Cruise Report

NBP9507

28 October to 7 December 1995

Punta Arenas, Chile
to
Lyttleton, New Zealand

Principal Investigators:

L.A. Lawver, UTIG
and
G. Klinkhammer, Oregon State Univ.

Marine Project Coordinator

J. Holik, ASA

Captain of R/V *Nathaniel B. Palmer*

Capt. Joe Borkowski

Science Party

Project S-087, Univ. of Texas at Austin, Institute for Geophysics
Lawrence Lawver, Principal Investigator
Marta Ghidella, Argentinian Antarctic Inst., gravity
James Lundy, UTIG Graduate Student, multibeam data, sidescan sonar
Amelia Shevenell, Hamilton College undergraduate, coring and sediments
Ben Sloan, UTIG Postdoc, multibeam data, coring and sediments
Steve Stevenoski, Wisc.Rapids H.S. Science teacher, biological samples
Richard Von Herzen, Woods Hole Ocean. Inst. Senior Res. Scientist, tectonics
Mark Wiederspahn, UTIG Senior Systems Analyst, Seismics and Camera work

Project S-060, Oregon State University, Dept. of Oceanography
Gary Klinkhammer, Principal Investigator
Kathryn Brooksforce, Instrument Technician, Sled work
Carol Chin, OSU graduate student, plume processes
Alex Flaveluke, OSU graduate student, engineering
Mark Rudnicki, OSU Postdoc, water chemistry
Chris Schneller, Research Assistant, water chemistry
Jay Simpkins, Research Assistant, Bouy deployment
Paul Stoffregen, Research Assistant, engineer and design
Cara Wilson, OSU graduate student, plume modeling

Antarctic Support Associates
Jim Holik, Marine Project Coordinator
Tim Bjokne, Electronics Technician
Christie Campbell, Marine Technician
Bruce Granger, Computer Technician
Lynn Granger, Computer Technician
Robert Kane, Senior Marine Technician
Rhonda Kelley, Marine Technician
David Leger, Senior Systems Analyst
David McWilliams, Observer (disembarked 9 Nov 95)
Don Michaelson, Electronics Technician
Mark Talkovic, Marine Technician
Bryan Thomas, Technical Editor

Seabeam 2112™ Support
Dale Chayes, LDEO, consultant
Kyo Jin, Seabeam Inc., Senior Programmer
Ken Kiesel, Senior Engineer

National Science Foundation
Scott Borg, Program Manager (disembarked 9 Nov 95)

Innovative Transducers, Inc.
Rick Pearce, CEO (disembarked 9 Nov 95)
Johnathan Pearce, Technician (disembarked 9 Nov 95)

Index
(paginated by section)

A. **Weekly reports**

i.	Week One:	28 October to 2 November 1995
ii.	Week Two:	3 November to 9 November 1995
iii.	Week Three:	10 November to 16 November 1995
iv.	Week Four:	17 November to 23 November 1995
v.	Transit:	24 November to 7 December 1995

B. **Seabeam 2112™ multibeam bathymetry, Ben Sloan**

C. **Sidescan Seabeam 2112™ data, Jim Lundy**

D. **Seismic reflection profiling, Mark Wiederspahn**

E. **Gravity and magnetics, Marta Ghidella**

F. **Coring, Amelia Shevenell**

G. **Dredging, Lawrence Lawver and Randall Keller, OSU**

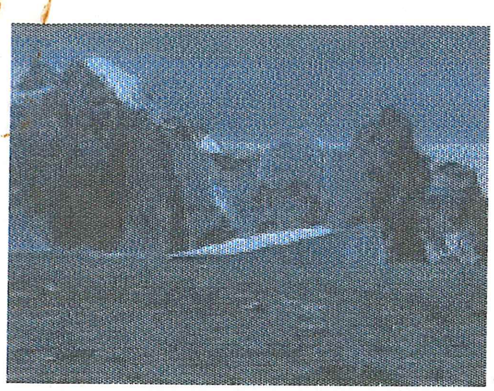
H. **Biological Sampling, Steven Stevenoski**

I. **Benthos Underwater Camera, Mark Wiederspahn**

J. **OSU Sled work, Gary Klinkhammer and the OSU group**

K. **Watch Standing, Richard Von Herzen**

L. **Station logs, Amelia Shevenell**



Antarctic Peninsula Neotectonics and Volcanism

Through December 11, Larry Lawver is chief scientist on a cruise aboard the R/V Nathaniel B. Palmer to investigate portions of the southwest Scotia Sea and Bransfield basin. The abstract from his NSF -funded proposal summarizes some of the objectives of the 41-day cruise. The program director has coupled Lawver's program (chiefly seismic and swath bathymetry) with that of Gary Klinkhammer (Oregon State University) who is studying the water chemistry in hopes of identifying hydrothermal plumes associated with active volcanism in Bransfield basin. Weekly reports from the cruise, including images, are available for the following weeks:

