

# SCIENCE REPORT JAN 17, 2004 NBP 03-06

## SCIENCE PERSONNEL

**PIs:** Luyendyk (UCSB), Bartek (UNC), Wilson (UCSB)

**Senior Staff:** Cook, Ralston

**Students:** 8 UCSB, 4 UNC

## OVERVIEW

MCM time

January 3: Transfer by helo to N.B. Palmer at ice edge north of McMurdo

January 4: Setting up systems at ice edge

January 5: Depart ice edge in AM; continue to set up systems.

January 6: Transit to east side of C19 survey area.

January 7: Geophysical profiling in east side C19 area

January 8: Transit to B15 calving site; begin geophysical survey B15 site

January 9: Continue geophysical profiles to east in B15 calving site.

January 10: Completed preliminary grid in B15 site and continue east to Bay of Whales

January 11: Tie to NBP 03-01 NE of Bay of Whales. Grid in Bay of Whales

January 12: Profile west to 167 30 W and complete small grid. Tie to NBP 96-01 lines to north.

January 13: Profile west to 172 30 W; complete grid.

January 14: Deep tow side scan/chirp within grid; complete two Kasten cores on deep tow line.

January 15: Profile westward to the west side of B15 calving site. Continue west across Central High into Central Trough.

January 16: Complete small grid at east side of Central Trough. Pull gear and transit to MCM.

January 17: Arrive sea ice edge north of McMurdo Station, transfer by helo to station. Move to ice pier.

## GEOPHYSICAL SYSTEMS

Navigation: No problems encountered.

Echo Sounding: The multibeam system functioned well except when pushing through ice. It acquired data over a 126-degree swath. Backscatter data was of high quality also. Computer trouble on January 8 led to 2.5 hours of only intermittent multibeam acquisition between restarts and diagnostics. The Bathy 2000 is functioning well.

Gravity: Gravity data were of good quality with no apparent noise. Short period noise apparent in prior legs has been eliminated by a change-out of gyros in Lyttleton.

Magnetics: The proton magnetometer was functioning without problems.

Seismics: *Multichannel (MCS) and single channel (SCS) seismic reflection profiling*: We deployed both single channel and 48 channel systems. MCS used six generator – injector (GI) guns and SCS one 25/25 GI gun. The GI gun array was towed at 3 meters depth. The gun hangers on the towing array had problems with a failure due to shocking. The Marine technicians (MT) corrected this. The gun array became tangled with the streamer on two occasions prompting the MTs to shorten the array tow point by about 10 meters. GI guns had a broken solenoid springs on several occasions. There were two air compressor shut downs that were due to false alarms concerning interruption in the flow of lubricating oil. The MCS streamer was towed at 7.5 meters depth. New birds were attached to the MCS streamer and they functioned well, except bird one appears to have a problematic inductive connection that gave frequent failure to read depth.

Shooting interval was 10 seconds with the SCS delayed by 7 seconds from the MCS. Shipboard MCS stacked sections show structural details of rifting structures in the basement. Resolution in the MCS images was very good. Onboard processing used Seismic Processing Workshop (SPW) of Parallel Geophysics Inc. We experimented with the Radon Transform method of multiple reduction (Ralston) with positive results.

Single channel seismic used the Univ. of North Carolina (UNC) systems with a 30-meter streamer and Elics acquisition system. High quality data were obtained. The UNC single streamer was seriously damaged by ice on last day of survey.

All seismic data was uploaded to the ships network for access by the science party for processing.

*Sonobuoys*: We launched buoys several times per day and obtained wide-angle reflection data. The ships ETs solved some initial system problems and put together a functioning system with recording on the OYO aux channel one.

*Deep Tow Side Scan and Chirp*: The SIS 100 unit was deployed for half-day at a site near 172 W. The unit functioned without problems.

*Kasten coring*: Two cores were taken at 172 WE. Coring equipment functioned well and cores were taken without incident.

