RV Southern Surveyor

Voyage Transit SST02/2007

Title:
The record of the ancient Lake Baudin located on the Lacepede Shelf offshore South Australia

Itinerary
Depart: Port Lincoln 1430hrs, Saturday 17 March 2007
Arrive: Hobart 0700hrs, Friday 23 March 2007

Principal Investigators

Professor Patrick De Deckker *(Chief Scientist)*
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Other Principal investigators:
Mr Peter Hill and Prof. Chris von der Borch,
Both Visiting Fellows, Department of Earth and Marine Sciences, ANU

Scientific Objectives

During voyage SS02/2006, using the sub-bottom profiler, we successfully located several ancient courses of the River Murray, and also determined the position of 2 extensive lacustrine deposits on the Lacepede Shelf. Despite many attempts at coring the sea floor using a gravity corer, we failed to penetrate a sandy layer that is overlapping the 'ancient lakes' deposits. One site is located offshore the Murray mouth at a depth of about 40m below the sea surface, and the other occurs in the central part of the Shelf at approximately 60 m below the sea surface.
The recovery of lake sediments located on the Lacepede Shelf could provide much information on past climatic events for a period of time that lasted possibly 20,000 years when sea level had receded more than 60m. This lacustrine phase ought to be synchronous with the wet phase recorded at Lake Mungo that saw many lakes being filled in the Willandra Lakes region, and coinciding with Marine Isotope Stage 3. Because of the poor preservation of pollen and microfossils at Lake Mungo, the Palaeo-lake Baudin may yield vital information on palaeoenvironments and palaeoclimates preceding the onstart of the Last Glacial Phase that culminated around 20,000 years BP.

Voyage Objectives

There were 2 main objectives: the first one is to obtain cores from the ancient lake deposits on the Lacepede Shelf, and the second was to obtain additional information on the sea floor near the coastlines offshore Portland adjacent to the Glenelg River and offshore western Tasmania. A few plankton tows were also obtained to determine the difference between upwelled waters offshore Cape Bonney and elsewhere.