- Week 1 transit from Punta Arenas, Chile, surveying the Shackleton Fracture Zone Ridge, Bransfield volcano
- Week 2 swath mapping, early ZAPS sled work in Bransfield basin, rendezvous with the Polar Duke
- Week 3 exciting ZAPS results, seismic in the souhwest Scotia Sea, cores, bottom photos, dredging
- Week 4 outing to Base Frei, Bransfield seismic, Deception Island, Thanksgiving in transit
- Week 5 calm seas on the long transit to New Zealand, crossing the Pacific-Antarctic ridge

The science and science-support personnel on the ship are a diverse group. Check this page after December 11 for a fuller description of them with action photos. Lawver's group includes:

Marta Ghidella	*Instituto Antartico Argentino*	gravity, magnetics, and navigation data reduction
Jim Lundy	*UTIG*	seismic work, side scan data processing
Amelia Shevenell	*Hamilton College*	sedimentology of core sediments
Ben Sloan	*UTIG*	multibeam data processing, sediment coring, web page
Steve Stevenoski	*Wisconsin Rapids, WI*	high school science teacher sponsored by NSF to participate in the cruise
Dick Von Herzen	*Woods Hole Oceanographic Institution*	marine geophysicist and Alvin submersible veteran
Mark Wiederspahn	*UTIG*	seismic acquisition, underwater photography

About these reports...
These reports are prepared weekly aboard RV *Nathaniel B. Palmer*. Larry Lawver and co-authors write the text. Ben Sloan generates the graphics, some by transfer of video images from a camcorder to a Silicon Graphics workstation. He then merges the images with an editted version of the text and rolls it all into HTML. Both text and images are electronically mailed (via satellite) to Lisa Gahagan at the Institute for Geophysics, who puts them on the UTIG web site from where you, gentle reader, access them. That's Clarence Island at the top of the page.

BJS 11/17/95

NPB-9507 Weekly Cruise Report #1
RVIB Nathaniel B. Palmer
28 October - 2 November 1995

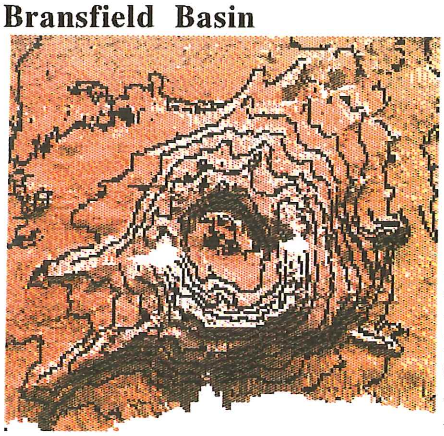
Punta Arenas, Chile

The scientific party members from the University of Texas at Austin left Austin on the 23rd of October. We rendevoused with Richard Von Herzen of the Woods Hole Oceanographic Institution, Scott Borg of the National Science Foundation, Amelia Shevenell of Hamilton College, and Steve Stevenoski of Wisconsin Rapids High School in Miami. We were met in Santiago by the Agunsa agency personel and stayed in the Hotel Monte Carlo in Santiago. While in Santiago, Scott Borg and I visited Sergio Barrientos and Emilio Vera of the Geophysics Department of the University of Chile. On the 25th of October we met Dr. Marta Ghidella of the Argentine Antarctic Program and Rick Pearce of Innovative Transducers Inc. (Ft. Worth, TX) at the Santiago Airport and flew to Punta Arenas. Most of the scientific party stayed at the Hotel Jose Noreiga in Punta Arenas. We settled in aboard the ship on the 26th but found that the ship had not been fueled while at the pier and that one ASA employee would not arrive until the 27th. Consequently, rather than sailing on the 27th as scheduled we did not depart the fuel pier until the morning of the 28th.

Drake Passage

We left the Straits of Magellan and sailed around the eastern tip of Tierra del Fuego. At 0805z on the 29 October 1995, we dropped a pressure gauge for Wentworth of Texas A&M. It, in conjunction with another instrument to be dropped near Elephant Island and some British instruments, will be used to determine flow rate and volume of water through Drake Passage. Total time on station was about 1.5 hours. We then proceeded along the continental margin on the southern side of Tierra del Fuego. We ran along at water depths varying between 1000 m and 3000 m. This was the first real trial of the new, improved Seabeam 2112ª. I am happy to say the system works well. We continued on course across the Shackleton Fracture Zone Ridge that extends from South America to the Antarctic Peninsula. We crossed the flat trench at a depth of ~4300 m and then turned northwest for a short survey, ran up the continental margin of South America, and found the southern corner of South America where the contours come to an angle of 50¡. We then headed down the start of the Shackleton Ridge using the Geosat gravity maps of David Sandwell. The ridge has one major offset at about 66¡ 30' W which we aniticipated from the Geosat gravity data. We then were able to follow the ridge without any problems all the way across the Drake. In the northern part of the ridge, it does not match the published position very well but with the new Seabeam system, it was quite easy to follow across. We did one additional quick survey of the intersection of the abandoned spreading center in the Scotia Sea with the Shackleton Ridge. Originally we had planned to deploy the new ITI streamer and balance it in our work area in the Southwest Scotia Sea but the wind was up to 30 kts and the seas were building so it was decided to postpone the streamer party until later. We turned and ran south along the east side of Bridgman Island, neatly imaging two of the small volcanic cones that Randy Keller and I dredged on our NBP9301 cruise. We then turned south around the southern edge of Bridgman Island and headed west into King George Basin.

