

## **Circum-Antarctic Stratigraphy and Paleobathymetry (CASP) project: Report on a meeting held at the 10<sup>th</sup> ISAES on September 1, 2007**

F.J. Davey<sup>1</sup> and A.K. Cooper<sup>2</sup> (convenors)

<sup>1</sup>GNS-Science, 1 Fairway Drive, Lower Hutt, New Zealand (f.davey@gns.cri.nz)

<sup>2</sup>Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305 USA

**Summary** CASP is a collaborative effort, initiated as part of International Polar Year activities, to create paleobathymetric maps of the whole Antarctic continental margin and Southern Ocean for the Late Cretaceous to the present using all existing seismic and drilling data collected in the region. The project was first discussed at the SCAR Open Science Conference in Hobart, Tasmania in July 2006 (i.e., Cooper and Wardell, 2006, p.15; Wardell et al., 2007), and proposed to be part of the Antarctic Climate Evolution Program (ACE) and to work cooperatively with the Antarctic Seismic Data Library System (SDLS). An overview of the objectives of CASP, as envisioned in the initial proposal circulated to the research community in early 2007, is given at the end of this report. The project has been informally adopted by ACE and SDLS. This meeting was the first formal effort to organize and implement the project.

**Citation:** Davey, F.J. and A.K. Cooper. (2007), Circum-Antarctic Stratigraphy and Paleobathymetry (CASP) project: Report on a meeting held at the 10th ISAES on September 1, 2007: *in* Antarctica: A Keystone in a Changing World – Online Proceedings of the 10<sup>th</sup> ISAES, edited by A.K. Cooper, C.R. Raymond, et al., USGS Open-File Report 2007-1047, MWR01, 4 p.

### **Introduction**

The half-day CASP meeting was held in conjunction with a full-day Antarctic drilling workshop on the Saturday immediately following the 10<sup>th</sup> ISAES in Santa Barbara, California, USA. The meeting agenda is given below. The meeting was held in the Corwin West room of University Centre, and eighteen people attended (see list below). Fred Davey gave the background for the CASP project, and then outlined the agenda and meeting objectives. The principal objective of this first CASP meeting was to organize the project, with later meetings and workshops then addressing procedural and science issues. Other meeting objectives were to: outline existing interests of investigators; discuss and achieve agreement by the community on data access and use; outline a work program for the next year; and select a Steering Committee and Convenor for the project.

Meeting participants introduced themselves and briefly discussed the regions of the Antarctic margin where they are working, the seismic data bases that they had and whether these data bases were now loaded in a seismic interpretation package. They also described how much seismic data had been interpreted for regional stratigraphy, the interpretive package they used and what they hoped to be able to contribute to the project. During these presentations, two phases for the project were recognized and emphasized i) merging of data bases held in different interpretive systems, and ii) integration of seismic stratigraphies for different parts of the continental margin.

Nearly 310,000 km of multichannel seismic data (MCS) now exist around the Antarctic margin from the continental shelf to the abyssal plain (e.g. Wardell et al., 2007), and many regional stratigraphic studies have been published. The former ANTOSTRAT project (1989 – 2003) compiled data in five principal areas around Antarctica and created regional data compilations, regional seismic stratigraphies and a seismic stratigraphic atlas of the Ross Sea (e.g., Cooper et al., 1995). Results of some of these studies are summarized in Cooper et al. (in press). Over the past decade, over 75,000 km of new MCS data have been collected principally by Australia, Russia, Norway, Germany, and Italy around the East Antarctic margin from the Weddell to Ross seas. German Leitchenkov indicated that Russian data have been entered into a Landmark system. Phil O'Brien noted that Australian data are entered into a GeoFrame system. The two groups together with an Italian group, are now working to merge the overlapping data sets and seismic stratigraphies.

On the West Antarctic margin, Chiara Sauli described the extensive work being done by the ROSSMAP Project to reassess the seismic stratigraphy of the Ross Sea, based on new data collected since the ANTOSTRAT atlas was made. This work is being done by several groups using at least three different seismic interpretation systems. Lou Bartek noted the U.S. MCS data that were being contributed to the ROSSMAP project. Karsten Gohl noted that stratigraphic analysis of about 10,000 km of MCS data in the Bellingshausen Sea was being done using a Landmark system, which is the same system that German scientists used for the compilation of their Weddell Sea data. In the Antarctic Peninsula and western Weddell Sea regions, Andres Maldonado described efforts at the University of Granada to compile all of Spain's MCS data on a Landmark system. Michele Rebesco noted that only few of the Italian lines in the Antarctic Peninsula region were in their interpretive system.

The presentations and follow-up discussion highlighted the high level of interest in regional seismic stratigraphic mapping, and the desire to integrate these interpretations into a unified circum-Antarctic stratigraphy. The general feeling was that such a project is now possible for large parts of the Antarctic margin if all existing seismic data sets are incorporated. This will be a massive undertaking and not possible by one research group, and will require a large

collaborative effort with careful coordination to ensure a timely completion of the circum-Antarctic seismic mapping effort.

