

Supplementary information to Hoem et al.,
Stepwise Oligocene–Miocene breakdown of sub-polar gyres and strengthening of the Antarctic Circumpolar Current

Age models

Table S1: Site 696 age model, adapted from Hoem et al., 2023.

Event/Characteristic	Kind	Lower level	Upper level	Bottom depth	Top depth	Mid-depth	Reference	Age (Ma)	Reference biozonation scheme
<i>FAD Denticulopsis maccollumii</i> ;	Diatoms	50R-2W, 26-29 cm	50R-1W, 88-92 cm	521.91	521.08	52.49	Gersonde and Burckle, (1990); López-Quirós et al. (2018; in prep.)	16.5-16.7	Harwood and Maruyama (1992); Ramsay and Baldauf (1999); Censarek and Gersonde (2002)
<i>FAAD Actinocyclus ingens</i>	Diatoms	50R-2W, 26-29 cm	50R-1W, 88-92 cm	521.91	521.08	521.49	López-Quirós et al. (in prep.)	16.5-16.7	Harwood and Maruyama (1992); Ramsay and Baldauf (1999); Censarek and Gersonde (2002)
<i>Gelatia inflata</i>	Dinocyst	51-1W, 143-145 cm				531.23	<i>This study</i>	33.7-23	<i>Bijl et al., (2018a)</i>
<i>FO Chiropteridium Galea</i>	Dinocysts	53R-3W, 80 cm	53R-2W, 130 cm	552.70	551.70	552.20	<i>Houben et al. 2012</i>	<33.6	<i>Pross et al. (2010)</i>
<i>FO Malvinia escutiana</i>	Dinocysts	55R-1W, 117 cm	55R-1W, 62 cm	569.39	568.82	569.11	<i>Houben et al. 2012; 2013</i>	33.7	<i>Houben et al. (2011)</i>
<i>FO Stoveracysta kakanuiensis</i>	Dinocysts	55R-3W, 75 cm	55R-2W, 147 cm	571.95	571.16	571.55	<i>Houben et al. 2012; 2013</i>	34.1	<i>Clowes (1985)</i>
<i>FO Reticulofenestra oarnaruensis</i>	Calcareous nannofossils	58R-1W, 122 cm	57R-1W, 112 cm	598.42	588.72	588.72	<i>Wei and Wise, 1990</i>	~35.5	<i>Villa et al. (2008)</i>
<i>FCO Istmolithus recurvus</i>	Calcareous nannofossils	60R-1W, 36 cm	59R-CC	616.96	616.6	616.78	<i>Wei and Wise, 1990</i>	36.27	<i>Villa et al. (2008)</i>
<i>FO Reticulofenestra bisecta</i>	Calcareous nannofossils	62R-6W, 132 cm	-	643.62	-	643.62	<i>Wei and Wise, 1990</i>	<37.61	<i>Villa et al. (2008)</i>

Table S2: Biostratigraphic datums summarised for the depth of the stratigraphic discontinuities with sediment reflectors from Pérez et al., (2021)

Type	Event	Taxa	Published Age (Ma)	Top	Bottom	Mid depth (mbsf)
Hole U1536E						
Reflector-b						
DIAT	LO	<i>Fragilariopsis praeinterfrigidaria</i>	3.5	4R-CC	5R-CC	366.37
DIAT	FO	<i>Rhizosolenia harwoodii</i>	3.6	4R-CC	5R-CC	366.37
RAD	LO	<i>Lampromitra coronata</i>	3.72	4R-CC	5R-CC	366.37
DIAT	LO	<i>Fragilariopsis aurica</i>	4.2	7R-CC	9R-CC	403.065
DIAT	LO	<i>Fragilariopsis praecurta</i>	4.2	7R-CC	9R-CC	403.065
DIAT	FO	<i>Fragilariopsis barronii</i>	4.4	7R-CC	9R-CC	403.065
DIAT	LO	<i>Denticulopsis delicata</i>	4.45	7R-CC	9R-CC	403.065
DIAT	LO	<i>Fragilariopsis arcula</i>	4.5	7R-CC	9R-CC	403.065
DIAT	LO	<i>Fragilariopsis curta</i>	4.7	7R-CC	9R-CC	403.065
RAD	FO	<i>Helotholus vema</i>	4.59	7R-CC	9R-CC	403.065
Reflector-c						
PALY	FO	<i>Operculodinium? eirikianum</i>	8.4	26R-CC	27R-CC	574.8025
DIAT	FO	<i>Fragilariopsis aurica</i>	8.4	30R-CC	31R-CC	613.245
DIAT	FO	<i>Denticulopsis simonsenii</i>	14.2	31R-CC	32R-CC	622.58
DIAT	LO	<i>Denticulopsis maccollumii</i>	14.3	31R-CC	32R-CC	622.58
PALY	FO	<i>Impagidinium patulum</i>	15.97	31R-CC	32R-CC	622.58

