					(as a spot rare occurrence only)	~138	9.03	Spiegler and Jansen 1989
					C5AAr/C5AAr	178.61-179.41	13.183	Bleil 1989
17.0	0.00	PF	Disappearance common <i>Neogloboquadrina continua</i> , <i>G. ex gr. praescitula-zealandica</i> , <i>P. mayeri</i> (Top MMCO fauna)	17.0	Hole 982B (Rockall Plateau)			
					LO <i>Sphenolithus heteromorphus</i>	(492.04)	13.53 (S.Atl)	Shipboard Scientific Party 1996
					(as rare occurrence)	570.22 (590.81)	17.0	Flower 1999
					FO <i>Sphenolithus heteromorphus</i>	(586.27)	17.71 (S.Atl)	Shipboard Scientific Party 1996
16.87	0.04	PF	LO <i>Paragloborotalia nana</i> ; LO (consistent) <i>Globigerinella obesa</i> ; LO (consistent) <i>Paragloborotalia acrostoma</i> ; Influx <i>Globoturborotalita druryi</i> ; LO (consistent) <i>Globoturborotalita connecta</i> ; LO (consistent)	17.18-17.23; 16.83-16.91	Hole 918D (Irminger Basin)			
					i) nannofossil LO <i>Sphenolithus heteromorphus</i> ; ii) strontium	i) 685.77-685.87; ii) 726.01	i) 13.53 (S.Atl); ii) 15.42	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
					87Sr/86Sr isotope ratio: 0.708757			
					NN4	772.90-775.32	i) 17.20; ii) 16.87	Spezzaferri 1998
					i) CN2/CN3 as FO <i>Sphenolithus heteromorphus</i> ; ii) strontium	i) 785.50-787.00; ii) 786.22	i) 17.71 (S.Atl); ii) 17.23-17.24	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
					87Sr/86Sr isotope ratio: 0.708647 and 0.708648			
					Hole 643A (Vøring Plateau)			
					C5Bn.1r/C5Bn.2n	134.26-134.66	15.032	Bleil 1989

15.2	(15.15)	0.00	PF	Influx <i>Paragloborotalia nana</i> - <i>Neogloboquadrina continuosa</i> transition	15.14-15.15	C5Bn.2n (as <i>Neogloboquadrina</i> <i>nana-continuosa</i> transition)	141.68	15.15	Spiegler and Jansen 1989
						C5Bn.2n/C5Br	142.26- 142.66	15.160	Bleil 1989
17.4-17.6	17.37-17.59	-	PF	Influx <i>Globorotalia peripheroronda</i> ; FO <i>Globigerina falconensis</i> ; Influx <i>Sphaeroidinellopsis disjuncta</i> ; Influx <i>Praeorbulina transitoria</i> ; Influx <i>Globigerinoides bisphericus</i> ; Reappearance	Hole 918D (Irminger Basin)				
					17.37-17.59; 16.97-17.17	i) nannofossil LO <i>Sphenolithus</i> <i>heteromorphus</i> ; ii) strontium 87Sr/86Sr isotope ratio: 0.708757	i) 685.77- 685.87; ii) 726.01	i) 13.53 (S.Atl); ii) 15.42	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
						NN4 (as spot occurrence of <i>G.</i> <i>peripheroronda</i>)	777.40- 784.00	i) 17.48; ii) 17.07	Spezzaferri 1998
						i) CN2/CN3 as FO <i>Sphenolithus</i> <i>heteromorphus</i> ; ii) strontium 87Sr/86Sr isotope ratio: 0.708647 and 0.708648	i) 785.50- 787.00; ii) 786.22	i) 17.71 (S.Atl); ii) 17.23- 17.24	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
(11.76)	0.04	PF	LO ? <i>Globorotalia</i> <i>aff. peripheroronda</i>	Hole 642B (Vøring Plateau)					
				11.72-11.80	C3An.2n/C3Ar	113.11- 113.52	6.733	Bleil 1989	
					"=C5r.3r" (as spot occurrence of <i>Neogloboquadrina</i> <i>sp. aff.</i> <i>peripheroronda</i> ")	163.27	11.76	Spiegler and Jansen 1989	
		C5AA n/C5AA r	176.93- 177.91	13.183	Bleil 1989				
				Hole 982B (Rockall Plateau)					
				LO <i>Sphenolithus</i> <i>heteromorphus</i>	(492.04)	13.53 (S.Atl)	Shipboard Scientific Party 1996		

16.6	16.64	0.00	PF	Reappearance common <i>Globigerina praebulloides</i> (Base acme <i>G. praebulloides</i>)	16.64	541.58 (562.17)	16.64	Flower 1999	
						FO <i>Sphenolithus heteromorphus</i> (586.27)	17.71 (S.Atl)	Shipboard Scientific Party 1996	
						Hole 918D (Irminger Basin)			
						i) nannofossil LO <i>Sphenolithus heteromorphus</i> ; ii) strontium 87Sr/86Sr isotope ratio: 0.708757	i) 685.77-685.87; ii) 726.01	i) 13.53 (S.Atl); ii) 15.42	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
16.9-17.0	16.91; 16.66	0.03; 0.00	PF	Disappearance <i>Globigerina praebulloides</i> ; LO <i>Globorotalia peripheroronda-peripheroacuta</i> transition; LO <i>Globoturborotalita ciperensis</i> s.l. (as <i>G. pseudociperoensis</i>)	16.88-16.94; 16.66	767.01	16.91; 16.66	Spezzaferri 1998	
						i) CN2/CN3 as FO <i>Sphenolithus heteromorphus</i> ; ii) strontium 87Sr/86Sr isotope ratio: 0.708647 and 0.708648	i) 785.50-787.00; ii) 786.22	i) 17.71 (S.Atl); ii) 17.23-17.24	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
						Hole 982B (Rockall Plateau)			
						LO <i>Sphenolithus heteromorphus</i> (492.04)	13.53 (S.Atl)	Shipboard Scientific Party 1996	
						(as rare occurrence)	570.22 (590.81)	17.0	Flower 1999
						FO <i>Sphenolithus heteromorphus</i> (586.27)	17.71 (S.Atl)	Shipboard Scientific Party 1996	
						Hole 918D (Irminger Basin)			
17.7	17.71	0.00	PF	LO <i>Cassigerinella chipolensis</i>	17.7	Same level as CN2/CN3 (NN3/NN4) as FO <i>Sphenolithus heteromorphus</i> (785.50-787.00)	17.71 (S.Atl)	Spezzaferri 1998, Wei 1998	

18.1

18.08

0.05

PF

FO *Globorotalia peripheronaa-peripheroacuta* transition; Influx *Globoturbotalita ciproensis* s.l. (as *G. pseudociproensis*); FO *Globorotalia cf. suterae*; FO *Globigerinella sinbonifera*

18.04-18.13

Hole 918D (Irminger Basin)

CN2/CN3 as FO
Sphenolithus heteromorphus 785.50-787.00 17.71 (S.Atl) Wei 1998

approximates CN2/CN3 790.00-792.29 18.08 Spezzaferri 1998
nannofossil zonal boundary

Strontium isotope ratios: 0.708496; 0.708519 803.99 19.20; 18.90 (ave. = 19.05) Israelson and Spezzaferri 1998 + McArthur et al. 2001

19.0

18.96

0.00

PF

LO (consistent) *Sphaeroidinellopsis disjuncta*; LO (consistent) *Dentoglobigerina langhiana*; LO (consistent) *Globorotaloides variabilis*; FO *Globigerinoides bisphericus*; FO *Globigerinoides quadrilobatus*; FO *Globorotalia miozea*; FO *Praeorbulina transitoria*; Influx *Globigerinoides subquadratus*

18.96

Hole 918D (Irminger Basin)

strontium ⁸⁷Sr/⁸⁶Sr isotope ratio: 0.708647 and 0.708648 786.22 17.23-17.24 Israelson and Spezzaferri 1998 + McArthur et al. 2001

803.14 18.96 Spezzaferri 1998

Strontium isotope ratios: 0.708496; 0.708519 803.99 19.20; 18.90 Israelson and Spezzaferri 1998 + McArthur et al. 2001

Hole 982B (Rockall Plateau)

LO *Sphenolithus heteromorphus* (492.04) 13.53 (S.Atl) Shipboard Scientific Party 1996

19.0

(16.78)

19.10

0.14

0.10

PF

PF

LO Catapsydrax dissimilis, Disappearance common *Neogloboquadrina continuosa*

LO (consistent) Catapsydrax dissimilis; *FO Paragloborotalia mayeri*; *FO Paragloborotalia acrostoma*; *FO Globorotalia peripheroronda*; *FO Globorotalia zealandica*; *FO Globorotalia praescitula (FO Globorotalia ex gr. praescitula-zealandica)*; *Influx Neogloboquadrina continuosa*

17.01 in Flower 1999

(Reworked?)
16.64-16.93

19.00-19.20

(as rare occurrence)

FO Sphenolithus heteromorphus

Hole 918D (Irminger Basin)

Strontium isotope ratios: 0.708496; 0.708519

Strontium isotope ratios: 0.708303; 0.708314

541.58
(562.17)-
548.07
(568.66)

(586.27)

803.30-
806.30

850.27

16.78

17.71
(S.Atl)

19.20;
18.90
(ave. =
19.05)

22.20;
22.05
(ave. =
22.125)

17.54 (S. Atl.)

