



XXXI SCAR Delegates Meeting

Buenos Aires, Argentina, 9-11 August 2010

Agenda Item: 6.1
Person Responsible: Carlota Escutia
& Rob DeConto

SCAR SRP “Antarctic Climate Evolution” Delegates Report 2010

C Escutia and R DeConto, Co-Chairs of the ACE Steering Committee, will present the ACE progress report and plans, and the revised membership of the ACE Steering Committee [WP13], noting among other items the success of the international ACE workshop in Granada in September 2009. The Co-Chairs will discuss plans for bringing the SRP to a conclusion.

Executive Summary

Title: SCAR SRP Antarctic Climate Evolution (ACE)

Authors: C. Escutia and R. DeConto (ACE co-chairs)

Relevant URLs or references to other reports:

www.acegranada2009.com; <http://antarcticclimate.blogspot.com>;
http://www.csam.montclair.edu/earth/eesweb/scar_ace; <http://walrus.wr.usgs.gov/sdls/>

Introduction/ Background: ACE represents the interests of a large land and marine geoscience research community focusing in deciphering the record of the onset and the response of the Antarctic ice sheets to past climate changes across a range of time scales. ACE coordinates the integration between geophysical and geological records of past ice sheet behavior and coupled ice sheet models. The Programme has a planned lifetime of 2005-2013.

Important Issues or Factors: Since ACE's last Report to Delegates in SCAR OSC 2008 and the very positive review of ACE by SCAR in 2008/9, ACE has continued to be very active in its primary coordination role, catalyzing interactions amongst the SCAR and scientists from the climate, ocean and ice coring communities. This was mainly achieved through the First ACE Symposium in Granada (Spain, September 2009). Delivery ACE aims for its final 2-3 year period are: 1) coordinate new subcommittees focused in processes to address gaps in our knowledge about the role of Antarctic ice sheets in the global climate system, as identified during the 1st ACE Symposium. Subcommittees are tasked with synthesizing the state of the art of our knowledge and defining the future questions and challenges that are critical for providing science-based advise to major scientific programs (i.e., IODP) and policy makers (i.e., IPCC); 2) submit of a series of coordinated drilling proposals (ANDRIL and IODP) in key areas around Antarctica and the Southern Ocean that can address the formulated questions; and 3) play an active and central role in the development of proposals to SCAR for the successor of SCAR ACE. In addition, ACE will continue to be active in proposing dedicated sessions in all international meetings, including 2011 ISAES and 2012 SCAR OSC, in publications of its results in the open literature as it has been done in the past.

Recommendations/Actions and Justification: (what actions are you requesting of the Delegates and why they should agree) 1) approval of ACE actions and progress to date; 2) support for ACE plans for the remaining life of the Programme; 3) Input from Delegates on ACE plans based on the new SCAR Strategic Plan (2011-2012).

Expected Benefits/Outcomes: Significant publication output (both content and numbers), Publications and science relevant to "Big- science" programmes and policy makers, enhancement of SCAR profile

Partners: IPICS; PAGES of the IGBP; IASC on APEX; ANDRILL, SHALDRIL, IODP and ERICON-AB.

Budget Implications: Request for confirmation of SCAR science programme funding at current level for planned remainder of the Programme's operation to 2013.

Antarctic Climate Evolution (ACE) - Report for SCAR Delegates, 2010

1. *Rationale*

ACE is one of the approved Scientific Research Program (SRP) of the Scientific Committee on Antarctic Research (SCAR). The mission of ACE is to facilitate the study of Antarctic climate and glacial history through integration of numerical modeling with geophysical and geological data. ACE is designed to determine both climate conditions and climatic changes and their impact on ice sheet and sea ice behavior during the recent past (i.e., the Holocene prior to anthropogenic impacts, as well as at the last glacial maximum and other Quaternary glaciations, when temperatures were cooler than at present) and the more distant past (i.e. the pre-Quaternary, when global temperatures were several degrees warmer than today).