*Marine Mammals*: We are employing the RPSC protocol of observing for marine mammals while conducting seismic operations. This includes an observer at all times and passive listening before starting a survey. Numerous marine mammals were sighted in McMurdo Sound. In the Eastern Basin sightings were rare. While surveying at 172 W a pod of minke whales came within or near the safety zone and seismic operations were halted. They were resumed after following the protocols for watching, waiting, and ramp-up.

## **ICE AND WEATHER**

The weather was generally fine with calm sunny days in McMurdo Sound and overcast conditions in the western Ross Sea along with south winds at 10-15 knots and brief snow

flurries. In the Eastern Basin later in the cruise winds were 20 knots from the SE, on occasion rinsing to 30 knots. This did not affect data quality. Returning westward to near the dateline winds moderated to 10 knots from the south with occasional periods of fog along the ice shelf front.

Ice was 50% or more in McMurdo Sound. Heavy ice was encountered on our departure immediately west and north of Ross Island in the Sound. We transited north between the B15K (sliver) and B15A icebergs, where water was mostly open. In contrast to the 2002-2003 season, ice in the southern Ross Sea, south of 77° S was largely absent. However, sea ice was thick in most of the Ross Sea north of 77 S in contrast to most seasons when it has been ice – free.

## **SCIENCE RESULTS**

Our objectives for this season were to survey the B-15 iceberg calving site along the Ross Ice Shelf front in the eastern Ross Sea from 177°W to 163°W. The survey plan was to complete geophysical profiles across the entire site and then to conduct grids over selected locations. Profiles and grids were located close to the ice shelf front so that these grids can be used for siting drill holes from the ice shelf when it flows over the grids in the next few years.

### ***C-19 site over Central Trough and Central High:***

In transit to the B-15 site we made a tie to previous Russian seismic profile SM 87004-2 crossing it while headed south to our survey completed last year. This tie will strengthen a correlation we have made from the Cape Roberts drill sites in the western Ross Sea to the east flank of the Coulman High – western Central Trough, where part of our survey is located.

On returning westward we made a geophysical profile along the ice shelf front from the Eastern Basin over the Central High and into the Central Trough. This profile shows deep units of the Eastern Basin cropping out at the sea floor on the east flank of the Central High – a promising candidate location for drilling into pre U6 strata. It may be possible to carry RSS units across the Central High from the eastern Basin with these profiles.

### ***B-15 Calving Site:***

After completing the tie line at C19 at the beginning of the cruise we transited east to the B-15 site. We completed a grid over a low-relief topographic ridge that trends north–south near 172°W. This ridge is comprised of several Plio-Pleistocene seismic stratigraphic units that are targets for drilling. Our lines are tied to seismic lines PD-90-22 and SIFP-202 in the north. Returning west over this site we added to the grid and also towed a near-bottom side scanning and chirp sonar for about a half day. We followed this up with two Kasten cores on the deep tow lines that recovered about 0.8 – 0.9 meters of sediment each. The cores were collected along one of the deep tow profiles and from locales that were under and beneath the ice shelf prior to the B-15 calving event.

Farther east near 167 W we made another grid including a line that extends north to tie to NBP 96-01 geophysical lines. This location is a candidate for drilling into the older strata of the Eastern Basin.

***Bay of Whales:***

We finished a transit within the B15 site to the eastern side of the Ross Sea where we completed a grid and tie to NBP 03-01 just northeast of the Bay of Whales. In the Bay faulted acoustic basement is within 100 milliseconds of the sea floor. It is not certain what the rock type may be but there is a possible significant magnetic anomaly at this location also. The unknown deeper sedimentary units of the Eastern Basin also are near the sea floor at this location. They may be units older than the known RSS units.

Our thanks to the ECO crew and to RPSC for excellent support of our science program.

**Bruce Luyendyk, Lou Bartek and Doug Wilson**