Bransfield Basin

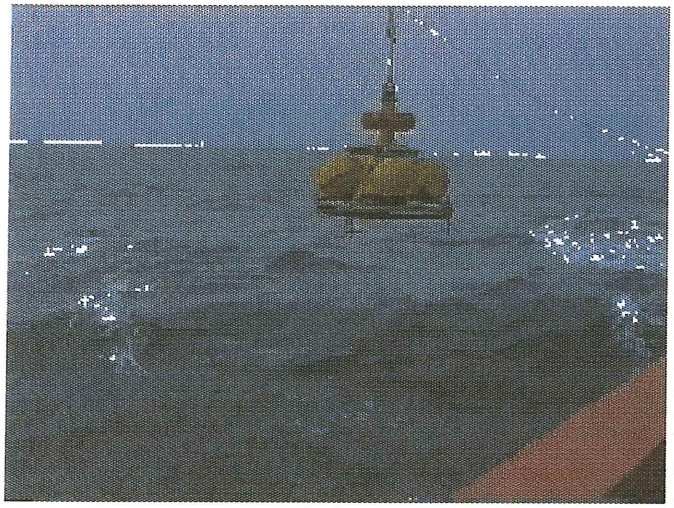


An initial lowering of the Oregon State vent detection (ZAPS) sled was made in the eastern end of King George Basin. We then turned southwest and began to profile the Central Bransfield Basin. The detail of the Seabeam image is astounding. We have a beautiful image of the submarine volcano just off Maxwell Bay, King George Island. We then returned to the eastern end of the King George Basin and made a second ZAPS sled lowering after which we made a second survey to the southwest. We picked up numerous small volcanic features, all of which seem to be lineated and parallel along about four lines. The lineation of these features is truly remarkable. After additional lowerings of the ZAPS sled and the CTD rosette we have now proceeded to the Eastern Bransfield Basin where we are in the process of running a Seabeam survey towards Clarence Island.

Larry Lawver and the Shipboard Scientific Party

RVIB Nathaniel B. Palmer
NBP-9507 Cruise Report
Week Two: November 3-9, 1995

During the second week of NBP9507, we worked in Bransfield Strait where we acquired nearly 1,000 nautical miles of swath bathymetry, lowered the ZAPS sled 13 times, acquired three water sample rosettes, retrieved one sediment core, and rendezvoused with the *Polar Duke*.



At the end of last week we were heading east into the eastern Bransfield Basin, east of Bridgeman Island. We turned the ship to a course of 050¡ and ran straight down the axis of a rather knobby ridge that stretched about 30 km in a straight line and attains a height of about 1000 m from a surrounding seafloor of 2 to 2.5 km. We surveyed the axis of the eastern Bransfield Basin towards Clarence Island where we turned and ran a parallel course to the southwest. We ran over a potential ZAPS sled station and surveyed a bit more. We then took a station and proceeded to a deep spot at the end of the 30 km ridge. We next steamed out of Bransfield Basin passing between Elephant and Clarence Islands where we **launched the second Whitworth buoy** at 60¡50'S, 54¡04'W. We found a nice flat spot at just about 1000 m northwest of the eastern end of Elephant Island. We then turned onto a course of 330¡ heading into the Scotia Sea while we deployed the seismic streamer and balanced it by attaching 0.8 pound lead sheets every other hydrophone. There are 5 hydrophones per channel and 48 channels. The streamer, which looks like a **bright yellow garden hose** with phone lumps every 5 m, has a 1.2 km active section. The streamer towed just below the surface with the weight that we put on it. There are six active bird locations although the one second one from the ship does not respond to commands. Unfortunately, by the time we got the streamer balanced and were about to bring it back in to put birds on, the weather had blown up to 35 kts and we were forced to postpone the streamer test. We then tried to Seabeam across the possible new plate boundary and got blown off the water when the winds went up to 45 kts. Most everyone on the ship was adamant about returning to the relative calm of Bransfield Strait.

By 1500z on the 5th of November, we had returned to the eastern Bransfield Basin and proceeded to take ZAPS sled stations 9 and 10. We then returned to the central Bransfield Basin steaming past Bridgeman Island once again. We were headed for a high heat flow location found on a 1989 R/V *Polar Duke* cruise. When we approached the site, we found the area covered in heavy pack ice. As time was now running out for our rendezvous with R/V *Polar Duke* on the 9th, we felt we needed to test the seismic streamer before Rick Pearce of ITI left the ship. Consequently we headed back north of Bridgeman Island in hopes of getting to the relatively ice-free waters of the eastern Bransfield Basin. We then began to deploy the streamer with birds and then the airguns. With our normal luck the weather began to deteriorate abruptly. We started with six SSI GI guns in the water towed as two bundles of three each. Immediately after getting underway with the guns firing it was obvious that the ship's crab angle would cause the port gun bundle to rub against the new streamer. The port guns were pulled and since one of the starboard guns was leaking and had been shut down, it made little sense to continue seismic work since we were not collecting quality data. It is safe to say that the streamer appears to be quiet and to work well. Alas, we have not been able to collect any real data with it because of weather. So, we once again passed Bridgeman Island and headed southwest for station work near the previously identified zone of high heatflow where we made ZAPS and rosette lowerings and acquired a core.