Antarctica has been glaciated for approximately 34 million years, but its ice sheets have fluctuated considerably and are one of the major driving forces for changes in global sea level and climate throughout the Cenozoic Era. The spatial scale and temporal pattern of these fluctuations is subject to considerable debate. Understanding the response of large ice masses to climatic forcing is of vital importance because ice-volume variations impact global sea level and also alter the capacity of ice sheets and sea ice to act as major heat sinks/insulators. It is particularly important to assess the stability of the cryosphere in the face of rising CO₂ levels, as modeling of the climate shift from a warm, vegetated Antarctica to a cold, ice-covered state 34 Myrs ago suggests a powerful greenhouse gas influence. As Antarctica is a major driver of Earth's climate and sea level, much effort has been expended in deriving models of its behavior. Some of these models have been successfully validated against modern conditions. Modeling the past record of ice-sheet behavior in response to changes in climate (inferred from ice cores for example), paleoceanographic conditions (inferred from paleoecology and climate proxies in ocean sediments) and paleogeography (as recorded in landscape evolution) is the next step and will allow for modeling of the large and dynamic changes observed in geologic history.

The cross-disciplinary approach within ACE, involving climate and ice sheet modelers, geologists, and geophysicists leads to a substantial improvement in the knowledge of past Antarctic climate, and our understanding of the factors that have guided its evolution. This in turn allows us to build hypotheses, examinable through numerical modeling, as to how Antarctic climate is likely to respond to future global change. Equally important, the development of data-driven models for Antarctic climate will allow us to extend our results to the analysis and forecasting of global climate variability.

ACE is structured in subcommittees:

- 1) LGM/Deglacial/Holocene (Active since 2004)
- 2) Pleistocene (Active since 2004)
- 3) Middle Miocene-Pliocene (Active since 2004)
- 4) Oligocene-Miocene (Active since 2004)
- 5) Eocene-Oligocene (Active since 2004)
- 6) Radio-echosounding (Active since 2005)
- 7) Circum Antarctic Stratigraphy and Paleobathymetry (CASP) (Resulting from the merge between ROSSMAP and CASP (Active since 2008)
- 8) ANTScene: Antarctic Paleotopography (Active since 2009)
- 9) Paleoclimate Records from the Antarctic Margin and Southern Ocean" (PRAMSO) (Active since 2010)

2. Major Tasks and Timeframe

2010:

- Field Season including the completion of the Integrated Ocean Drilling Program Expedition 318 to the Wilkes Land margin one of the Programs in the ACE implementation Plan.
- ACE publications in EOS (Larter et al., 2010; DeConto and Escutia, 2010)
- Publication of the Preliminary Report from IODP Expedition 318 to the Wilkes Land margin.
- Preparation for a special volume in *Palaeo3* with selection of articles presented during the 1st ACE Symposium
- Preparation of a publication about the ACE Programme for International Innovation by Research Media Ltd.
- Continue to provide science-based advise to major scientific programs (i.e., IODP and ERICON-AB Science Plan writing) and policy makers (i.e., Tim Naish charged with contributing in paleoclimate-pre-Quaternary)
- Continue to coordinate cross-linkages across programs (e.g., with the paleoceanography community and through ESF EuroPOLAR Project HOLOCLIP: integration of the Holocene paleoclimate record from very high resolution sediment cores with the ice core records)
- SCAR OSC ACE workshops and business meetings: Meetings of the ACE Steering Committee, ANDRILL, SDLS, and CASP
- AGU Fall 2010 ACE workshops and business meetings: Meetings of the ACE Steering Committee, Antarctic Drilling Subcommittee.
- ACE sessions in major international meetings (EGU, IPY, SCAR OSC and AGU)
- Continue to work on development of EuroANDRILL through submission of a proposal to ESF and with National Science Foundations
- Technological developments and Site Surveys for the ANDRILL Coulman High Project
- Field seasons for major Porjects (e.g., ICECAP, WIZZARD, LIZZARD)
- ACE participation in the Urbino Paleoclimate School
- ACE Travel grants to SCAR OSC.