Voyage Track

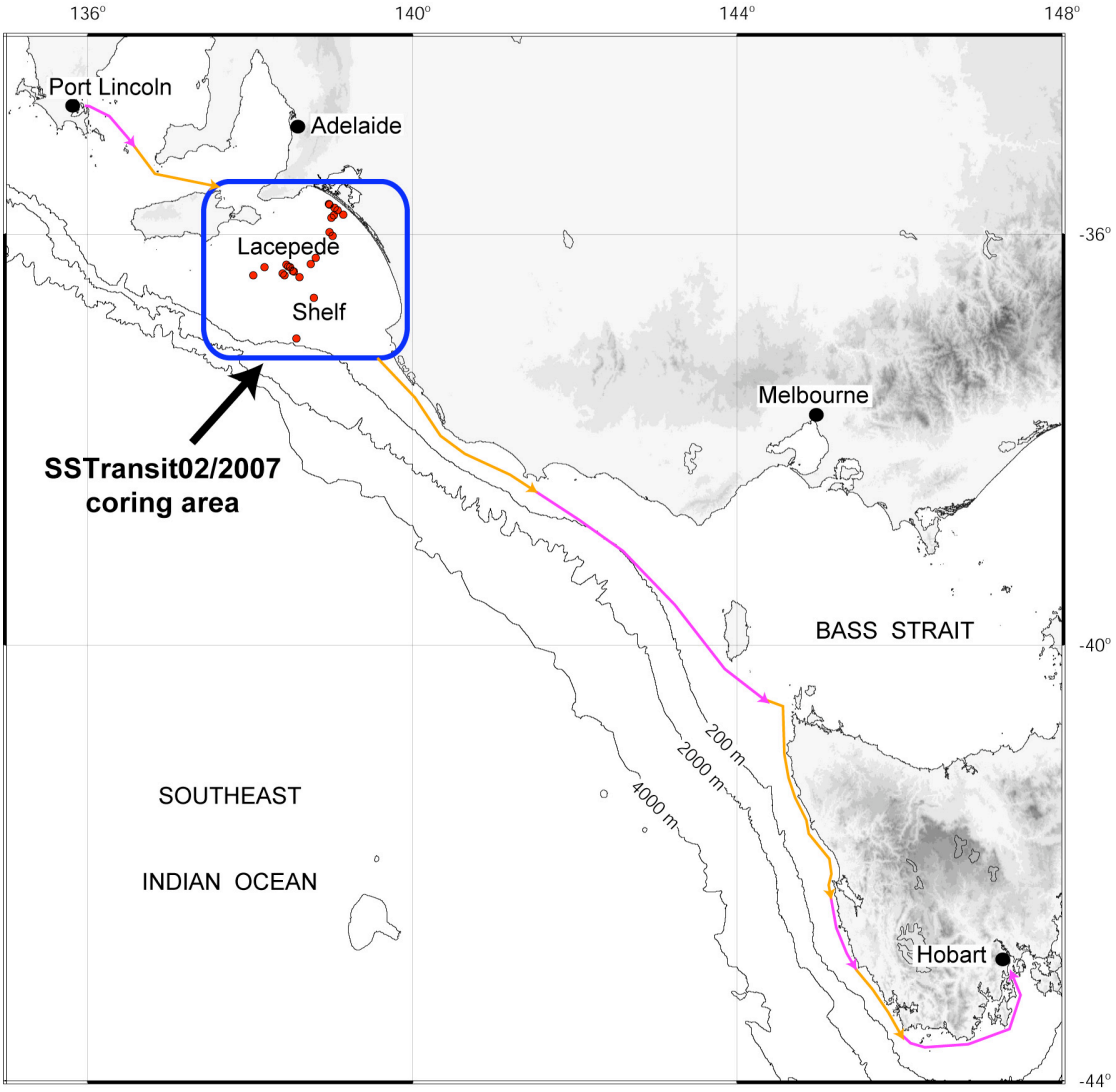

Figure 1 showing the itinerary of voyage SST02/07. The orange lines show the track followed with particular interest in swath mapping, and the others for which the sub-bottom profiler was constantly monitored.

Results

Coring on the Lacepede Shelf; on each coring occasion, except one, we recovered sediments. In total, we obtained 21 cores with varying levels of recovery [see table 1]. The reason for not having recovered longer cores on most occasions related to the fact

that the corer could not penetrate hard and compressed sandy layers, or others consisting of a shell hash. As we decided not to open the cores while at sea, we are unaware of the lithological units recovered, but already were able to identify some of the material where we had to cut the cores in shorter sections. The overall situation is that the top of most cores consisted in a loose red/brown sand. We interpret the latter sands as having originally been part of a dune field, which subsequently became trangressed by the sea, and consequently reworked by oceanic currents and redistributed over the entire Lacepede Shelf. We recovered 2 long cores [>3m length], which consisted in a substantial amount of clay, but at present we are unable to say if they represent a lagoonal/estuarine facies, or a freshwater lake. Only [micro]palaeontological investigations in the laboratory at ANU will inform us on the origin of the material. Table 1 provides the list and details of all the cores obtained during the voyage.

Sub-bottom profiler: This equipment item is providing to be of excellent value as we obtained clear and high quality information of the sea floor on the Lacepede Shelf as, while in transit to other sites. We sailed along the western coast of Tasmania and paid particular attention to the sea floor near Cape Davey where some ancient channels were found. During the night of the last day, prior to our arrival in Hobart, we used the sub-bottom profiler to determine the topographic features on the sea floor in the Derwent River.

Swath mapping

Two areas were investigated; one offshore the Glenelg River to complete previously obtained swath data, and the other to obtain sub-bottom profiles of the shelf offshore Western Tasmania.

We recovered sufficient data offshore the Glenlelg River, although we did not complete all of the proposed lines. A new view of the canyons is being prepared by Mr Michele Spinoccia of Geoscience Australia. The swath mapping equipment remained turned on for the rest of the voyage to in the hope to obtain suitable data complimentary to the sub-bottom profiles we obtained.

Voyage Narrative

We sailed from Port Lincoln on March 17 at 1630 and traversed straight away to Backstairs Passage. From the onstart of the voyage, we turned the sub-bottom profiler on so as to survey the sea floor near Kangaroo Island for identifying possible courses of ancient rivers. We reached the first coring site the following morning (day 2) by 0900. From then on, we took a total of 8 cores, having commenced the coring near the Young Husband Peninsula that separates the Coorong Lagoon from the Ocean.

On day 3, we took some 11 cores.

On day 4, three cores sites were chosen, but only one would return sediments. After that we sailed over the Glenelg canyons area for additional swath mapping.

Occasionally, plankton tows were carried out especially for comparison between areas with cold water (referring to an upwelling) to those that are bathed in warmer waters. The region of upwelled water could be best seen the day before the voyage departed on the satellite imagery accessible on the CSIRO Marine and Atmospheric Research web site. Around the middle of the day, we proceeded towards Tasmania and continued to do swath mapping work as well as sub-bottom profiling investigations.

On days 5 and 6, we first sailed towards King Island and enjoyed the smooth seas and warm weather. Swath mapping continued as planned to fill gaps along previous swath lines. After that we followed the western coastline of Tasmania along a line parallel to the one

we did last year during voyage SS02/06, in order to obtain additional data on the continental shelf. On this occasion, we sailed closer to the wild and spectacular Tasmanian coastline.
We safely reached Hobart early in the morning of Friday March 23.