17.54 (S. Atl.)

Flower 1999

Shipboard Scientific Party 1996

Israelson and Spezzaferri 1998 + McArthur et al. 2001

Spezzaferri 1998

Hole 918D (Irminger Basin)

Strontium isotope ratios: 0.708496; 0.708519

803.99

19.20;
18.90
(ave. =
19.05)

Israelson and Spezzaferri 1998 + McArthur et al. 2001

19.2	19.24	0.04	PF	<i>LO Catapsydrax unicavus</i> ; <i>FO Cassigerinella chipolensis</i>	19.20-19.28	(as spot occurrence) (<i>Globorotaloides suteri</i> = <i>Catapsydrax unicavus</i> in Iaccarino et al. 2007)	806.30-807.52	19.24	Spezzaferri 1998
						Strontium isotope ratios: 0.708303; 0.708314			
?19.3	(19.29)	0.00	PF	<i>LO Paragloborotalia kugleri</i> ; <i>FO Globigerinoides subquadratus</i> ; <i>FO Globoturborotalita labiacrassata</i> ; <i>FO Globoturborotalita brazieri</i> ; <i>FO Sphaeroidinellopsis disjuncta</i>	Reworked? (19.29)	Hole 918D (Irminger Basin)		19.20; 18.90 (ave. = 19.05)	Israelson and Spezzaferri 1998 + McArthur et al. 2001
						Strontium isotope ratios: 0.708496; 0.708519	803.99		
						Strontium isotope ratios: 0.708303; 0.708314		850.27	22.20; 22.05 (ave. = 22.125)
Hole 918D (Irminger Basin)		19.20; 18.90 (ave. = 19.05)	Israelson and Spezzaferri 1998 + McArthur et al. 2001						
Strontium isotope ratios: 0.708496; 0.708519	803.99								

20.4	20.43	0.05	PF	<i>LO (consistent) Catapsydrax unicavus; FO Dentoglobigerina langhiana</i>	20.38-20.48	<i>(Globorotaloides suteri = Catapsydrax unicavus in Iaccarino et al. 2007)</i>	824.00-825.50	20.43	Spezzaferri 1998
						Strontium isotope ratios: 0.708303; 0.708314	850.27	22.20; 22.05 (ave. = 22.125)	Israelson and Spezzaferri 1998 + McArthur et al. 2001
> 20.9	> 20.85	0.00	PF	<i>FO Globoquadrina dehiscens; FO Globigerinoides immaturus</i>	23.3 in Spezzaferri 1998, but may overly an unconformity	(Above base due to underlying hiatus) > 20.85			
								19.20; 18.90 (ave. = 19.05)	Israelson and Spezzaferri 1998 + McArthur et al. 2001
							831.12	> 20.85	22.38 (S.Atl.)
						Strontium isotope ratios: 0.708303; 0.708314	850.27	22.20; 22.05 (ave. = 22.125)	Israelson and Spezzaferri 1998 + McArthur et al. 2001
~22-26			HIATUS	Missing lower half of planktonic foraminiferal Zone N4 and upper N3 of Blow 1969, between FO <i>G. dehiscens</i> and LO <i>P. opima</i> (831.80-869.30 mbsf in Hole 918D). Correlates to Ch4/Aq1 global sequence boundary of Hardenbol et al. (1998)					
				Metocnia Section, Gavdos Island (Mediterranean)					

10.6	10.6	-	BO	<i>LO Bolboforma subfragoris</i>	10.6	8.58-11.47	Palazzolo Section, Sicily (Mediterranean)			~ 10.6	Spezzaferri et al. (2001)				
												Hole 608 (Kings Trough)			
												FO <i>Discoaster hamatus</i>	223.69-225.66	10.55 (S.Atl)	Spiegler and Mueller 1992 + Baldauf et al. 1986
	10.67	0.03										near NN8/NN9 boundary	228.00	10.67	
												LO <i>Coccolithus miopelagicus</i>	236.76-238.26	11.02 (S.Atl)	Baldauf et al. 1986
												Hole 982B (Rockall Plateau)			
												FO <i>Discoaster surculus</i> ; orbitally tuned isotope record	246.20; (284.460)	~ 8 (Java); 8.901	Shipboard Scientific Party 1996; Hodell et al. 2001
												NN8/NN9 in Spiegler (1999)	369.59 (390.18)	43.26; 10.85; 10.88	Spiegler 1999
												LO <i>Coccolithus miopelagicus</i>	376.85 (397.44)	11.02 (S.Atl)	Shipboard Scientific Party 1996
10.9	10.88	0.00	BO	<i>LO Bolboforma subfragoris</i>	10.6	10.85; 10.88	Hole 555 (Rockall Plateau)			8.11	Backman 1984; Berggren et al. 1995				
												approximately at NN10/NN11 as FO <i>Discoaster quinqueringus</i>	109.64-133.29		
												?lower NN9 (9.53-10.55)	148.00-157.00	9.47	Murray (1984)
	9.47	0.23										NN6/NN7 (as LO <i>Cyclicargolithus abisectus</i> (C. floridanus grp.))	235.30-243.00	13.33 (S.Atl)	Backman 1989
												Hole 918D (Irminger Basin)			

Age (ka)	Depth (m)	Stratigraphic Unit	Sample ID	Age (ka)	Depth (m)	Notes	Reference		
9.4	10.88	BO	<i>LO Bolboforma subfragoris</i>	10.91-10.94; 10.86-10.90	near CN6/CN7 boundary (As spot occurrence only)	631.60- 633.10	10.93; 10.88	Spezzaferri and Spiegler 1998	
	9.12			9.09-9.15	C3An.2n/C3Ar	113.11- 113.52	6.733	Bleil 1989	
	8.49			8.45-8.53	C5AAn/C5AAr	176.93- 177.91	13.183	Bleil 1989	
	9.38			9.37-9.39	C4Ar.1r/C4Ar.1n	93.26-93.66	9.312	Bleil 1989	
					C4Ar.1n	~ 95	9.38	Qvale and Spiegler 1989	
					C4Ar.1n/C4Ar.2r	95.56-95.86	9.409	Bleil 1989	
					Hole 642B (Vøring Plateau)				
					C3Bn/C3Br.1r	119.61- 120.41	7.212	Bleil 1989	
					Hole 642C (Vøring Plateau)				
					C5AAn/C5AAr	178.61- 179.41	13.183	Bleil 1989	
11.0	11.0; 11.46	BO	<i>LO Bolboforma fragori</i>	11.0; 11.35- 11.57	i) re-calibrated isotope record (this study); 2) near NN7/NN8 boundary (10.89)	241.08	11; 11.46	Spiegler & Mueller 1992	
				Hole 608 (Kings Trough)					
				LO <i>Coccolithus</i> <i>miopelagicus</i>	236.76- 238.26	11.02 (S.Atl)	Baldauf et al. 1986		

11.8	11.83	0.02	BO	LO common <i>Bolbofoma clodiusi</i>	11.7	11.81-11.85	LO <i>Coccolithus miopelagicus</i>	376.85	11.02 (S.Atl)	Shipboard Scientific Party 1996		
								406.59- 408.09	11.83	Spiegler 1999		
							LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996		
11.4	11.4; 12.46	0.00; 0.06	BO	LO <i>Bolbofoma compressispinosa</i> ; FO common <i>Bolbofoma clodiusi</i>	11.4; 12.41-12.52	Hole 608 (Kings Trough)			12.46	Spiegler and Mueller 1992	h	
						LO <i>Coccolithus miopelagicus</i>	236.76-238.26	11.02 (S.Atl)				Baldauf et al. 1986
						NN7 - NN8 (As LO <i>B. compressispinosa</i> + spot presence of common <i>B. clodiusi</i> ; within Mid-Miocene Acme of <i>Bolbofoma</i> cysts)	248.46- 249.96					
						LO <i>Cyclicargolithus floridanus</i>	254.76-257.76	13.33 (S.Atl)				Baldauf et al. 1986
						Hole 982B (Rockall Plateau)						
						LO <i>Coccolithus miopelagicus</i>	376.85	11.02 (S.Atl)				Shipboard Scientific Party 1996
11.9	11.96	0.06	BO	LO common <i>Bolbofoma compressispinosa</i> ; FO common <i>Bolbofoma clodiusi</i> ; Base Acme <i>Bolbofoma laevis</i> ; Top Mid-Miocene Acme of <i>Bolbofoma</i> two-chambered cysts	11.89-12.02	near NN7/NN6	409.8-414.69	11.96	Spiegler 1999			
						LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996			
						Hole 408 (West Reykjanes Ridge)						
						?lower NN7	209.03- 212.62	~11.9	Spiegler and Mueller 1992			
						Hole 555 (Rockall Plateau)						