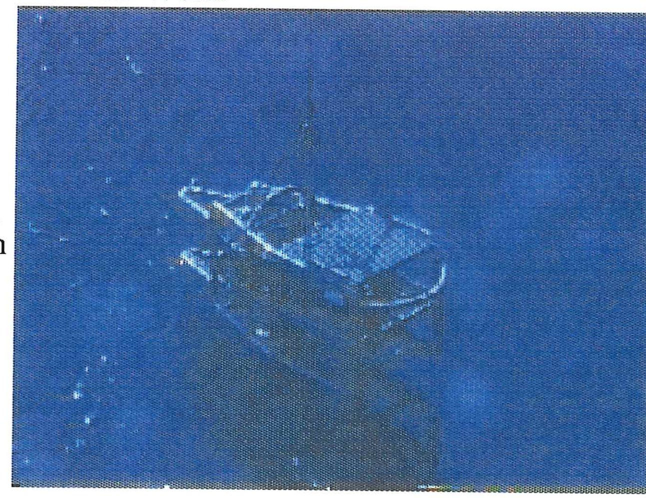
Sediment Coring

The coring device used is a modified Kastenlot corer, a three-meter long stainless steel barrel with a square cross-section. Operatedby Amelia Shevenell, a Hamilton College undergraduate representative of sedimentologist Eugene Domack, and University of Texas foraminiferal micropaleontologist Ben Sloan, the device is designed to preserve the sediment-water interface. The initial lowering of the device failed to retrieve any sediment, most likely because the half-ton instrument was too light for the heavy aft winch line on which it was lowered. A second lowering on the starboard winch penetrated the sea bottom, but a flapper stuck in the open position and allowed the sample to slide out as the tool was lifted from the water. Following modification of the catcher by ASA marine tech Robert Kane, a third penetration returned with a full three meters of mud from 1,960 meters water. The mud was described by Shevenell and Sloan as very soft, weakly stratified olive-gray hemipelagic mud with occasional interbedded black layers inferred to be rich in heavy minerals, possibly manganese and/or sulfides. The two photographed the core and took samples at ten centimeter intervals for sedimentological and foraminiferal analyses. Sloan extracted small subsamples of the top ten centimeters at one-centimeter intervals to be used to evaluate the microhabitats of foraminifera living in the mud near the sea bottom.

Rendezvous

We continued our Seabeam mapping of the region and met R/V *Polar Duke* at about 0100 local on the eighth. I had allotted 3 hours for the rendezvous, which began on **calm, moonlit waters**. The computer technicians from our ship went over for emergency TLC for the *Duke*'s systems. Steve Stevenoski, our high school teacher went over as well to find out how others work under far more trying conditions. The scientific party of the *Duke* as well as Al Hickey, their MPC, visited the *Palmer*. About two hours into the rendezvous, the winds kicked up to almost 20 kts and the transfer party returned cold and wet. The air tempature was down to -4¡C. After the transfer we continued surveying and returned to the Great Wall where we undertook our first ZAPS drift.

Hydrothermal Work



Work on Project S-060 (Hydrothermal Survey of Bransfield Strait) went exceedingly well. We have carried out 19 lowerings of **the ZAPS instrument package** and 7 rosette casts. These stations were distributed along the axis of the rift between 54¡30'W to 59¡00'W. This area includes the eastern basin and the majority of the central basin. Water samples were collected for radon gas, helium isotopes, manganese, and rare earth elements. Both filtered and unfiltered samples were collected. Radon is being measured on the ship; the other analyses will be carried out in shore-based laboratories. In addition manganese profiles are being determined routinely with a flow-through chemical sensor on the ZAPS sled. CTD information from the instrument package and rosette are well matched. This combined data set provides us with the best possible coverage.

Hydrography across this area is complex, especially in intermediate waters where there are well developed temperature and salinity maxima and a dissolved oxygen minimum. Several water masses are present and the proportions of these waters vary across the study area. This information will add considerably to what we know about circulation in the Strait and communication of the waters here with other areas.

We have detected signals indicative of hydrothermal activity in several areas, including both basins. At one of these locations in the central basin our exploration has advanced to the site survey stage. Along a ridge of pillow basalts in the central basin known as the "great wall" we detected a hydrothermal plume that has a turbidity signal comparable to that observed at the TAG mound on the Mid-Atlantic Ridge. This plume is the first clear evidence of high-temperature, black smoker vents in the Bransfield Strait. More detailed work at this site is planned for later in the project.

Lawver, Klinkhammer, and the Shipboard Scientific Party

During the third week of NBP9507, we worked in Bransfield Strait and the southwest Scotia Sea. We acquired about 1,000 nautical miles of swath bathymetry, 67 miles of 48-channel seismic data, lowered the ZAPS sled seven times, acquired three water sample rosettes, retrieved one sediment core, took two dredge hauls, and made two camera lowerings.

