Auxiliary Material for

**Timing of the descent into the last ice age determined by the bipolar seesaw**

Stephen Barker1 and Paula Diz2

1School of Earth and Ocean Sciences, Cardiff University, Cardiff CF10 3AT, UK

2Department of Xeociencias Mariñas e Ordenación do Territorio, Facultade de Ciencias do Mar, University of Vigo, 36310 Vigo, Spain

Paleoceanography, 2014

Introduction

The text and data presented here include supplementary figures and text covering age models for the Cape Basin cores and effects of dissolution on planktonic faunal assemblages. The spreadsheet contains all datasets presented in the study, including new data from TNO57-21 and revised age models for several other datasets reproduced in the study.

1. text01.pdf Supplementary information on alignment of the Cape Basin cores and potential dissolution artefacts.

2. data01.xlsx Datasets presented in the study

2.1 Tab ‘This study’

 2.1.1 Column “Event”, Descriptor

 2.1.2 Column “TNO57-21 depth (m)”, Depth of transition in TNO57-21

 2.1.3 Column “Age (kyr)”, Age of ice core transition

 2.1.4 Column “depth error (m)”, Half width of transition within TNO57-21 (2)

 2.1.5 Column “age error (kyr)”, 2 age uncertainty corresponding to ice core transition

 2.1.6 Column “Depth in TNO57-21 (m)”

 2.1.7 Column “Age GICC05/NALPSSpeleo (Kyr)”

2.1.8 Column “whole shells/g”, Number of unbroken shells of planktonic forams per gram of bulk dried sediment

2.1.9 Column “Species diversity”, Number of species of planktonic foram present in sample

 2.1.10 Column “%Cold”, Total of *T. quinqueloba* plus *N. pachyderma* (sin) plus N. pachyderma (dex)

 2.1.11 Column “% Polar”, Total of *T. quinqueloba* plus *N. pachyderma* (sin)

 2.1.12 Column “%NPS/totPD”, % NPS over total N. pachyderma

 2.1.13 Column “% Warm”, Total *G. ruber* + *O. universa* +, *G. hirsuta* + *G. truncatulinoides* (dex)

 2.1.14 Column “G. bulloides d18O”, ‰, 18O of *G. bulloides*

 2.1.15 Column “stdev”, 1 error on 18O measurement

2.2 Tab ‘Other data from TNO57-21

 2.2.1 Column “Depth (meters)”, depth in TNO57-21

 2.2.2 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

 2.2.3 Column “13C Cib. wuellerstorfi TNO57-21”, from [*Ninnemann et al.*, 1999]

 2.2.4 Column “18O Cib. wuellerstorfi TNO57-21” from [*Ninnemann et al.*, 1999]

 2.2.5 Column “Depth (m)”, depth in TNO57-21

 2.2.6 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

 2.2.7 Column “13C.250-425.Gbull TNO57-21”, from [*Mortyn et al.*, 2002]

 2.2.8 Column “18O.250-425.Gbull TNO57-21”, from [*Mortyn et al.*, 2002]

 2.2.9 Column “13C.250-425.Gtrun TNO57-21”, from [*Mortyn et al.*, 2002]

 2.2.10 Column “18O.250-425.Gtrun TNO57-21”, from [*Mortyn et al.*, 2002]

 2.2.11 Column “Depth (m)”, depth in TNO57-21

 2.2.12 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

 2.2.13 Column “%CaCO3 hi res TNO57-21”, from [*Sachs and Anderson*, 2005]

 2.2.14 Column “Depth (m)”, depth in TNO57-21

 2.2.15 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

 2.2.16 Column “εNd TNO57-21”, from [*Piotrowski et al.*, 2005]

 2.2.17 Column “± error”, from [*Piotrowski et al.*, 2005]

2.3 Tab ‘ODP 1089’

2.3.1 Column “ODP 1089 Depth (modified mcd)”, Depth in ODP 1089

2.3.1 Column “Depth on TNO57-21”, Equivalent depth in TNO57-21

2.3.1 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

2.3.1 Column “d18O G. bulloides (permil) ODP1089”, from [*Hodell et al.*, 2003]

2.3.1 Column “d18O G. bulloides (permil) (ODP 1089) adjusted ODP1089”, from [*Hodell et al.*, 2003]

2.3.1 Column “d13C G. bulloides (permil) ODP1089”, from [*Hodell et al.*, 2003]

2.3.1 Column “d18O Cibicidoides (permil) ODP1089”, from [*Hodell et al.*, 2001]

2.3.1 Column “d13C Cibicidoides (permil) ODP1089”, from [*Hodell et al.*, 2001]

2.3.1 Column “CaCO3 (wt%) ODP1089”, from [*Hodell et al.*, 2001]

2.4 Tab ‘RC11-83’

2.4.1 Column “RC11-83 Depth (m)”, Depth in RC11-83