9.1	11.13	0.32	BO	LO common <i>Bolboforma compressispinosa</i> ; FO common <i>Bolbofoma clodiusi</i> ; Base <i>Acme Bolboforma laevis</i> ; Top acme <i>Bolboforma spinosa</i> ; Top Mid-Miocene <i>Acme Bolboforma</i> two-chambered cysts	approximately at NN10/NN11 as FO	109.64-133.29	8.11	Backman 1984; Berggren et al. 1995			
	11.02	-			~11 in Spezzaferri and Spiegler 1998	~ 11.02	<i>Discoaster quinquerramus</i>				
							?lower NN7 (As spot occurrence of <i>B. compressispinosa</i> + abundant <i>B. compressibadenensis</i>)	189.97	11.13	Spiegler and Mueller 1992	
							NN6/NN7 (as LO <i>Cyclicargolithus abisectus</i> (<i>C. floridanus</i> grp.))	235.30-243.00	13.33 (S.Atl)	Backman 1989	
	Hole 918D (Irminger Basin)										
	11.02	-			~11 in Spezzaferri and Spiegler 1998	~ 11.02	Near CN6/CN7 boundary (As Influx common <i>B. compressibadenensis</i>)	633.10-634.08	~11.0	Spezzaferri and Spiegler 1998	
							nannofossil LO <i>Coccolithus miopelagicus</i>	634.08-635.07	11.02 in Lourens et al. 2004	Wei 1998	
							Hole 642B (Vøring Plateau)				
	9.22	0.03			BO	LO common <i>Bolboforma compressispinosa</i> ; FO common <i>Bolbofoma clodiusi</i> ; Base <i>Acme Bolboforma laevis</i> ; Top acme <i>Bolboforma spinosa</i> ; Top Mid-Miocene <i>Acme Bolboforma</i> two-chambered cysts	C3An.2n/C3Ar	113.11-113.52	6.733	Bleil 1989	
							(As LO <i>Bolboforma compressispinosa</i> ; Spot occurrence common <i>Bolboforma clodiusi</i> ; Base acme <i>B. laevis</i>)	~ 138	9.22	Qvale and Spiegler 1989	
C5AAr/C5AAr			176.93-177.91	13.183			Bleil 1989				
Hole 642C (Vøring Plateau)											
					C3Bn/C3Br.1r	119.61-120.41	7.212	Bleil 1989			

10.2-10.5	11.32	0.02				nannofossil LO <i>Coccolithus miopelagicus</i>	634.08-635.07	11.02 in Lourens et al. 2004	Wei 1998		
					11.30-11.35	NN7	638.20-639.70	11.32	Spezzaferri and Spiegler 1998		
						nannofossil LO <i>Cyclicargolithus floridanus</i>	645.70-646.20	11.81 in Lourens et al. 2004	Wei 1998		
	Hole 642B (Vøring Plateau)										
	10.22	0.04	BO	<i>LO abundant Bolboforma badenensis</i>							
				10.19-10.26	C5n.2n	~ 148	10.22	Qvale and Spiegler 1989			
					C5AA n/C5AA r	176.93-177.91	13.183	Bleil 1989			
	Hole 642C (Vøring Plateau)										
					C3Bn/C3Br.1r	119.61-120.41	7.212	Bleil 1989			
	10.45	0.04			10.41-10.49	C5n.2n	~ 152	10.45	Qvale and Spiegler 1989		
					C5AA n/C5AA r	178.61-179.41	13.183	Bleil 1989			
12.6	12.51	0.02	BO	<i>Acme Bolboforma atlantica</i>	12.6	12.49-12.53	Hole 982B (Rockall Plateau)				
								LO <i>Coccolithus miopelagicus</i>	376.85	11.02 (S.Atl)	Shipboard Scientific Party 1996
								NN6	432.39-433.89	12.51	Spiegler 1999
								LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996
							Hole 408 (West Reykjanes Ridge)				

12.72	0.82			11.90-13.53	?mid-NN6	240.35-245.02	ave. = 12.715				
				Hole 555 (Rockall Plateau)							
12.08	0.10				approximately at NN10/NN11 as FO	109.64-133.29	8.11	Backman 1984; Berggren et al. 1995			
					<i>Discoaster quinqueringus</i>						
				11.97-12.18	?mid-NN6 (11.90-13.53)	207.53-214.50	12.08	Murray (1984)			
				NN6/NN7 (as LO)	<i>Cyclicargolithus abisectus</i> (C. floridanus grp.)	235.30-243.00	13.33 (S.Atl)	Backman 1989			
				Hole 608 (Kings Trough)							
12.7	0.00	BO	<i>Acme Bolboforma danielsi</i>	12.7; 13.43-13.44	LO <i>Cyclicargolithus floridanus</i>	254.76-257.76	13.33 (S.Atl)	Baldauf et al. 1986			
						?lower NN6	278.45	12.7; 13.44	Spiegler and Mueller 1992		
						LO <i>Sphenolithus heteromorphus</i>	297.16-299.09	13.53 (S.Atl)	Baldauf et al. 1986		
				Hole 982B (Rockall Plateau)							
12.63	0.02	BO	<i>Acme Bolboforma danielsi</i>	12.6-12.7	12.61-12.65	NN6	436.89-438.2	12.63	Shipboard Scientific Party 1996		
									Spiegler 1999		
						LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996		
				Hole 116 (Rockall Plateau)							
12.21	1.32			12.0	(Possible contamination according to Spiegler 1999) 10.89-13.53	NN7 - NN6 (10.89-13.53)	459.53	12.21			
				Hole 408 (West Reykjanes Ridge)							

12.72	0.82	11.90-13.53	?lower NN6	254.36- 255.15	ave. = 12.715	
			Hole 555 (Rockall Plateau)			
			approximately at NN10/NN11 as FO <i>Discoaster</i> <i>quinquaramus</i>	109.64- 133.29	8.11	Backman 1984; Berggren et al. 1995
12.30	0.12	12.18-12.43	i) ?mid- NN6 (10.55- 11.90); ii) NN7 - NN8 (11.90-13.53)	207.53- 224.00	12.30	i) Spiegler and Mueller 1992; ii) Murray 1986; Backman 1984
			NN6/NN7 (as LO <i>Cyclicargolithus</i> <i>abisectus</i> (C. <i>floridanus</i> grp.))	235.30- 243.00	13.33 (S.Atl)	Backman 1989
			Hole 552A (Rockall Plateau)			
			LO <i>Discoaster</i> <i>quinquaramus</i>	123.40- 128.40	5.58 (S. Atl)	
11.37	0.00	11.37	NN7 - NN8 (10.55- 11.90)	163.66- 168.65	11.37	Murray 1986; Backman 1984
			LO <i>Paragloborotalia</i> <i>mayeri</i>	168.50- 173.50	12.07 (E. Med)	
			Hole 918D (Irminger Basin)			
			i) nannofossil LO <i>Coccolithus</i> <i>miopelagicus</i> ; ii)	i) 634.08- 635.07; ii)	i) 11.02; ii) 10.24,1	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
			87Sr/86Sr isotope ratios: 0.708878, 0.708870, 0.708894	621.16- 621.66	0.50, 9.78 (ave. 10.173)	
11.43; 12.11	0.03; 0.06	11.40-11.46; 12.04-12.17	NN7 (As rare spot occurrence)	639.70- 641.20	11.43; 12.11	Spezzaferri and Spiegler 1998

10.5	10.93	0.04		LO <i>Bolboforma reticulata</i> group (LO <i>Bolboforma reticulata</i>); Influx <i>Bolboforma voeringensis</i>	10.89-10.97	C3An.2n/C3Ar	113.11-113.52	6.733	Bleil 1989
						C5n.2n (As LO common B. <i>reticulata</i> : see Qvale and Spiegler 1989)	155.0	10.93	Qvale and Spiegler 1989
						C5AAAn/C5AAr	176.93-177.91	13.183	Bleil 1989
Hole 642C (Vøring Plateau)									
10.51	0.04				10.47-10.55	C3Bn/C3Br.1r	119.61-120.41	7.212	Bleil 1989
						C5n.2n (As LO common B. <i>reticulata</i> and influx B. <i>voeringensis</i>)	152.6	10.51	Qvale and Spiegler 1989
						C5AAAn/C5AAr	178.61-179.41	13.183	Bleil 1989
14.2	14.35	0.00	BO	LO <i>Bolboforma reticulata</i> s. s.	14.35	Hole 982B (Rockall Plateau)			
						LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996
						NN5	489.89	14.35	Spiegler 1999
						FO <i>Sphenolithus heteromorphus</i>	565.68	17.71 (S.Atl)	Shipboard Scientific Party 1996
						Hole 116 (Rockall Plateau)			
~ 12	13.53-14.91	?upper NN5	511.99- 513.94	ave. = 14.22					
13.9	13.88	0.18	BO	FO common <i>Bolboforma reticulata</i>	13.71-14.06	Hole 608 (Kings Trough)			
						LO <i>Sphenolithus heteromorphus</i>	297.16-299.09	13.53 (S.Atl)	Baldauf et al. 1986
						NN5/NN6 to uppermost NN5	301.21 -311.38	13.88	Spiegler and Mueller 1992
						LO <i>Helicosphaera ampliapertura</i>	328.71-331.26	14.91 (S.Atl)	Baldauf et al. 1986