Bransfield Basin

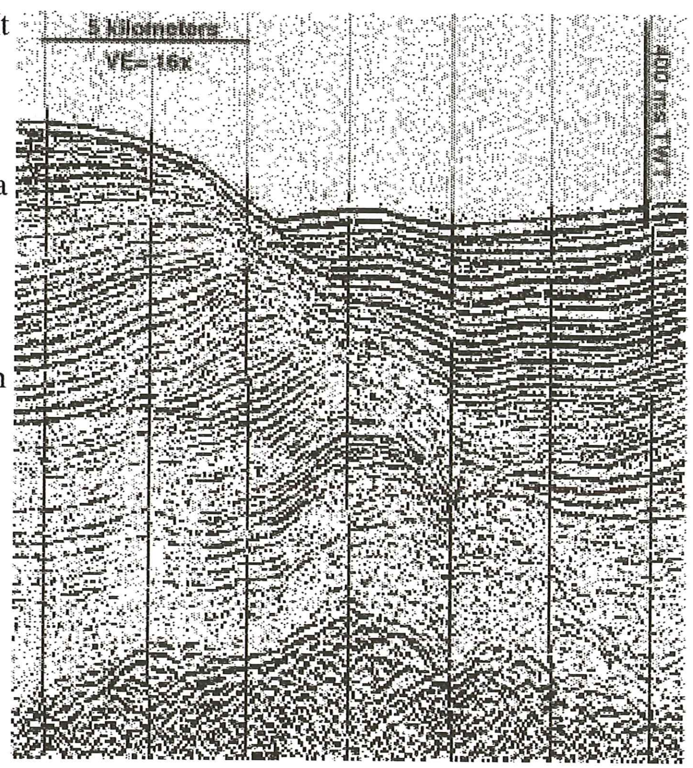
At the end of last week we had just rendezvoused with RV *Polar Duke* and started our first ZAPS sled drift. After we finished the sled tow, we slalomed our way around the central Bransfield Basin dodging icebergs, bergy bits, brash ice and some healthy pack ice. Sometimes our course looked like a drunken sailor's meander back to his bunk. We then approached the submarine volcano we had previously imaged (see the report from week 1) and lowered the ZAPS sled and a rosette into the caldera.

On two previous Seabeam survey runs we passed very close to what should be a nearly symmetrical volcano on the steep northern margin of central basin. Once again ice covered the feature and we did not get near enough to image it. We then headed off to what is now being called Fish Ridge for a ZAPS drift. The drift lasted eight hours and covered about 4.25 n.m. in a straight line along a sawtooth course created through deft adjustments by the bridge officers to keep us atop the linear ridge.

Southwest Scotia Sea

After Sled Drift #20 we headed north into the Scotia Sea in hopes of collecting multi-channel seismic data. We spent the next two days surveying the southwestern corner of the Scotia Sea northwest of Elephant Island. On the second day, we crossed an east-west trending ridge up to 600 m high with a steep (up to 45 degrees) south face. Lawver interprets it to be the equivalent of the San Bernadino Mountains where the structure is dominated by compressive forces resulting from a bend in the San Andreas fault. In this area, the compressive stresses could be the result of a bend in the recently reorganized Scotia-Antarctica plate boundary. We also found a linear fault trace along the east side of the Shackleton Ridge with rotated fault blocks where the fault trend changes.

Seismic Work



On November 13th we deployed the seismic streamer. It took about three hours to deploy the streamer and airguns. Gun 5 was still leaking so it was shut off. We then headed north for about four hours and recorded MCS data across the equivalent of the San Bernadino Mountains, turned west for about an hour and then ran a parallel course to the south. As we crossed the southwest Scotia Sea we saw a lot of structure in the sediments which ranged from 1 to 2 seconds thick. Basement was well-imaged but there was no sub-basement structure apparent on the single channel monitor record. Toward the southern corner of the basin we detected what may be a **major normal fault**. In all, we collected 13 hours of MCS data and about 67 n.m. at the rate of just over 5 knots. The data look good.

Fish Ridge

We headed due south to take a ZAPS sled lowering along the ridge in the eastern Bransfield Basin. The eastern Basin was now covered with a lot of pack ice where previously it had been clear. We then returned to Fish Ridge, passing to the south of Bridgeman Island once again. We did the second ZAPS drift in the Fish Ridge area. The survey was confined to a small box less than 2 km by 1 km. In the process of dodging icebergs within this small box, the sled detected an anomaly. Continued drifting was undertaken to try to determine the extent of this plume.