2011:

- ISAES 2011: ACE sessions, workshops and business meetings (i.e., Meetings of the ACE Steering Committee, SDLS, CASP, etc)
- Publication of the *Palaeo3* Special Volume with selection of articles presented during the 1st ACE Symposium
- Publication of the Initial Reports Volume from IODP Expedition 318 to the Wilkes Land margin
- Continue to coordinate cross-linkages across programs (e.g., with the paleoceanography community and through ESF EuroPOLAR Project HOLOCLIP: integration of the Holocene paleoclimate record from very high resolution sediment cores with the ice core records)
- Continue to provide science-based advise to major scientific programs (i.e., IODP and ERICON_AB Science Plan writing) and policy makers (i.e., Tim Naish charged with contributing in paleoclimate-pre-Quaternary)
- Site Surveys for the ANDRILL Coulman High Project
- Field seasons for major Porjects (e.g., ICECAP, WIZZARD, LIZZARD)
- ACE sessions in major international meetings (EGU, ISAES, AGU)
- ACE participation in the Urbino Paleoclimate School

2012:

- SCAR Open Science Conference in Portland
- ACE Coordination of workshops (preferably during the SCAR OSC) of different subcommittees
- Writing and submission of pre-proposals to IODP (may be in 2011 depending on how the transition from IODP to IODP² in the evaluation of proposals takes place)
- ACE Symposium-Meeting: wrap up of results and guiding new SRPs proposals
- Continue to coordinate cross-linkages across programs
- Publication of results from some of the cross-linkages projects (i.e., ESF EuroPOLAR Project HOLOCLIP: integration of the Holocene paleoclimate record from very high resolution sediment cores with the ice core records)
- Continue to provide science-based advise to major scientific programs (i.e., IODP Science Plan writing) and policy makers (i.e., Tim Naish charged with contributing in paleoclimate-pre-Quaternary)
- Site Surveys and preparations for the drilling of the ANDRILL Coulman High Project
- Field seasons for major Porjects (e.g., ICECAP, WIZZARD, LIZZARD)
- ACE sessions in major international meetings (EGU, SCAR OSC and AGU)
- ACE participation in the Urbino Paleoclimate School

3. **Deliverables**

- Primary literature publications and books
- First ACE Symposium conference proceedings in Paleo3 Special Publications 2011.
- ACE Programme reports
- Continue coordination and integration, through subcommittees, of field work results
- Continue development of process-based multidisciplinary subcommittees to formulate future research directions
- Provide science-based advise to major scientific programs (i.e., IODP) and policy makers (i.e., IPCC); Synergies with other SCAR programmes (e.g., SALE)
- Guide the submission of a set of ocean drilling proposals
- Guide proposals to SCAR for future SRPs
- Train PhD graduates and post-doctoral research fellows
- Outreach via National/International Programmes
- Participation and support for Urbino graduate summer school in paleoclimatology;
- Continue efforts to develop an European ANDRILL consortium (EuroANDRILL);
- Apply for a Chapman or Gordon conference on bi-polar paleoclimate records after Oslo IPY 2010.
- ACE Website
- Input to databases

4. **ACE Committee**

* co-chair since 2008

Name	Role	Gender	Country	Term From
Dr Ccarlota Escutia	<i>Co-Chair</i>	Female	Spain	2004*
Dr Robert DeConto	<i>Co-Chair</i>	Male	United States	2004*
Bob Arko	<i>JCADM liaison</i>	Male	United States	2008
Dr Mike Bentley	Member LGM Subcommittee leader	Male	United Kingdom	2008
Sun Bo	<i>Member</i>	Male	China	2005
Dr Fabio Florindo	<i>Member</i>	Male	Italy	2004