15.95; 15.97	0.77; 0.57					i) nannofossil LO <i>Sphenolithus heteromorphus</i> ; ii) strontium 87Sr/86Sr isotope ratio: 0.708757	i) 685.77-685.87; ii) 726.01	i) 13.53 (S.Atl); ii) 15.42	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
					15.18-16.73; 15.40-16.54	upper N8 Zone of Blow (1969,1979) (14.74-16.97)	725.20-763.20	i); 15.95 ii) 15.97	Spezzaferri & Spiegler (1998)
						i) CN2/CN3 as FO <i>Sphenolithus heteromorphus</i> ; ii) strontium 87Sr/86Sr isotope ratio: 0.708647 and 0.708648	i) 785.50-787.00; ii) 786.22	i) 17.71 (S.Atl); ii) 17.23-17.24	i) Wei 1998; ii) Israelson and Spezzaferri 1998 + McArthur et al. 2001
13.7-14.4	13.71-14.36	HIATUS	Mid-Miocene Hiatus (as a Mid-Miocene near-barren interval)	13.71-14.36	Hole 608 (Kings Trough)			Baldauf et al. 1986	
					LO <i>Sphenolithus heteromorphus</i>	297.16-299.09	13.53 (S.Atl)		
15.4-18.3	16.37-17.50	HIATUS	Mid-Miocene Hiatus (as a Mid-Miocene near-barren interval)	16.37-17.50	?upper NN5, between FO B. reticulata group and LO B.spinosa	301.21-318.35	14.03	Spiegler and Mueller 1992	
					LO <i>Helicosphaera ampliaperta</i>	328.71-331.26	14.91 (S.Atl)	Baldauf et al. 1986	
					Hole 982B (Rockall Plateau)				
					LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996	
					NN4, between FO B. reticulata group and LO B. rotunda	535.38-560.84	16.93	Spiegler 1999	
					FO <i>Sphenolithus heteromorphus</i>	565.68	17.71 (S.Atl)	Shipboard Scientific Party 1996	
					Hole 116 (Rockall Plateau)				

17.6	17.63	0.13	BO	<i>LO Bolboforma rotunda</i>	17.5	17.50-17.76	~ 13.5-18.0	NN4 to NN5, between FO B. reticulata group and LO B. rotunda	517.70- 561.15	13.53- 17.95	Spiegler and Mueller 1992	
							Hole 408 (West Reykjanes Ridge)					
							~ 15-18	?mid-NN4 - NN3	302.46- 314.00 (base)	14.91- 18.28	Spiegler and Mueller 1992	
							Hole 555 (Rockall Plateau)					
							~18	within NN3	258.50- 281.11	17.95- 18.28	Backman 1983	
								within NN3	255.92- 275.12	~ 18	Spiegler and Mueller 1992	
							Hole 918D (Irminger Basin)					
							15.42-18.28	strontium isotope ratio: 0.708757	726.01	15.42	Israelson and Spezzaferri 1998 + McArthur et al. 2001	
								CN2 - CN3 (=NN3 - NN4) = 14.91- 18.28; N7 - N8 = 14.74-17.54	763.20- 803.30	14.74- 18.28	Spezzaferri & Spiegler (1998)	
								strontium isotope ratios: 0.708496; 0.708519	803.99	19.20; 18.90	Israelson and Spezzaferri 1998 + McArthur et al. 2001	
Hole 982B (Rockall Plateau)												
(15)	-			<i>LO Sphenolithus heteromorphus</i>	17.5	17.50-17.76	LO <i>Sphenolithus heteromorphus</i>	471.45	13.53 (S.Atl)	Shipboard Scientific Party 1996		
							NN4	560.84- 566.89	17.63	Spiegler 1999		
							FO <i>Sphenolithus heteromorphus</i>	565.68	17.71 (S.Atl)	Shipboard Scientific Party 1996		
Hole 116 (Rockall Plateau)												
				(14.91-17.95)	?upper NN4	561.15	~ 15					

11.0	11.0	-	DC	LO <i>Cannosphaeropsis passio</i>	~ 11.0 in Munsterman and Brinkhuis 2004	11.0	?	?	11.040; ii) < 11.8	v	<p>nannofossil FO Sphenolithus heteromorphus 785.50-787.00 17.71 Wei (1998)</p> <p>Mazzapiedi Section, NW Italy</p> <p>top C5r (C5n.2n/C5r.1r); overlying the Serravalian/Tortonian sealevel fall (= Ser4/Tor1 major sequence boundary of Hardenbol et al. 1998)</p> <p>Hole 905A (U.S. East Coast Atlantic)</p> <p>i) calcareous nannofossil Zone NN7 to possibly ?NN8 of Martini 1971; ii) planktonic foraminiferal Zone N14 of Blow 1969</p> <p>Onshore Netherlands boreholes (Southern North Sea)</p> <p>Within the "Tor-1 Sequence" and transgressive sequence tract of Munsterman and Brinkhuis 2004 (above the major sealevel fall interpreted as Ser4/Tor1 major sequence boundary of Hardenbol et al. 1998)</p> <p>Breda Formation</p> <p>< 11.8 (Ogg and Lugowski 2008)</p> <p>Zevenboom 1995 (according to Munsterman and Brinkhuis 2004); i) Lourens et al. 2004; ii) Ogg and Lugowski 2008</p> <p>de Verteuil and Norris 1996; de Verteuil 1996; Shipboard Scientific Party 1994d</p> <p>Munsterman and Brinkhuis 2004; Ogg and Lugowski 2008</p>
	10.9-11.6	-			10.9-11.6	10.9-11.6	(587.07) 617.08-617.48	i) (?10.55) 10.89-11.9; ii) 11.47-11.63			
	?11.0	?11-11.8	-	DC	LO <i>Cannosphaeropsis passio</i>	~ 11.0 according to Munsterman and Brinkhuis 2004	?11.0 (< 11.8)				
					NW Italy						

11.8	11.81	0.20	DC	<i>LO Cerebrocysta poulsenii</i>	~ 11.7 in Munsterman and Brinkhuis 2004	11.6-12.0	basal C5r (?C5r.3r) (11.614-12.014)	?	ave. = 11.814	Zevenboom 1995 (according to Munsterman and Brinkhuis 2004)	
	16.2	16.22; 16.24	0.04; 0.03	DC	<i>LO Cordosphaeridium minimum</i>	18.0	16.21-16.27	Hole 645E (Baffin Bay)			Head et al. 1989b
(as <i>Cordosphaeridium minimum</i> sensu Benedek and Sarjeant)											
Hole 643A (Vøring Plateau)											
i) C5Br/C5Cn.1n; ii) C5Cn.1n/C5n.1r											
i) 177.26-177.66; ii) 210.96-211.46											
DC	<i>LO Cordosphaeridium minimum</i>			(as "Dinocyst II of Manum 1976" in Manum et al. 1989, according to Williams and Manum 1999)			201.60-211.40			16.22; 16.24	Manum et al. 1989
C5Cn.1r/C5Cn.2n			216.26-216.76			16.303			Bleil 1989		
Hole 985A (Norwegian Sea)			315.69			Williams and Manum 1999					
Antwerpen member, Berchem Formation (Onkare, Belgium, North Sea Basin)											

11.8

11.8-17.0

-

BF

LO Uvigerina ex. gr. semiornata; LO Uvigerina tenuipustulata

(present within 11.8-17.0 (17.6)

1) Base of member correlated to global sequence boundary Bur5/Lan1 of Hardenbol et al. 1998, top of member correlated to global sequence boundary Ser4/Tor1 of Hardenbol et al. 1998; 2) Member spans the calcareous nannofossil Zone NN4 of Martini 1971; 3) Member spans the planktonic foraminiferal Zones N6-N13 of Blow 1969 (as presence of *U. semiornata* and *U. tenuipustulata*)

present in the temporary outcrop Antwerpen Kievitstraat

1) 11.8-16.97; 2) 14.91-17.95; 3) 11.63-17.59

1) Louwye 2005 (see references within) + Hardenbol et al. 1998 + updated in Ogg and Lugowski 2008; 2) and 3) Lourens et al. 2004

w

Zonderschol member, Berchem Formation (Onchare, Belgium, North Sea Basin)