Summary

This voyage proved to be a success. We obtained a total of 21 cores from the Lacepede Shelf, many of which are very short. The difficulty has been to be able to penetrate the sandy layers that appear to cover the entire Shelf. Nevertheless, on several occasions, we penetrated the upper layers to eventually return with fine, clayey sediments which we interpret as being either lacustrine or estuarine in origin. We cannot be more definitive at this stage as we did not open the core tubes on board. However, it is clear that on several occasions we encountered shell hash material that have an estuarine origin.
We have been blessed with calm weather during the coring operations, and this facilitated our coring performance.
We are particularly grateful to all three staff who performed the coring operations, Mr Craig Wintle, Mr Andrew Hislop and Mr Nigel Craddy. They simply did a superb job. The vibrocorer on loan from Geoscience Australia proved to be an excellent tool for obtaining the short cores on the shelf that could not be cored last year using a gravity corer.
We also obtained additional swath mapping data offshore the Glenelg River that allowed us to fill in the gaps in our data obtained in 2006, together with new data acquired during the AUSFAIR swath mapping voyage in March 2006.
Sub-bottom profiling offshore the western coast of Tasmania revealed several depressions made by rivers that would have flowed on the continental shelf during periods of low sea level.
We also obtained a few plankton samples to identify species diversity in the prominent upwelling region offshore Cape Bonney. The list of plankton tows is provided in Table 1.
The crew and staff on board the ship were all eager to help and make sure the voyage was a success, and this proved to be the case. Thank you to all.
We also arranged to have 2 undergraduate and 2 postgraduate students, all from the ANU, participate in the voyage so as to learn to appreciate research activities at sea. This training over a short period of time proved very rewarding for all.

Personnel

Scientific Participants

Prof. Patrick De Deckker, ANU	Chief Scientist
Mr Peter Hill, Visiting Fellow ANU	Principal Investigator, geophysicist
Prof. Chris von der Borch, Visiting Fellow ANU	Principal Investigator, marine geologist, sedimentologist
Mr John Rogers, ANU	PhD student
Ms Sophie Bretherton, ANU	PhD student
Ms Louise Soroka, ANU	Undergraduate student
Mr Graham Nash, ANU	Undergraduate student
Mr Nigel Craddy, ANU	Technical support
Mr Peter Dunn, CSIRO	Voyage Manager, Electronics Support
Ms Bernadette Heaney, CSIRO	Computing Support
Mr Michelle Spinoccia, Geoscience Australia	Geophysicist, swath mapping support
Mr Craig Wintle, Geoscience Australia	Vibrocoring
Mr Andrew Hislop, Geoscience Australia	Vibrocoring

Marine Crew

Master	Captain Ian Taylor
Chief Officer	Ms Madeleine Habib
2nd Officer	Mr Michael Tuck
Chief Engineer	Mr John Morton
1st Engineer	Mr David Jonker
2nd Engineer	Mr Seamus Elder
Bosun	Mr Malcolm McDougall
Integrated Rating	Mr John Hall
Integrated Rating	Mr Tony Van Rooy
Integrated Rating	Mr Phillip French
Chief Steward	Ms Charmayne Aylett
Chief Cook	Ms Kym Farmer
2nd Cook	Ms Julie Porch

Additional Staff

Ship's auditing	Captain Fred Stein, CSIRO, MNF Director
Ship's auditing	Ms Rohanne Young, CSIRO, OHS&E Manager

Acknowledgements

We are grateful for having received so much help from a variety of institutions and individuals, all of whom made this voyage possible. These are: Don McKenzie who originally suggested that a piggy back project be applied for after voyage SS02/06 during which we failed to recover lacustrine deposits with the gravity corer. Don also helped us prepare the voyage, and Pam Reid and Ron Plaschke helped with enquiries prior to our sailing. Captain Fred Stein also was instrumental in permitting our research program to occur while the ship was in transit. Many people at Geoscience Australia (GA) in

Canberra helped gave tremendous support with respect to assembling all the necessary coring gear, freighting to it Port Lincoln, and for arranging for GA technicians to be on board during the voyage to help us with the vibrocoring. These are David Holdway, Ray de Graaf, Andrew Hislop, Craig Wintle, and also Peter Harris behind the scenes who 'gave the nod' to allow this program to happen.
We are also thankful to all the Master Ian Taylor and the *Southern Surveyor* crew who provided an outstanding service. It has been a pleasure working with them, knowing also that this would be a safe voyage.
Finally, we are grateful to Cameron Mitchell of GA, the previous voyage leader on the *Southern Surveyor*, and Ray de Graaf also of GA, who arranged for us to board the vessel earlier than scheduled, to enable us to gain more than 12 additional hours of research time.

Patrick De Deckker
Chief Scientist.

Figures

Refer to the excel sheet which I am enclosing and which contains two separate data sets, one related to the cores, and the other to the plankton tows.