Dr Andrzej Gazdzicki	<i>Member</i>	Male	Poland	2005
Dr Alan Haywood	<i>Member</i> Miocene-Pliocene Subcommittee leader	Male	United Kingdom	2008
Dr Robert Larter	<i>Member</i>	Male	United Kingdom	2004
Dr Andrew Mackintosh	<i>Member</i>	Male	New Zealand	2008
Dr Sandra Passchier	<i>Member</i>	Female	United States	2005
Dr Ross Powell	<i>Member</i>	Male	United States	2004
Dr Gary Wilson	<i>Member</i>	Male	New Zealand	2005
Dr Eric Wolf	<i>Member</i>	Male	United Kingdom	2005
Dr Detlef Damaske	<i>Member</i> Radio-echo sounding Subcommittee leader	Male	Germany	2005
Dr Martin Siegert	Ex-Officio	Male	United Kingdom	2004
Dr Robert Dunbar	Ex-Officio	Male	United States	2004
Dr Tim Naish	Pleistocene Subcommittee leader Member (2004-2008)	Male	New Zealand	2004
Dr Jane Francis	Eocene.Oligocene Subcommittee leader Member (2005-2008)	Female	United Kingdom	2005
Dr Karsten Gohl Dr Stuart Henrys	CASP Subcommittee	Male Male	Germany New Zealand	2007
Dr Peter Barrett	ANTScape	Male	New Zealand	2009
Dr Alan Cooper	Seismic Data Library System	Male	United states	2004

5. **Outputs**

a. **Key achievements**

I. Contributions to IPY other science Programmes and policy makers

Besides being a SCAR programme, ACE is also an IPY Project (Project ID No: 54). In addition, several other IPY projects contribute to ACE (e.g. PLATES&GATES; BIPOMAC, ANDRILL).

ACE continues to stimulate and be involved in geological drilling. For this, ACE was involved in the planning meetings (EGU 2009 in Vienna and INVEST in Bremen) for the successor (member of the ACE community). The workshop on "Developing an Integrated Strategy to Recover Paleoclimate Records from the Antarctic Margin and Southern Ocean" (12-13 September, ACE, Granada, Spain) addressed knowledge gaps in the role of Antarctic Ice Sheets in climate change and outlined a sediment drilling strategy. This strategy was submitted to the IODP New Ventures in Exploring Scientific Targets (INVEST) meeting as a reference document for the planning of IODP beyond 2013. Members of ACE are part of the writing of the Science Plan for IODP beyond 2013.

ACE has been also active in making the case for a more developed paleoclimate section for the next IPCC report. P. Barrett (member of the ACE community) was the SCAR-IUCN Observer 31st IPCC Plenary Meeting, Bali, 26-29 October 2009. T. Naish, also part of the ACE community has been invite to contribute to the IPCC report in the section of pre-Quaternary paleoclimate.

II. Publications in peer reviewed literature

ACE as it stands has produced key peer reviewed publications, which include:

- Special issue of Palaeogeography, Palaeoclimatology, Palaeoecology, Volume 198, issues 1-2, 2004. "Antarctic Cenozoic Palaeoenvironments: Geologic Record and Models, edited by F. Florindo, A.K. Cooper and P. E. O'Brien.