(?15.5-17.0)

					1) Base of member correlated to global sequence boundary Bur5/Lan1 of Hardenbol et al. 1998; 2) <i>Bolboforma rotunda</i> present; 3) Planktonic foraminiferal Zones N6 or N7 of Blow 1969; 4) Dinoflagellate cyst Zone DN4 of de Verteuil and Norris 1996. (as presence of common <i>U. tenuipustulata</i>)		1) ?-16.97; 2) 17.5-18.2; 3) 16.97-17.54 or 17.54-17.59; 4) 13.5-15.5	1) Louwye 2005 (see ref's within) + Hardenbol et al. 1998 + updated in Ogg and Lugowski 2008; 2) Spiegler 2001; 3) Louwye 2005 (see ref's within) + Lourens et al. 2004; 4) Louwye 2005 + This study
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16.1

16.11

0.07

DC

LO Lophocysta sulcolimbata

Hole 645E (Baffin Bay)

(as *Lophocysta* sp. cf. *L. sulcolimbata*) (1061.32) 1066.40-1067.90

Head et al. 1989b

DC

LO Lophocysta sulcolimbata

12.0 16.03-16.18

Hole 643A (Vøring Plateau)

C5Br/C5Cn.1n 177.26-177.66 15.974

Bleil 1989

C5Cn.1n 184.20-201.60 16.11

Manum et al. 1989

C5Cn.1n/C5n.1r 210.96-211.46 16.268

Bleil 1989

Hole 985A (Norwegian Sea)

311.19

Williams and Manum 1999

Hole 643A (Vøring Plateau)

C4Ar.2r/C4Ar.2n 97.36-97.76 9.656

Bleil 1989

11.1	11.05	0.09	DC	<i>LO Palaeocystodinium sp. A of Costa and Downie 1979</i>	10.95-11.14	(i)100.70- 119.62; (ii)105.11- 106.61 C5AAr/C5ABn	119.56- 119.88	11.05 13.369	(i)Mudie 1989; (ii)Manum et al. 1989 Bleil 1989
13.4	13.4-13.5 (~ 8.1)	-	DC	<i>LO Cleistosphaeridium placacanthum (Systematophora placacantha)</i>	~ 8.1 in Munsterman and Brinkhuis 2004 (Reworked?) 8.1	Mazzapiedi Section, NW Italy			Zevenboom 1995 (according to Munsterman and Brinkhuis 2004)
						C4r/C4n (= C4r.1r/C4n.2n)	?	8.108 (Lourens et al. 2004)	x
						Hole 905A (U.S. East Coast Atlantic)			
						13.4-13.5	1) calcareous nannofossil Zone NN6 of Martini 1971; 2) planktonic foraminiferal Zone N10 to N11 of Blow 1969, 1979	(752.19) 780.39- 780.70	1) 11.9-13.53; 2) 13.41-14.24
13.5	13.48; 14.52	0.00; 0.02	DC	<i>LO Cleistosphaeridium placacanthum (Systematophora placacantha)</i>	13.48; 14.49-14.54	Hole 555 (Rockall Plateau)			Backman 1984
						calcareous nannofossil Zone NN6 of Martini 1971	235.30- 243.00	13.33 (S.Atl)	
						within NN5 (between LO <i>H. ampliapertura</i> and LO <i>S. heteromorphus</i>)	255.50- 257.00	13.48; 14.52	Edwards 1984; Backman 1984
13.3	10.68	0.45	DC	<i>LO Cleistosphaeridium placacanthum (Systematophora placacantha)</i>	10.23-11.13	Hole 642B (Vøring Plateau)			Bleil 1989
						C3An.2n/C3Ar	113.11- 113.52	6.733	
								147.68- 157.40	Mudie 1989

10.21-13.33	-	-	DC		10.21-13.33	C5AAr/C5AAr	176.93-177.91	13.183	Bleil 1989						
						Hole 643A (Vøring Plateau)									
						C4Ar.2r/C4Ar.2n	97.36-97.76	9.656	Bleil 1989						
						near C5AAr/C5ABn	100.70-119.62	~13.3	Mudie 1989						
						C5AAr/C5ABn	119.56-119.88	13.369	Bleil 1989						
Gram borehole (Onshore Denmark, North Sea Basin)															
		uppermost Hodde Formation	29.0 m below surface					Piasecki 1980							
12.8; 13.4	-	-	DC	<i>LO Unipontidinium aquaeductum</i>	~ 12.4 in Munsterman and Brinkhuis 2004	12.77	C5An.1n/C5Ar.2r	?	12.765 (Lourens et al. 2004)	Zevenboom 1995 (according to Munsterman and Brinkhuis 2004)					
							Hole 905A (U.S. East Coast Atlantic)								
							13.4-13.5	-	-	13.4-13.5	1) calcareous nannofossil Zone NN6 of Martini 1971; 2) planktonic foraminiferal Zone N10 to N11 of Blow 1969, 1979	(752.19)	780.39-780.70	1) 11.9-13.53; 2) 13.41-14.24	de Verteuil and Norris 1996; de Verteuil 1996; Shipboard Scientific Party 1994d
											Hole 607 (Central North Atlantic)				
							(5.07)	0.02	-		(Reworked?) 5.05-5.09	C3n.3r/C3n.4n	208.58-213.08	4.997	Clement and Robinson 1989
												(as <i>N. aquaeducta</i>) NN13/NN14; PL1	214.10-215.60	5.07	Mudie 1987
												C3n.4n/C3r	222.94-224.31	5.235	Clement and Robinson 1989
							Hole 555 (Rockall Plateau)								

?	?	?	?	?	?	?	?	?	?	?	?
?13.1	(13.10)	0.16	DC	LO Unipontidinium aquaeductum	(12.94-13.26)	approximately at NN10/NN11 as FO	109.64-133.29	8.11	Backman 1984; Berggren et al. 1995		
						(?as spot occurrence of <i>Nematosphaeropsis aquaeducta</i>)	233.50-234.90	13.10	Edwards 1984		
						NN6/NN7 as LO <i>Cyclicargolithus abisectus</i> (C. floridanus group)	235.30-243.00	13.33 (S.Atl)	Backman 1984		
						Hole 611C (Gardar Drift)					
						C2An.2n/C2An.2r	155.28-157.41	3.207	Clement and Robinson 1986		
						(Reworked?) 4.33-4.47	NN13; PL2	212.39-225.59	4.40	Mudie 1987	
						C3n.2n/C3n.2r	227.56-234.18	4.631	Clement and Robinson 1986		
						Hole 645E (Baffin Bay)					
							(788.30) 811.20-812.70		Head et al. 1989b		
						?13.5	(8.91; 10.66)	0.18; 0.39	DC	LO Unipontidinium aquaeductum	(Reworked?) 8.73-9.09; 10.27-11.05
C4Ar.2r/C4Ar.2n	97.36-97.76	9.656									
(as <i>Impagidinium aquaeductum</i>)	(i) 81.71-90.82; (ii) 100.61-105.11	8.91; 10.66	(i)Mudie 1989; (ii)Manum et al. 1989								
C4An/C4Ar.1r; C5AAn/C5AAr	90.56-91.06; 116.06-116.36	9.098; 13.183	Bleil 1989								
Hole 643A (Vøring Plateau)											
C3An.2n/C3Ar	113.11-113.52	6.733	Bleil 1989								
Hole 642B (Vøring Plateau)											

?14.9	14.9	-	DC	<i>LO Apteodinium spiridooides</i> (<i>Emslandia spiridooides</i>)	13.53-14.91	?upper part of calcareous nannofossil Zone NN5 of Martini 1971 (as near top of Zone DN4 of de Verteuil and Norris 1996)	(860.43) 875.13-875.18	13.53-14.91 (Lourens et al. 2004)	de Verteuil and Norris 1996; de Verteuil 1996; Shipboard Scientific Party 1994b	
	19.5	0.3				~19.5 (19.2-19.8)	(i) N5-(?N6); (ii) NN2; (iii) Sr-isotopes	3.5 m from base section in Londeix and Jan du Chene 1998	(i)(17.54)17.9-21.12; (ii)18.28-22.82; (iii)19.2-19.8	(i) Poignant and Pujol 1978; (ii) Mueller and Pujol 1979; (iii) Cahuzac et al. 1997
?14.9	15.01	0.07	DC	<i>LO Apteodinium spiridooides</i>	Hole 645E (Baffin Bay)					Head et al. 1989b
									(1097.54) 1108.88-1109.14	
			Hole 643A (Vøring Plateau)							
?14.9	15.01	0.07	DC	<i>LO Apteodinium spiridooides</i> (<i>Emslandia spiridooides</i>)	14.94-15.08	C5Bn.1n/C5Bn.1r	121.06-121.36	14.877	Bleil 1989	
					C5Bn.1r	125.62-136.58	15.01	Manum et al. 1989		
					C5Bn.2n/C5Br	142.26-142.66	15.160	Bleil 1989		
~13.6	? >13.5-15.01	-	BF	<i>LO Asterigerina staeschei</i>	>13.5-15.01	Well Alma-1A (Central North Sea, offshore Denmark)	20 m below the dinoflagellate cyst <i>LO A. spiridooides</i> and <i>LO D. paradoxum</i> (As <i>LO Asterigerina guerichi</i>)	1405 m MD (Lark Formation)	>13.5-15.01	Schioler 2005
						Well Alma-1A (Central North Sea, offshore Denmark)				