### **Data access and use**

Access to and use of MCS data are critical issues for the success of CASP, to ensure that:

- all existing MCS data, including recent and new data, will be included in the analyses; and
- anyone interested in working on the project (even if not an MCS data collector) may participate in the project.

Alan Cooper led the discussion on access to and use of multichannel seismic reflection data (MCS), during which the following guidelines were adopted for the CASP project:

1. Guidelines established by the SDLS under ATCM XVI-12 in 1991 would be followed for access to MCS data, specifically:
  - a) MCS data collected more than 8 years ago are openly accessible, without restrictions
  - b) MCS data collected from 4-8 years ago would be accessible under the SDLS guidelines (i.e., see Cooper, 1991 and 2001 for a full list of the specific guidelines)
2. For data collected less than 4 years ago, the use of these data would be decided by the data collectors and project members.

Access to MCS data collected less than 4 years ago has long been a sensitive issue. Under the SDLS guidelines, data collectors have exclusive use to these data. However, to ensure that these data will also be included in the circum-Antarctic stratigraphic compilation, some different options for access were discussed:

- Installing the data into a seismic interpretation system (e.g. Landmark) for collaborative interactive interpretation sessions, and then extracting the original seismic data leaving the interpreted events only; or
- Keeping the data in an interpretive system under high-security conditions of password access only, with the password held by the data collector; or
- Allowing data collectors to incorporate their data at their institution and then just share the interpreted events; or
- Other options to protect the intellectual property rights of the data collector.

However, the only consensus was for voluntary contribution of recent data (i.e., less than 4 years old) by any individual group.

### **Project structure**

Fred Davey led the discussion on the structure of CASP. As a SCAR project under the ACE Program, the structure would best be suited as having a coordinator and four or five members. It was agreed that the members should have between them good regional coverage, they should be active data acquirers and they should be from several different countries. An SDLS person should be nominated to ensure close working ties with the SDLS system. This person could be a member of the steering committee but not necessarily so. It was agreed that this person should probably be a member of the SDLS Executive committee or an SDLS library branch manager (i.e., a senior Antarctic researcher).

The new steering committee agreed was:

Lou Bartek,  
Laura De Santis,  
Karsten Gohl,  
German Leitchenkov\*  
Andres Maldonado.

The steering committee was directed to select a convenor from their members and discuss with Alan Cooper a suitable SDLS representative. The committee was also encouraged to discuss how they would function in the future.

\* Directly following the CASP meeting, the committee met and selected German Leitchenkov as their coordinator. Nigel Wardell and/or Alan Cooper will be the SDLS liaison person.

### **Future work**

The future work program for the project was discussed briefly. Some of the important and immediate issues to be resolved are:

- organizing future seismic interpretation workshops;
- developing the formal relationship with the SCAR ACE project and its ROSSMAP sub-committee that has some similar objectives;
- organising into regional working groups;
- facilitating inter-relationships between the regional groups;
- establishing stratigraphic standards;
- deciding which interpretational software package is to be used.

A workshop for Wilkes Land data was suggested for Granada in June 2008, and the SCAR Open Science Meeting in St Petersburg in July 2008 was noted as an opportunity for the CASP group to meet.

Meeting participants recognized that to successfully create the desired products (e.g., paleobathymetry maps), the project must have good age control from drilling in addition to seismic stratigraphic maps. The compilation of the maps will help identify and justify sites for future drilling. The meeting closed at lunchtime, and in the afternoon participants joined the concurrent workshop on Antarctic scientific drilling.

**Postscript:** The former name of the project (i.e., Circum-Antarctic Paleobathymetry and Stratigraphy and Paleobathymetry (CAPS) project) was changed to the new name (CASP) after the meeting, to avoid duplication of acronyms with another CAPS project within SCAR.

## References

- Cooper, A. K., convener (1991-paper, 2001-web), A SCAR seismic data library system for cooperative research (SDLS): Summary report of the International Workshop on Antarctic Seismic Data, Oslo, Norway, April 11-15, 1991, SCAR Report 9, <http://www.scar.org/publications/reports/9/>, with addendum 1 (2002), <http://www.scar.org/publications/reports/9/addendum.html> and addendum 2 (2006), [http://www.scar.org/publications/reports/9/Addendum2\\_Report9.pdf](http://www.scar.org/publications/reports/9/Addendum2_Report9.pdf).
- Cooper, A. K., P. F. Barker, and G. Brancolini, eds. (1995), Geology and Seismic Stratigraphy of the Antarctic Margin, Antarctic Research Series vol. 68, Amer. Geophys. Union, Washington D.C., 303 p., atlas, 2 CD.
- Cooper, A. K., and N. Wardell (2006), Report on the Workshop for the Antarctic Seismic Data Library System for Cooperative Research (SDLS), Hobart, Australia, July 9, 2006, SCAR Report 28, [www.scar.org/publications/reports/28/Report28rev.pdf](http://www.scar.org/publications/reports/28/Report28rev.pdf).
- Cooper, A. K., G. Brancolini, C. Escutia, Y. Kristoffersen, R. Larter, G. Leitchenkov, P. O'Brien, P., and W. Jokat (2008), Cenozoic climate history from seismic-reflection and drilling studies on the Antarctic continental margin, in Antarctic Climate Evolution, edited by F. Florindo and M. Siebert, Elsevier, New York, in press.
- Wardell, N, J. R. Childs, and A. K. Cooper. (2007), Advances through collaboration: Sharing seismic reflection data via the Antarctic Seismic Data Library System for Cooperative Research (SDLS), in Antarctica: A Keystone in a Changing World – Online Proceedings of the 10<sup>th</sup> ISAES, edited by A. K. Cooper and C. R. Raymond et al., USGS Open-File Report 2007-1047, SRP 001, 4 p.; doi:10.3133/of2007-1047.srp001.