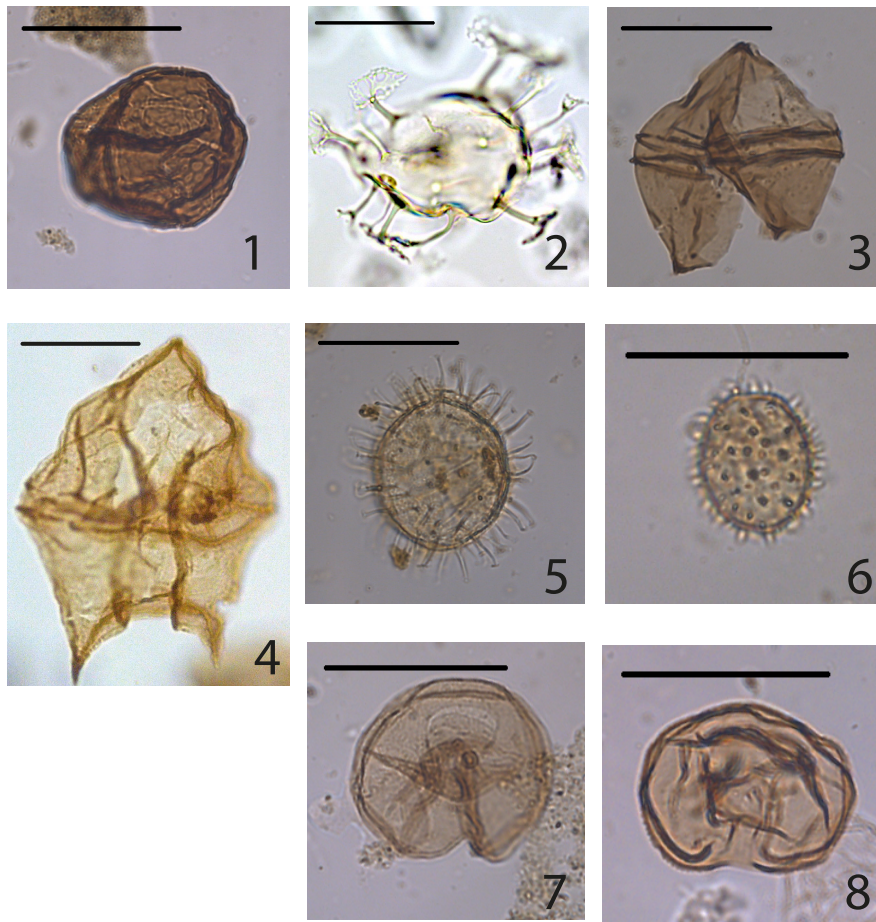


Plate S1. Light Microscopy photos of common dinocysts at ODP Site 696, Core 50R–52R, 55R. The black scale bars represent 20 μ m.

1. *Brigantedinium pynei* 696-50R-1W, 86-88 cm
2. *Enneadocysta dictyostila* 696-52R-1W, 10-12 cm
3. *Lejeunecysta adeliensis* 696-52R-1W, 86-88 cm
4. *Lejeunecysta adeliensis* 696-55R-1W, 69-71 cm
5. *Operculodinium centrocarpum* 696-50R-1W, 86-88 cm
6. *Operculodinium janduchenei* 696-50R-1W, 86-88 cm
7. *Selenopemphix nephroides* 696-50R-1W, 86-88 cm
8. *Selenopemphix undulata* 696-50R-1W, 86-88 cm

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