? ~13.5	13.5-15.0		BF	LO Coarse agglutinated species	~	20 m above LO A. <i>guerichi guerichi</i> ; coincident with the dinoflagellate cyst LO A. <i>spiridoides</i> and LO D. <i>paradoxum</i> (as LO <i>Haplophagmoides</i> spp.)	1385 m MD (upper Lark Formation)	13.5-15.0 (this study)	Schioler 2005	
?17.5	17.50	0.22	DC	LO <i>Distatodinium craterum</i>	17.28-17.72	But Smelror (pers. comm.) believes it ranges above LO T.cantharellus!	Hole 643A (Vøring Plateau)		Bleil 1989	
							C5Cr/C5Dn	239.86-240.86		17.235
							C5Dr.1n	240.80-250.61		17.50
							C5Dr.1n/C5Dr.2r	250.66-251.03	17.740	Bleil 1989
13.7	13.73	0.39	DC	LO <i>Cribroperidinium giuseppi</i>	13.34-14.12		Hole 643A (Vøring Plateau)		Bleil 1989	
							C5AAn/C5AAr	116.06-116.36		13.183
							"=C5AAr-C5ACr"	117.61-125.62		13.73
							C5Bn.1r/C5Bn.2n	134.26-134.66	15.032	Bleil 1989
?20.6	20.6	0.00	DC	LO <i>Ectosphaeropsis burdigalensis</i>	20.6		Anciennes carrieres Section, Burdigalian type region (Lorraine, France)		Londeix and Jan du Chene 1998, Cahuzac et al. 1997	
							Dated with Sr-isotopes (87Sr/86Sr ratio)	3.5 m above section base in Londeix and Jan du Chene 1998		20.6
							Anciennes carrieres Section, Burdigalian type region (Lorraine, France)			

20.6	20.6	0.00	DC	<i>LO Apteodinium australiense</i>	20.6	Dated with Sr-isotopes (87Sr/86Sr ratio)	3.5 m above section base in Londeix and Jan du Chene 1998	20.6	Londeix and Jan du Chene 1998, Cahuzac et al. 1997	
15.7	15.71	0.19	DC	<i>LO Apteodinium australiense</i>	16.0	15.52-15.90	Hole 643A (Vøring Plateau)			
							C5Bn.2n/C5Br	142.26-142.66	15.160	Bleil 1989
								157.81- 174.60	15.71	Manum et al. 1989
							C5Br/C5Cn.1n	177.26-177.66	15.974	Bleil 1989
							Hole 985A (Norwegian Sea)			
				320.89	Williams and Manum 1999					
18.8	18.82	0.00	DC	LO <i>Cribroperidinium tenuitabulatum</i>	19.9 (Sugarman et al. 1993, based on regression of Miller et al. 1991)	18.82	ACGS-4 borehole (Onshore U.S. East Coast Atlantic)		de Verteuil and Norris 1996; Sugarman et al. 1993 + McArthur et al. 2001	
							Strontium (87Sr/86Sr) isotope ratio of 0.708525 (as spot occurrence only)	90 m (295 ft) from top of logged core		18.82
15.0	15.01	0.07	DC	<i>LO Cribroperidinium tenuitabulatum</i>	14.94-15.08	Hole 645E (Baffin Bay)				
							(1086.70)		Head et al. 1989b	
							1094.90-1096.40			
						Hole 643A (Vøring Plateau)				
						C5Bn.1n/C5Bn.1r	121.06-121.36	14.877	Bleil 1989	
						"=C5Bn.1r-C5Bn.2n"	125.62- 136.58	15.01	Manum et al. 1989	
						C5Bn.2n/C5Br	142.26-142.66	15.160	Bleil 1989	
Cortemilia Section, NW Italy										

17.5	17.53	0.00	DC	LO <i>Tityrosphaeridium cantharellus</i> (<i>Cordosphaeridium cantharellum</i>)	17.53	near C5Dn/C5Dr.1r	?	17.553	Zevenboom 1995		
						Hole 903-4 (Offshore U.S. East Coast Atlantic)					
				19.9 (Sugarman et al. 1993, based on regression of Miller et al. 1991)	18.82	Strontium (⁸⁷ Sr/ ⁸⁶ Sr) isotope ratio of 0.708525	90 m (295 ft) from top of logged core	18.82	de Verteuil and Norris 1996; Sugarman et al. 1993 + McArthur et al. 2001		
						Hole 902D (U.S. East Coast Atlantic)					
					17.59-21.12	calcareous nannofossil zone NN2 and planktonic foraminiferal zone N5 (as dinoflagellate cyst Zone DN2 of de Verteuil and Norris 1996)	574.07- 574.46	18.28- 22.82 and 17.59- 21.12	de Verteuil and Norris 1996; Shipboard Scientific Party 1994		
						Hole 645E (Baffin Bay)					
			DC	LO <i>Tityrosphaeridium cantharellus</i> (<i>Cordosphaeridium cantharellum</i>)			(770.50) 786.80- 788.30		Head et al. 1989b		
						Hole 643A (Vøring Plateau)					
17.5; 18.2	(16.11); 18.29	0.07; 0.23	DC	LO <i>Tityrosphaeridium cantharellus</i> (<i>Cordosphaeridium cantharellum</i>)	17.5	(Reworked?) 16.03-16.18; 18.29	i) As last occurrence; ii) " C5En" (as last consistent)occurrence	177.26- 177.66 i) 184.20- 201.60; ii) 263.10- 263.51	15.974 i) 16.11; ii) ~18.29	Bleil 1989 Manum et al. 1989	y

18.18

0.03

17.54-17.83

DC

LO Evittosphaerula paratabulata

i) C5Cn.1n/C5n.1r;
ii) C5En

i) 210.96-211.46; ii) 255.46~273

i) 16.268;
ii) 18.056-18.524 (ave. = 18.29)

i) Bleil 1989; ii) Goll 1989

Hole 642D (Vøring Plateau)

18.16-18.21

C5Dn/C5Dr.1r 217.11-217.81 17.533 Bleil 1989

"= C5En" 226.40-227.90 18.18 Manum et al. 1989

C5En/C5Er 231.91-232.61 18.524 Bleil 1989

Hole 985A (Norwegian Sea)

447.49 Williams and Manum 1999

Onshore Neulienhus borealis (Southern North Sea)

~ 17.6 according to Munsterman and Brinkhuis 2004

~ 17.6 (17.54-17.83)

Within the "Bur3 Sequence" of Munsterman and Brinkhuis 2004. (at or between the Bur 3 maximum flooding surface and the Bur 4 sequence boundary of Hardenbol et al. 1998)

Breda Formation 17.54-17.83

Munsterman and Brinkhuis 2004; Hardenbol et al. 1998 + Ogg and Lugowski 2008

Hole 645E (Baffin Bay)

(1067.90)
1085.20-1086.70

Head et al. 1989b

Hole 643A (Vøring Plateau)

17.5	17.50	0.22	DC	<i>LO Evittosphaerula paratabulata</i>	19.0	17.28-17.72	C5Cr/C5Dn	239.86-240.86	17.235	Bleil 1989
								240.80- 250.61	17.50	Manum et al. 1989
							C5Dr.1n/C5Dr.2r	250.66-251.03	17.740	Bleil 1989
							Hole 985A (Norwegian Sea)			
								319.39	Williams and Manum 1999	
22.8	22.8-23.1	-	DC	<i>LO Caligodinium amiculum</i>	22.8-23.1		Marche region (Central Italy)			Biffi and Manum 1988 (according to de Verteuil and Norris 1996)
							calcareous nannofossil Zone NN1 of Martini 1971	?	22.81-23.14 (Lourens et al. 2004)	
21.8	21.75	0.51; -	DC	<i>LO Caligodinium amiculum</i>	22.0	21.24-22.26	Hole 643A (Vøring Plateau)			Bleil 1989
							C5Dr.2r/C5En	255.46-255.96	18.056	
								314.70- 338.80	21.75	Manum et al. 1989
							LO <i>Enneadocysta</i> (<i>Areosphaeridium</i>) <i>pectiniformis</i>	464.40-477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004
							Hole 985A (Norwegian Sea)			Williams and Manum 1999
							384.09			
							Well Alma-1A (Central North Sea, offshore Denmark)			