Dredge work

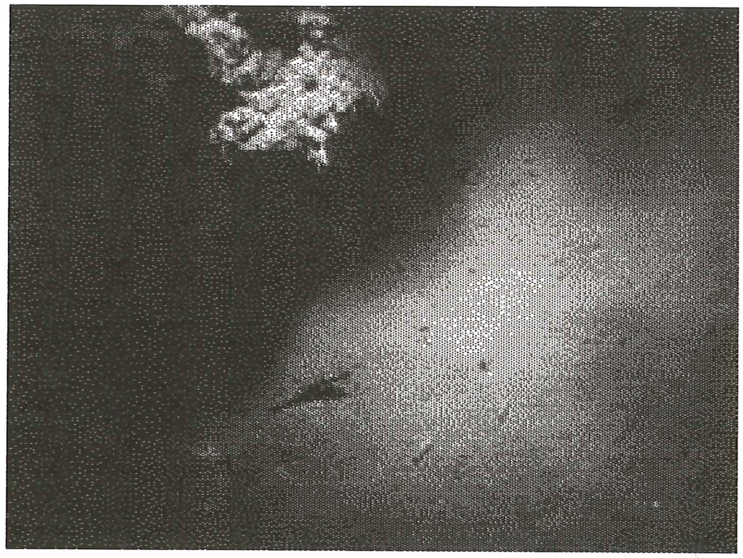
We next undertook Dredge #1. The dredge team consisted of Carol Chin on the bridge advising the bridge of position, Jay Simpkins on Simrad watch to relay depths to us, and Larry Lawver in aft control telling the winch operator to lower and raise the winch. We laid the dredge on the bottom at about 1450 meters of wire out, got the ship underway, passed over the target area and then pulled in the dredge. We got a series of four groups of significant pulls with the last being the greatest at 5,000 lbs. of tension. The rocks weighed about 40 kg and included two large pieces of unaltered vesicular basalt with many small attached organisms and numerous smaller rocks including a few glacial erratics. We also collected three fish, one slimey yucky worm-like creature, numerous brittle stars, and a small arthropod. The largest fish was a pouty-lipped Scotia sea Gapehead (***Chaenocephalus aceratus***) about 47 cm long. Since the fish were wedged into the dredge basket with the rocks we infer they were collected near the bottom. The Gapehead is a bottom dweller although it has previously only been collected in water depths of 5 to 439 m (Miller, 1993). This one was collected somewhere around 1200 m.

Underwater Pictures! Immediately after the first dredge we lowered the Benthos underwater camera loaded with Polaroid black and white 35 mm film. We found this camera in the ASA warehouse in Punta Arenas in 1993. During NBP9301, we pressure tested the housing and fired the camera in the lab but did not get an opportunity to deploy it. The camera is triggered by bouncing a dangling trip weight on the bottom. Thirty-five bounces over Fish Ridge produced about 20 successful photos. Most were of a flat muddy bottom with an abundance of brittle stars, including over thirty in a field of view estimated to be only two meters across! A couple of images showed basalt outcrops along with various other benthic creatures such as seapens.

Side trip to slope volcano and a core

While giving the ZAPS crew time to recuperate, we made a short swath survey in which we finally successfully surveyed the volcanic edifice perched on the northern slope of the central basin. We recovered our second kastenlot core near where a German core contained higher order hydrocarbons a number of years ago. We retrieved a full three meters of mud, with more intriguing black-olive mud than in the first core. Additional surveying was done in the northeast corner of central basin and we finally returned to Fish Ridge (so-named for the Gapefish collected in the first dredge).

Return to Fish Ridge



A second ZAPS drift was made along Fish Ridge in a similar sized box next to the original one. Again two very large anomalies were found. A second dredge and a second camera run were made. The proscribed dredge course into the wind resulted in dredging along a nearly flat bottom. One very fresh looking basalt rock was recovered, again with an abundance of benthic flora and fauna. The rock was about 25 cm by 15 cm by 15 cm and weighed about 6 kg. It appeared to have been part of a pillow lava. The second camera run experienced initial difficulties when the second pinger available on the ship turned out not to be an oceanographic pinger but rather a location beacon. After worrying about what to do, it was decided we should try to see if we could operate the camera without the use of a pinger utilizing the tensionmeter. The total package including camera and pinger with about 1100 m of wire out weighed 750 lbs. When the camera hit bottom the tensionmeter fell off to about 600 lbs. So, we were able to control the camera along the bottom by observing the tensionmeter and raising and lowering the camera about 5 to 10 meters between "hits". Twenty five such lowerings get to be very boring. In the picture above, the bottom is muddy, with a **pillow basalt outcrop** to the left (vent?) and a white brittle star and seapen nearby. After the camera run we left the central Bransfield basin and headed for the eastern Bransfield Basin where we began a ZAPS drift along the central of what we call the Three Sisters. This ended what we considered to be a highly successful and satisfying week.

Next Week Tune in for more seismic, coring, and ZAPS, a trip to the Chilean Base Frei, and Thanksgiving aboard the *Palmer*!