- Special Issue of Global and Planetary Change: Florindo, F., Harwood, D.M., Wilson, G.S. (Editors), 2005. Long-term changes in Southern high-latitude ice sheets and climate: the Cenozoic history. *Global and Planetary Change* 45, 1-264.
- Special Issue of Palaeogeography, Palaeoclimatology, Palaeoecology, Volume 260, 2008. "Antarctic cryosphere and Southern Ocean climate evolution (Cenozoic–Holocene)", edited by F. Florindo, A. Nelson and A. Haywood.
- ACE Book: Developments in Earth and Environmental Sciences Volume 8, 2009. Antarctic Climate Evolution. Edited by F. Florindo and M. Siebert (eds). The Netherlands: Elsevier, 2009, DOI 10.1016/S1571-9197(08)00005-0.
- 1st ACE Symposium publications: Understanding Antarctic Climate and Glacial History First Antarctic Climate Evolution Symposium; Granada, Spain, 7–11 September 2009. *Eos*, Vol. 91, No. 4: p 34, 26 January 2010.
- 1st ACE Symposium publications: Improving Constraints on Paleo Ice Sheets in the Amundsen Sea Embayment Amundsen Sea Embayment: Tectonic and Climatic Evolution - Granada, Spain, 9 September 2009. *Eos*, Vol. 91, No. 4: p 33, 26 January 2010

ACE has contributed through collaborative efforts with other communities (i.e., PAGES, AGCS, and EBA) to the following publications:

- 'Antarctic Climate Change and the Environment', edited by Turner et al (2009) available at: <http://www.scar.org/publications/occasionals/acce.html>
- Brigham-Grette, J., Powell R.D. Newman, L. and Keiffer, T. (editors). 2009. Changing Poles: A Paleoscience Perspective. *PAGES News*, 17: 48pp.
- Brigham-Grette, J. and Powell R.D. 2009. Editorial: Changing Poles: A Paleoscience Perspective, in Brigham-Grette, J., Powell R.D. Newman, L. and Keiffer, T. (editors), *Changing Poles: A Paleoscience Perspective*. *PAGES News*, 17: 2.
- Powell, R., Naish, T., Levy, R. and the MIS Science Team. 2009. New Records of the Role of Antarctic Ice Sheets in Late Cenozoic Climate, in Brigham-Grette, J., Powell R.D. Newman, L. and Keiffer, T. (editors), *Changing Poles: A Paleoscience Perspective*. *PAGES News*, 17: 32-34.

Publications from individual groups in many national and international projects and programmes that contribute to ACE are numerous. Listed below are some of the highlights for 2009:

- Naish, T., Powell, R., Levy, R., Krissek, L., Niessen, F., Pompilio, M., Scherer, R., Talarico, F., Wilson, G., Wilson, T., Barrett, P., Browne, G., Carter, L., Cody, R., Cowan E., Crampton, J., DeConto, R., Dunbar, G., Dunbar, N., Florindo, F., Gebhardt, C., Graham, I., Hannah, M., Harwood, D., Hansaraj, D., Henrys, S., Helling, D., Kuhn, G., Kyle, P., Läufer, A., Maffioli, P., Magens, D., Mandernack, K., McIntosh, W., McKay, R., Millan, C., Morin, R., Ohneiser, C., Paulsen, T., Persico, D., Pollard, D., Reed, J., Ross., J., Raine, I., Schmitt, D., Sagnotti, L., Sjunneskog, C., Strong, P., Taviani, M., Vogel, S., Wilch, T., Williams, T. and Winter, D. 2009. Obliquity-paced Pliocene West Antarctic Ice Sheet Oscillations. *Nature* 458, 322-328, doi:10.1038/nature07867.
- Pollard D. and DeConto R.M., 2009. Modelling West Antarctic Ice Sheet growth and collapse through the past five million years. *Nature* 458, 329-33, doi:10.1038/nature07809.
- Sun Bo, Siebert, M.J., Mudd, S.M., Sugden, D.E., Fujita, S., Xiangbin, C., Yunyun, J., Xueyuan, T. & Yuansheng, L. The Gamburtsev Mountains and the origin and early evolution of the Antarctic Ice Sheet. *Nature*, 459,690-693 (2009).
- Harwood, D., Florindo, F., Talarico, T., Levy, R., Kuhn, G., Naish, T., Niessen, F., Powell, R., Pyne, A. and Wilson, G. 2009. Antarctic Drilling Recovers Stratigraphic Records from the Continental Margin. *Eos Trans. AGU*, 90(11), doi:10.1029/2009EO110002.
- Wilson, D.S. and Luyendyk, B.P., 2009. West Antarctic paleotopography et the Eocene-Oligocene climate transition. *Geophysical Research Letters*, 36, L16302, doi:10.1029/2009GL039297.