21.4	0.45	BF	<i>LO Spirosigmoinella compressa</i>	20.9-21.8	Between dinoflagellate cyst LO <i>Thalassiphora pelagica</i> and LO <i>Caligodinium amiculum</i> (as <i>Spirosigmoinella compressa</i>)	1650 m MD (Lark Formation)	ave. = 21.35	Schioler 2005		
~22.0		MD	<i>LO Aulacodiscus insignis var. aemulans</i>	>21.8, <22.2	Midway between the dinoflagellate cyst LO <i>Caligodinium amiculum</i> and LO <i>Chiropteridium galea</i> (as LO <i>Aulacodiscus aemulans</i>)	Well Alma-1X (Central North Sea, offshore Denmark)		1670 m MD (Lark Formation)	22.0 (this study)	Schioler 2005 z
~27.3	-	MD	<i>LO Aulacodiscus insignis var. quadrata</i>	~ 27.3	10 m below dinoflagellate cyst LO <i>Svalbardella cooksoniae</i> and below 'Upper Oligocene unconformity' (as LO <i>A. insignis quadratus</i> var. B)	1752 m MD (Lark Formation)	26.71-27.83 (top of <i>Svalbardella</i> interval within C9n in Van Simaey's 2004; Berggren et al. 1995)	Schioler 2005; Van Simaey's 2004	z	

19.9; 22.8	19.88	0.16	DC	LO <i>Chiropteridium</i> spp.	19.72-20.04	C6r	311 m composite depth (sample 35)	(19.722-20.040) ave. = 19.881	Montanari et al. (1997)	
	20.44; ~23.0	-			1) < 20.44; 2) ~ 23	1) younger than C6An.2n; 2) as "approximate LO" in Steininger et al. 1997	1) Present throughout section (top sample Lem III-0); 2) 1m above base Neogene GSSP	1) < 20.439; 2) ~ 23.03	Zevenboom 1996; Steininger et al. 1997	æ
	~22.82	-			22.2 in Munsterman and Brinkhuis 2004	18.28-22.82	lower NN2 Zone (as LO C. <i>mespilanum</i> and LO C. <i>partispinatum</i>)	?	~ 22.82	Powell 1986 (according to Munsterman and Brinkhuis 2004)
	~22-23	-				~ 22-23	calcareous nannofossil zones NP25 (top), and possibly NN1 to lower NN2	595.20-596.65	~ 22-23 (Lourens et al. 2004)	de Verteuil and Norris 1996; Shipboard Scientific Party 1994
22.2	25.74	0.15	DC	LO <i>Chiropteridium</i> spp. (incl. <i>C. galea</i>)	25.0	25.59-25.89	C5Dr.2r/C5En	255.46-255.96	18.056	Bleil 1989
								395.39-410.50	25.74	Manum et al. 1989
							LO <i>Enneadocysta</i> (<i>Areosphaeridium</i>) <i>pectiniformis</i>	464.40-477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004

?25.16	(<14.9)	-	DC	LO common <i>Palaeocystodinium golzowense</i>	< 14.9	(916.53) 922.80- 924.30		Head et al. 1989b	
						NN3-4/NN5-15 as LO <i>Helicosphaera</i> <i>amliaperta</i>	1064.90- 1070.08	14.91 (S.Atl.)	
						Hole 643A (Vøring Plateau)			
						C5Dr.2r/C5En	255.46- 255.96	18.056	Bleil 1989
	25.16	0.18	DC	LO common <i>Palaeocystodinium golzowense</i>	24.97-25.34	390.89- 392.39		25.16	Manum et al. 1989
						LO <i>Enneadocysta</i> (<i>Areosphaeridium</i>) <i>pectiniformis</i>	464.40- 477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004
?21.7	21.73	0.00	DC	LO common <i>Deflandrea spp.</i>	21.688-21.767	Lemne-Carriso Section, NW Italy (base Messene stratotype section)			
						CAAr.3r (as "highest abundance <i>Deflandrea</i>)	(sample Lem III-15)	ave. = 21.728	Zevenboom 1996; Steininger et al. 1997
						Hole 643A (Vøring Plateau)			
						C5Dr.2r/C5En	255.46- 255.96	18.056	Bleil 1989
						LO <i>Enneadocysta</i> (<i>Areosphaeridium</i>) <i>pectiniformis</i>	464.40- 477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004
	31.6	0.30	DC	LO common <i>Deflandrea phosphoritica</i> ; LO common <i>Thalassiphora pelagica</i>	(Extrapolated) 31.4-31.9	513.00- 518.20		31.6	Manum et al. 1989
						Frida-1 well, offshore Denmark (North Sea)			

223	25.5	3.05	DC	LO common <i>Deflandrea phosphoritica</i>	22.2-28.3	Above LO <i>D. bifidii</i> and below LO <i>Chiropteridium spp.</i>	1490 m MD ("Sequence A/Sequence B" boundary at top Freja Member, within Lark Formation, in Dybkjaer and Rasmussen 2007)	ave. = 25.25	Dybkjær and Rasmussen (2007) + Zevenboom 1996	ø
20.6	20.6	0.00	DC	LO <i>Thalassiphora pelagica</i>	20.6-21.12	(i) Circa 0.5 m below level dated by Sr-isotope ratio; (ii) planktonic foraminiferal Zone N5 of Blow 1969, 1979	Anciennes carrières Section, Burgignan type section (Lacaze, France) 3 m above section base in Londeix and Jan du Chene 1998	(i) 20.6; (ii) 17.59-21.12 in Lourens et al. 2004	Londeix and Jan du Chene 1998, (i) Cahuzac et al. 1997; (ii) Poignant and Pujol 1978	
27.8	27.76	0.22	DC	LO <i>Thalassiphora pelagica</i>	(Subtop?) 27.54-27.99		Hole 643A (Vøring Plateau) C5Dr.2r/C5En 255.46-255.96	18.056	Bleil 1989	
							440.00-443.00	27.76	Manum et al. 1989	
							LO <i>Enneadocysta (Areosphaeridium) pectiniformis</i>	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004	
27.1	27.06	0.17	DC	LO <i>Chiropteridium lobospinosum</i> + Major abundance decrease in dinocysts	26.89-27.23		Hole 643A (Vøring Plateau) C5Dr.2r/C5En 255.46-255.96	18.056	Bleil 1989	
							425.99-430.22	27.06	Manum et al. 1989	

26.9	26.91	0.23	DC	LO common <i>Homotryblium</i> spp.	26.68-27.15	C5Dr.2r/C5En	255.46-255.96	18.056	Bleil 1989	å
						(as LO <i>H. floripes</i>)	424.39-425.99	26.91	Manum et al. 1989	
						LO <i>Enneadocysta</i> (<i>Areosphaeridium</i>) <i>pectiniformis</i>	464.40-477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004	
						Hole 645E (Baffin Bay)				
			DC	LO common <i>Distatodinium paradoxum</i>	(~ 14.5)		(1048.60)		Head et al. 1989b	
						NN3-4/NN5-15 as LO <i>Helicosphaera ampliapertura</i>	1064.90-1070.08	14.91 (S.Atl.)		
						Hole 643A (Vøring Plateau)				
						C5Dr.2r/C5En	255.46-255.96	18.056	Bleil 1989	
23.0	22.96	0.06	DC	LO common <i>Distatodinium paradoxum</i>	22.90-23.02		345.50-353.89	22.96	Manum et al. 1989	
						LO <i>Enneadocysta</i> (<i>Areosphaeridium</i>) <i>pectiniformis</i>	464.40-477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004	
						Anciennes carrieres Section, Burgalian type (Lorraine, France)				
20.9	20.86	0.26	DC	FO <i>Apteodinium spiridoïdes</i> (<i>Emslandia spiridoïdes</i>)	~ 21 (20.6-21.12)	(i) Lies ca. 1 m below a level dated by Sr-isotopes; (ii) planktonic foraminiferal Zone N5 of Blow 1969, 1979; (iii) nannofossil Zone NN2 of Martini 1971	~ 2.5 m above section base in Londeix and Jan du Chene 1998	(i) > 20.6; (ii) 17.59-21.12; (iii) 18.2-22.82 in Lourens et al. 2004	Londeix and Jan du Chene 1998, Cahuzac et al. 1997	
						Hole 645E (Baffin Bay)				