## CASP meeting participants

Name	Institution	Contact address
Lou Bartek	University of North Carolina	bartek@email.unc.edu
Alan Cooper	U.S. Geological Survey (Emeritus) and Stanford University	acooper@usgs.gov
Fred Davey	GNS Science	f.davey@gns.cri.nz
Laura De Santis	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS	ldesantis@ogs.trieste.it
Federica Donda,	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS	fdonda@ogs.trieste.it
Carlota Escutia	Instituto Andaluz de Ciencias de la Tierra CSIC-Univ. de Granada	cescutia@ugr.es
Karsten Gohl	Alfred Wegener Institute for Polar and Marine Research	karsten.gohl@awi.de
Victor Gandyukhin	Polar Marine Geosurvey Expedition - PMGE	antarctida@polarex.SPB.ru
Julia Guseva	Polar Marine Geosurvey Expedition - PMGE	antarctida@polarex.SPB.ru
Travis Hayden	Ohio State University	thayden@ohio-state.edu
German Leitchenkov	Institute for Geology and Mineral Resources of the World Ocean, VNIIOkeangeologia	german_l@mail.ru
Andres Maldonado	Instituto Andaluz de Ciencias de la Tierra CSIC-Univ. de Granada	amaldona@ugr.es
Philip O'Brien	Geoscience Australia	phil.obrien@ga.gov.au
Michele Rebesco	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS	mrebesco@ogs.trieste.it
Chiara Sauli	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS	csauli@ogs.trieste.it
Christopher Sorlien	Institute for Crustal Studies, Univ. California, Santa Barbara	chris@crustal.ucsb.edu
Nigel Wardell	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS	nwardell@ogs.trieste.it

## Meeting Agenda

- Meeting objectives
- CASP background
- Data access issues
- Data coverage and status of circum-Antarctic stratigraphies  
Summary from each research group of MCS data, correlation to drill sites, status of event/horizon digitisation and stratigraphic correlations.
- CASP organisation – project structure and selection of Steering Committee
- Goal and objectives – future work plan
- Drilling targets - Joint session with Drilling Workshop

**CAPS – Circum Antarctic Paleobathymetry and Stratigraphy project** (original title)  
**CASP – Circum Antarctic Stratigraphy and Paleobathymetry project** (current title)

### General concept

A new international collaborative project is proposed to create paleobathymetric maps of the Antarctic continental margin and Southern Ocean from the Cretaceous (90 m.y.) to the present using all existing digital seismic reflection data and rock sample information (e.g., drilling, coring, dredging). Such maps are needed to set boundary conditions for ocean circulation models, for opening of ocean gateways, and for Global Climate Models (GCM). The project builds on the multichannel seismic database held in the SCAR Antarctic Seismic Data Library System (SDLS).

Many attempts are now underway to map the seismic stratigraphy and bathymetry of various segments of the continental margin using selected seismic data, and to create paleobathymetry maps using plate tectonic models and assumptions about crustal thickness. However, there has not yet been a concerted and coordinated effort to integrate the various regional stratigraphies to achieve a unified circum-Antarctic seismic stratigraphic model that that in turn can be linked to available rock sample data to determine ages, lithostratigraphies and paleoenvironments.

There is now a vast quantity of seismic data around Antarctica, including over 310,000 km of multichannel seismic reflection data, so the project would need to be done by several regional groups working on different parts of the Antarctic margin.

The project would likely follow the work sequence:

- Existing digital seismic reflection data and regional velocity information would be collated and entered into digital interpretation systems (e.g., Landmark).
- Project members would meet at a workshop to discuss and establish criteria, standards, guidelines and methods by which the seismic data would be interpreted for key stratigraphic intervals, and would be integrated with existing stratigraphies (which may need updating).
- Stratigraphic horizons would be picked and integrated from region to region to achieve a unified acoustic stratigraphy, which would then be merged with velocity models to make sediment thickness maps of the key stratigraphic intervals.
- Drilling and other rock-sample data would then be integrated with the seismic data to establish a unified lithostratigraphic age model and to make compaction history corrections.
- The lithostratigraphic age model would be integrated with regional framework studies (e.g., plate age models, deep crustal structure) and other information needed to derive the circum-Antarctic paleo-stratigraphy and – bathymetry maps.