2.4.2 Column “Depth on TNO57-21”, Equivalent depth in TNO57-21

2.4.3 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

2.4.4 Column “%carb RC11-83”, from [*Charles et al.*, 1996]

2.4.5 Column “N.pachd18O RC11-83”, from [*Charles et al.*, 1996]

2.4.6 Column “N.pachd13C RC11-83”, from [*Charles et al.*, 1996]

2.4.7 Column “C.mund.d13C RC11-83”, from [*Charles et al.*, 1996]

2.4.8 Column “C.mund.d18O RC11-83”, from [*Charles et al.*, 1996]

2.4.9 Column “RC11-83 Depth (m)”, Depth in RC11-83

2.4.10 Column “Depth on TNO57-21”, Equivalent depth in TNO57-21

2.4.11 Column “GICC05/NALPSSpeleoAge”, Age on GICC05/NALPS age scale

2.4.12 Column “εNd RC11-83”, from [*Piotrowski et al.*, 2005]

2.4.13 Column “± error”, from [*Piotrowski et al.*, 2005]

2.5 Tab ‘Ice core data’

 2.5.1 Column “EDCGICC05/NALPSSpeleoAge kyr b195”, Age in EDC

 2.5.1 Column “EDC Deuterium”, from [*Jouzel et al.*, 2007]

 2.5.1 Column “GICC05/NALPS Age b1950”, Age in NGRIP

 2.5.1 Column “NGRIP 18O”, from [*NGRIP\_members*, 2004]

 2.5.1 Column “GICC05/NALPS b1950”, Age in EDC

 2.5.1 Column “EDC DustFlux(mg/m2/a)”, from [*Lambert et al.*, 2012]

 2.5.1 Column “GICC05/NALPS kyr b1950”, Age in Byrd

 2.5.1 Column “Byrd CO2”, ppmv, from [*Ahn and Brook*, 2008]

 2.5.1 Column “GICC05/NALPS kyr b1950”, Age in EDC

 2.5.1 Column “EDML CO2 (ppmv)”, from [*Bereiter et al.*, 2012]

References:

Ahn, J., and E. J. Brook (2008), Atmospheric CO2 and climate on millennial time scales during the last glacial period, *Science*, *322*(5898), 83-85.

Bereiter, B., D. Luthi, M. Siegrist, S. Schupbach, T. F. Stocker, and H. Fischer (2012), Mode change of millennial CO2 variability during the last glacial cycle associated with a bipolar marine carbon seesaw, *Proceedings of the National Academy of Sciences of the United States of America*, *109*(25), 9755-9760.

Charles, C. D., J. Lynch-Stieglitz, U. S. Ninnemann, and R. G. Fairbanks (1996), Climate connections between the hemispheres revealed by deep sea sediment core ice core correlations, *Earth and Planetary Science Letters*, *142*(1-2), 19-27.

Hodell, D. A., C. D. Charles, and F. J. Sierro (2001), Late Pleistocene evolution of the ocean's carbonate system, *Earth and Planetary Science Letters*, *192*(2), 109-124.

Hodell, D. A., C. D. Charles, J. H. Curtis, P. G. Mortyn, U. S. Ninnemann, and K. A. Venz (2003), Data report: Oxygen isotope stratigraphy of ODP Leg 177 Sites 1088, 1089, 1090, 1093, and 1094, *Proceedings of the Ocean Drilling Program, Scientific Results*, *177*, [Online].

Jouzel, J., et al. (2007), Orbital and millennial Antarctic climate variability over the past 800,000 years, *Science*, *317*(5839), 793-796.

Lambert, F., M. Bigler, J. P. Steffensen, M. Hutterli, and H. Fischer (2012), Centennial mineral dust variability in high-resolution ice core data from Dome C, Antarctica, *Climate of the Past*, *8*(2), 609-623.

Mortyn, P., C. D. Charles, and D. A. Hodell (2002), Southern Ocean upper water column structure over the last 140 kyr with emphasis on the glacial terminations, *Global and Planetary Change*, *34*(3-4), 241-252.

NGRIP\_members (2004), High-resolution record of Northern Hemisphere climate extending into the last interglacial period, *Nature*, *431*(7005), 147-151.

Ninnemann, U. S., C. D. Charles, and D. A. Hodell (1999), Origin of global millennnial-scale climate events: Constraints from the Southern Ocean deep sea sedimentary record, in *Mechanisms of global climate change at millennial timescales*, edited by P. U. Clark, R. S. Webb and L. D. Keigwin, pp. 99-112, American Geophysical Union, Washinton, DC.

Piotrowski, A. M., S. L. Goldstein, S. R. Hemming, and R. G. Fairbanks (2005), Temporal relationships of carbon cycling and ocean circulation at glacial boundaries, *Science*, *307*(5717), 1933-1938.

Sachs, J. P., and R. F. Anderson (2005), Increased productivity in the subantarctic ocean during Heinrich events, *Nature*, *434*(7037), 1118-1121.