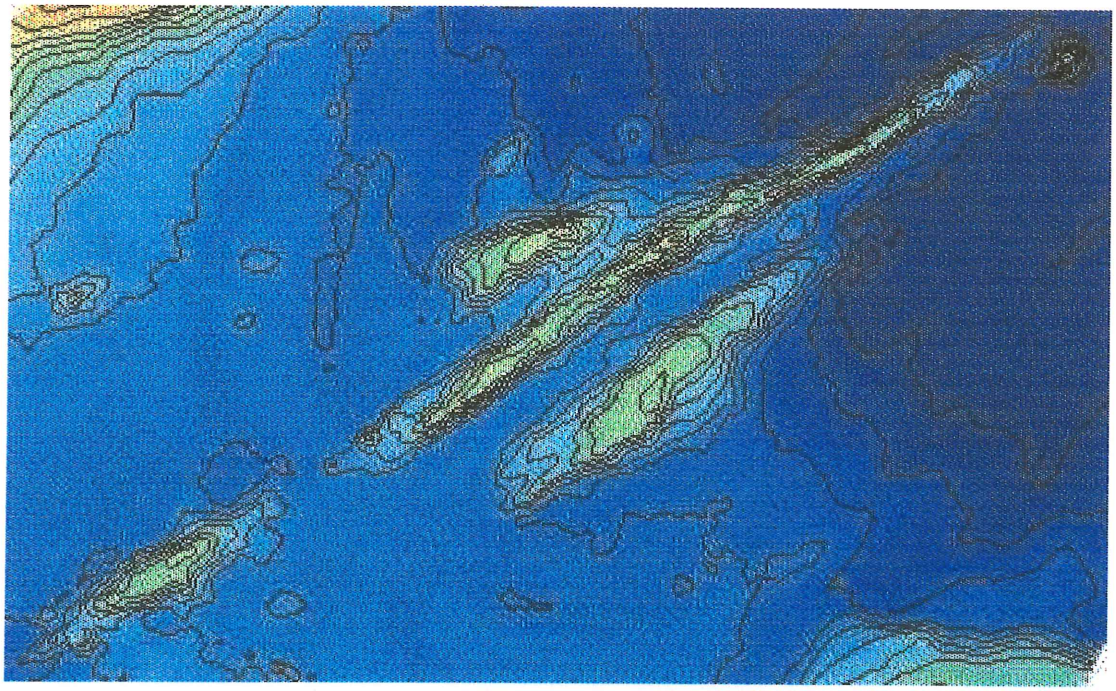
Reference

Miller, R.G., 1993, History and atlas of the fishes of the Antarctic Ocean, Foresta Institute for Ocean and Mountain Studies, Carson City, Nevada, 795 p.

Lawver, Klinkhammer, and the Shipboard Scientific Party

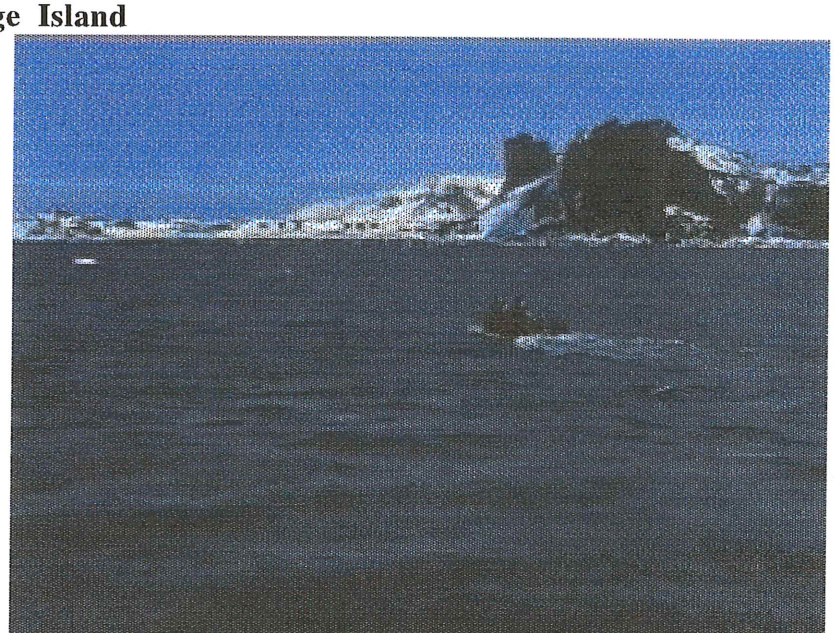
RVIB *Nathaniel B. Palmer*
NBP-9507 Cruise Report
Week Four: November 17-23, 1995

During the fourth week of NBP9507, we worked in Bransfield Strait and made a brief stop at the Chilean Base, Frei, on King George Island. We acquired nearly 800 nautical miles of swath bathymetry, 50 nautical miles of single channel seismic data, lowered the ZAPS sled seven times, acquired four water sample rosettes, retrieved three sediment cores, took one dredge haul, and made one small boat excursion to collect uncontaminated seawater.



The Three Sisters Ridge
We started the week during a sled tow along the long middle ridge of the Three Sisters system which ended on the northern Sister. Another tow along the middle Sister was completed next. Then we took Kastenlot core #3 between the middle and north Sisters. After the core we collected swath bathymetry along the slope break on the southern margin of the central Bransfield basin en route to Maxwell Bay.