III. Meetings and workshops

In 2009, ACE held its First Antarctic Climate Evolution in Granada, Spain (7-11 September) (<http://www.acegranada2009.com/>). Nearly 200 international scientists from the fields of climate, ocean, and ice modeling joined geologists, geophysicists and geochemists for five days of intense interaction. A summary of the symposium and its outcomes, is published in EOS (DeConto and Escutia, 2010 as listed previously).

In addition to providing co-funding for the First ACE Symposium, ACE coordinated and financially supported the following workshops:

- First and Second Reconstruction of Antarctic Paleotopography (ANTscape) workshops, 15-17 April, Leeds (UK), and 10-11 September, Granada (Spain).
- Circum-Antarctic Stratigraphy and Palaeobathymetry (CASP) Project. 7-8 September, Granada, Spain.
- Antarctic Ice-Volume Proxies: High and Low Latitude Sequence and Seismic Stratigraphy and Deep-Sea Records. 9 September, Granada, Spain.
- Seismic Data Library System (SDLS) workshop, 9 September, Granada, Spain.
- Amundsen Sea Embayment: Tectonic and Climatic Evolution workshop, 9 September, Granada, Spain. Information and outcomes from this workshop are published in EOS (Larter, Gohl and Bentley, 2010).
- Developing an Integrated Strategy to Recover Paleoclimate Records from the Antarctic Margin and Southern Ocean, 12-13 September, Granada, Spain.

ACE has been also active in organizing special sessions, business meetings and Town Meetings in all major scientific meetings such as the European Geophysical Union, Vienna; and AGU Fall Meeting, San Francisco.

IV. Links to other SCAR SRPs or SCAR Action or Expert Groups and to other Programmes

ACE has links to the ice core community via the International Partnership in Ice Core Sciences (IPICS) and through the ESF EuroPOLAR Project HOLOCLIP; to the palaeoclimate community via the past climate change (PAGES) programme of the International Geosphere Biosphere Programme (IGBP); to the IASC programme on Arctic Palaeoclimate and its Extremes (APEX); and to drilling programs such as are the Antarctic Geological Drilling programme (ANDRILL), the Shallow Drilling Program (SHALDRIL), the Integrated Ocean Drilling Program (IODP) and ESF ERICON-AB.

V. Education and training

ACE provided funding for travel expenses, student housing and low registration fees for students to attend the First ACE Symposium. ACE also co-funded an Association of Polar Early Career Scientists (APECS) workshop, 7 September, Granada, Spain.

Members of ACE participate as teachers and, when possible, ACE provides funding for 1-2 students to attend the Urbino Summer School in Paleoclimate: <http://www.uniurb.it/ussp/>

ACE has been very active in education and outreach programmes within the ANDRILL and the IODP Programmes (e.g., <http://www.andrill.org/education>; <http://www.youtube.com/user/OceanLeadership>; <http://www.iodp.org> and <http://www.iodp-usio.org/>).

VI. Project Databases

ACE database is the SCAR-ACE Seismic Data Library System (SDLS) (<http://scar-sdls.org/>).

In addition, for the research conducted within ACE other databases supported by other programmes are used such as are:

ANDRILL: PANGAEA <http://www.pangaea.de/>

IODP:

Riserless Core data and log data: <http://iodp.tamu.edu/database>

Riserless Downhole log data: <http://iodp.ldeo.columbia.edu/DATA/index.html>

Antarctic and Southern Ocean Data existing coring expedition can be checked at the Google earth link: <http://campanian.iodp-mi-sapporo.org/google/data/iodp.kml>