			DC	<i>FO Impagidinium patulum</i>		(as FO <i>Leptodinium patulum</i>)	311.50-311.68 (312.00)		Harland 1979
						Hole 645E (Baffin Bay)			
	?	(<14.9)	DC	<i>FO Impagidinium patulum</i>	< 14.9		624.40-625.90		Head et al. 1989b
						NN3-4/NN5-15 as LO <i>Helicosphaera ampliaperta</i>	1064.90-1070.08	14.91 (S.Atl.)	
						Hole 643A (Vøring Plateau)			
						C5Dr.1r/C5Dr.1n	248.16-249.10	17.717	Bleil 1989
?18.1		18.14	DC	<i>FO Impagidinium patulum</i>	17.85-18.44		250.61- 263.40	18.14	Manum et al. 1989
		0.30				LO <i>Enneadocysta (Areosphaeridium) pectiniformis</i>	464.40-477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004
						Hole 645E (Baffin Bay)			
						NN3-4/NN5-15 as LO <i>Helicosphaera ampliaperta</i>	1064.90-1070.08	14.91 (S.Atl.)	
			DC	<i>FO Selenopemphix nephroides</i>	> 14.9		1097.40-1097.54 (1108.88)		Head et al. 1989b
						Hole 643A (Vøring Plateau)			
						C5Dr.1r/C5Dr.1n	248.16-249.10	17.717	Bleil 1989
?18.1		18.14	DC	<i>FO Selenopemphix nephroides</i>	17.85-18.44		250.61- 263.40	18.14	Manum et al. 1989
		0.30				LO <i>Enneadocysta (Areosphaeridium) pectiniformis</i>	464.40-477.70	~29.3 (North Sea)	Manum et al. 1989; Van Simaey 2004
						Cessole Section, NW Italy			

14.9-15.2	15.16	0.00	DC	FO <i>Labyrinthodinium truncatum s.l.</i>	15.032-15.160	lower C5Bn.2n	?	ave. = 15.096	Zevenboom 1995
	~14.91	-			Hole 903C (U.S. East Coast Atlantic)				
					13.53-14.91	lower calcareous nannofossil Zone NN5 of Martini 1971 (as base of Zone DN4 of de Verteuil and Norris 1996)	875.13- 875.18 (886.48)	13.53- 14.91 (Louren s et al. 2004)	de Verteuil and Norris 1996; de Verteuil 1996; Shipboard Scientific Party 1994b
					Hole 555 (Rockall Plateau)				
						approximately NN9- 10/NN11 (as FO <i>Discoaster</i> <i>quinqueramus</i>)	109.64- 133.29	8.11	Backman 1984, Berggren et al. 1995
14.9	12.75	0.18	DC	FO <i>Labyrinthodinium truncatum</i>	12.57-12.92		225.50- 227.00	12.75	Edwards 1984
						NN6/NN7 (as LO <i>Cyclicargolithus</i> <i>abisectus</i> (C. <i>floridanus</i> grp.))	235.30- 243.00	13.33 (S.Atl)	Backman 1989
					Hole 645E (Baffin Bay)				
						NN3-4/NN5-15 as LO <i>Helicosphaera</i> <i>amliaperta</i>	1064.90- 1070.08	14.91 (S.Atl.)	
	~14.9	-			~14.9	(as FO consistent L. truncatum)	1061.9	~14.9	Head et al. 1989b
					Hole 643A (Vøring Plateau)				
						C5Bn.1n/C5Bn.1r	121.06- 121.36	14.877	Bleil 1989
							125.62- 136.58		Manum et al. 1989
						C5Bn.2n/C5Br	142.26- 142.66	15.160	Bleil 1989
~15.5			DC	FO <i>Labyrinthodinium truncatum</i>	16.8				
					Hole 985A (Norwegian Sea)				
								291.99	Williams and Manum 1999

9.3
9.34
0.27

~15.5

-

DC

FO common
Achomosphaera
andalousiensis
(base acme)

		Onshore Netherlands boreholes (Southern North Sea)				
	15.8 according to Munsterman and Brinkhuis 2004	~15.5	"Langhian 1" maximum flooding surface of Hardenbol et al. (1998)	Breda Formation	15.51 (Middle of Sequence Bur5/Lan1 according to Ogg and Lugowski 2008)	Munsterman and Brinkhuis 2004; Ogg and Lugowski 2008
		Onshore Denmark boreholes (North Sea Basin)				
			lowermost Hodde Formation	36.0 m below top of Gram boring	lower Hodde contains the LO <i>Asterigerina guerichi staeschei</i> in Sønder Vium boring (this study)	Piasecki 1980
		Hole 643A (Vøring Plateau)				
			C4r.2r/C4An	82.66-83.06	8.769	Bleil 1989
		9.07-9.62		87.61-97.10	9.34	Manum et al. 1989

						C4Ar.2r/C4Ar.2n	97.36-97.76	9.656	Bleil 1989	
						NW Italy				
12.1	12.10	0.05	DC	FO <i>Achomospaera andalusiensis</i>	~ 12.2 according to Munsterman and Brinkhuis 2004	12.014-12.116	upper C5An (?C5An.1n)	?	ave. = 12.065	Zevnboom 1995 (according to Munsterman and Brinkhuis 2004)
							Hole 905A (U.S. East Coast Atlantic)			
	11.5-11.9	-				11.5-11.9	1) calcareous nannofossil Zone NN7 to possibly ?NN8 of Martini 1971; 2) planktonic foraminiferal Zone N14 of Blow 1969, 1979	(587.07) 617.08-617.48	1) (?10.55) 10.89-11.9; 2) 11.47-11.63	de Verteuil and Norris 1996; de Verteuil 1996; Shipboard Scientific Party 1994d
							Hole 643A (Vøring Plateau)			
?11.6	10.66	0.39	DC	FO <i>Achomospaera andalusiensis</i>		10.27-11.05	C4Ar.2r/C4Ar.2n	97.36-97.76	9.656	Bleil 1989
								100.61-105.11	10.66	Manum et al. 1989
							C5AAAn/C5AAr	116.06-116.36	13.183	Bleil 1989
							Gram borehole (Onshore Denmark, North Sea Basin)			
							lower Gram Formation (glaconitic clay member)	29.0 m below surface		Piasecki 1980
							Sønder vium borehole (Onshore Denmark, North Sea Basin)			
	11.6-16.0	-				11.6-16.0	basal Gram Formation (glaconitic clay member); 4 m below LO C. <i>poulsenii</i> and benthic foraminiferal LO <i>Ceratobulimina contraria</i>	44.08 m below surface	11.61-15.97 (Langhian - Serravallian)	Piasecki et al. 2004; This study

23.3	~22.7	-	DC	FO <i>Ectosphaeropsis burdigalensis</i>	~22.7	near C6Cn.1r/C6Cn.1n (22.754)	300.50 m above composite section base	~22.7	Montanari et al. 1997		
						?C6Bn; Strontium 87Sr/86Sr isotope ratio 0.708300	302.0	22.24	Montanari et al. 1997 + McArthur et al. 2001		
						Lemme-Carrosio Section, NW Italy (base Neogene stratotype section)					
	23.25	0.00	DC	FO <i>Ectosphaeropsis burdigalensis</i> ; base of youngest acme <i>Deflandrea</i> spp. (in Zevenboom 1996)	23.25	base C6Cn.2r	(sample Lem III-4)	23.25	Zevenboom 1996; Ogg and Lugowski 2008 + Gradstein et al. 2004		
						Frida-1 well, offshore Denmark (North Sea)					
?21.6-21.8	< 22.2	-	DC	FO <i>Ectosphaeropsis burdigalensis</i>	21.8 in Dybkjær and Piasecki (2008)	(?21.6-21.8) < 22.2	Above LO <i>Chiropteridium</i> spp and below LO <i>Homotryblum</i> <i>plectilum</i> , probably correlates with a warm 18O peak following Mi1 glaciation	1330 m MD (Upper part of "Sequence B" within Lark Formation)	?21.6- 21.8	Dybkjaer and Rasmussen 2007	ac
						Hole 555 (Rockall Plateau)					
						approximately at NN10/NN11 as FO	109.64- 133.29	8.11	Backman 1984; Berggren et al. 1995		
11.9; 14.2	11.90	0.24	DC	FO <i>Invertocysta tabulata</i>	11.66-12.13		(198.00) 206.50- 207.91	11.90	Edwards 1984		

14.8; 25.8

?14.22

0.69

25.75

0.15

DC

(14.8
2)

0.93

FO Invertocysta tabulata

NN6/NN7 as LO
Cyclicargolithus 235.30- 13.33
abisectus (C. 243.00 (S.Atl) Backman
floridanus group) 1984

Hole 645E (Baffin Bay)

13.53-14.91 ?NN5 1047.10-
1048.60 ave. =
(1061.15) 14.22 Head et al.
1989b

NN3-4/NN5-15 as
LO *Helicosphaera* 1064.90- 14.91
amliaperta 1070.08 (S.Atl.)

Hole 643A (Vøring Plateau)

C5Dr.1r/C5Dr.1n 248.16- 17.717 Bleil 1989
249.10
25.60-25.90 **395.39-**
410.50 25.75 Manum et al.
1989

LO *Enneadocysta* 464.40- ~29.3
(*Areosphaeridium*) 477.70 (North
pectiniformis Sea) Manum et al.
1989; Van
Simaey 2004

Hole 642C (Vøring Plateau)

(Above base) C5ABn/C5ABr 185.23- 13.605 Bleil 1989
186.09
13.89-15.75 **186.61-** Manum et al.
196.21 14.82 1989
C5Br/C5Cn.1n 196.58- 15.974 Bleil 1989
197.28