Base Frei, Maxwell Bay, King George Island

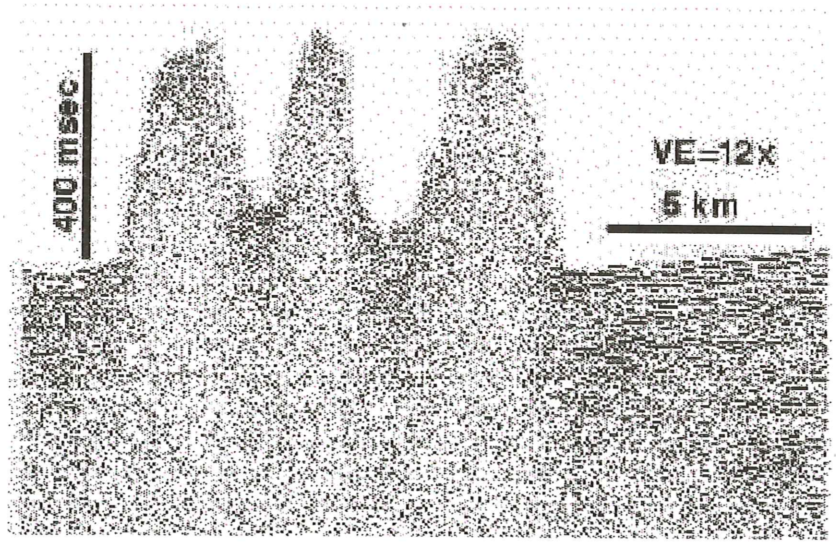


We had received confirmation the previous day that two packages we needed had been flown to King George Island by Chilean air support. We arrived at **Maxwell Bay** to find about 200 meters of fast ice along the shore. The Chileans had stopped walking on the ice about a week before but the only way for our party to get ashore was to beach the inflatable boat on the ice and then carefully walk across the ice. The intrepid landing party included Robert Kane, senior marine technician on Palmer, Jim Holik, the marine projects coordinator who is fluent in spanish, Steve Stevenoski, our high school teacher from Wisconsin Rapids, Wisconsin, and Dick Von Herzen, senior science party member, recently retired from Woods Hole Oceanographic Institution. After some brief confusion as to exactly where the packages were and the obligatory social exchange and coffee drinking, the party returned via the Russian camp

(Bellingshausen Base) which is next door to the Chilean base and closest to where the Zodiac was beached. Since the Chilean store, complete with tourist souvenirs, was closed because most of the base personnel were at the airport for the arrival of the new base commander, the shore party's shopping frenzy never materialized. Although each of the Russians ran a shop out of his house, the quality of the goods for sale was not great. Total time in Maxwell Bay was about two and one-half hours.

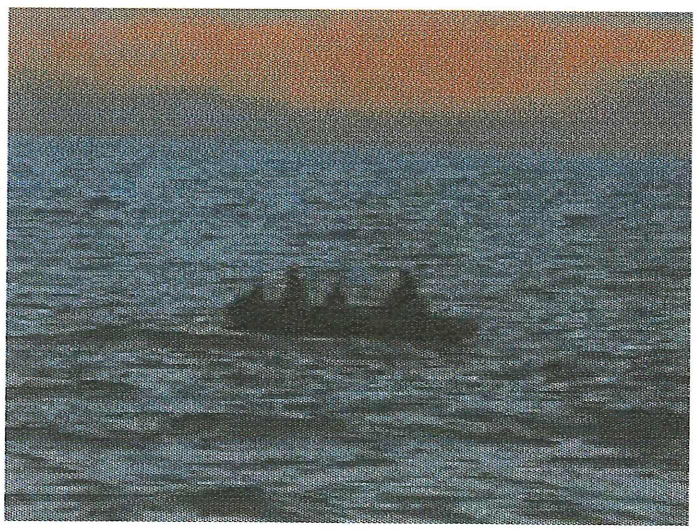
Two-fingered Jack

Immediately to the southwest of the middle Sister of the Three Sisters Ridge is a short ridge with a small volcano on its southern end. A sled tow along this ridge took about eight hours and covered about five kilometers. The tow was followed by a CTD lowering. Next, a systematic multibeam survey was begun of the area immediately to the west which had been covered by pack ice the previous week. Now the whole basin from the base of the northern slope to the southern edge was accessible. We found an amazing assortment of linear ridges and small lineated mounds and seamounts. We returned to the small volcano on the end of the Two-fingered Jack ridge where we did another CTD lowering, a sled tow and finally a dredge. The dredge was lowered on the northwest edge of the caldera rim, dragged across the crater center and up the southeast wall. The total elevation change was down about 40 meters, flat and then up about 60 meters. Unlike the first two dredges we did not recover any basalt. Rather we collected some compacted mud and some strange sea creatures. A few of the these grew attached to small rocks, which although volcanic appearing may have been drop stones. The amount of sediment cover leads us to think that this small crater may be older then the ridges and certainly older than the large volcano featured in the first weekly report. After the dredge was aboard, we headed to the northern margin of the basin, deployed the single channel seismic streamer and two airguns configured at a reduced capacity of 50 cu. inches each. We ran across a small seamount about 150 meters high on the northern margin of the basin and then across Two-fingered Jack to the southern edge of the deep part of the central Bransfield Basin. We then ran east-northeast, turned north-northwest and crossed the **Three Sisters Ridge**. The seismic data show faulting of the subsurface sediments, possibly as dikes were injected into the center of the basin.

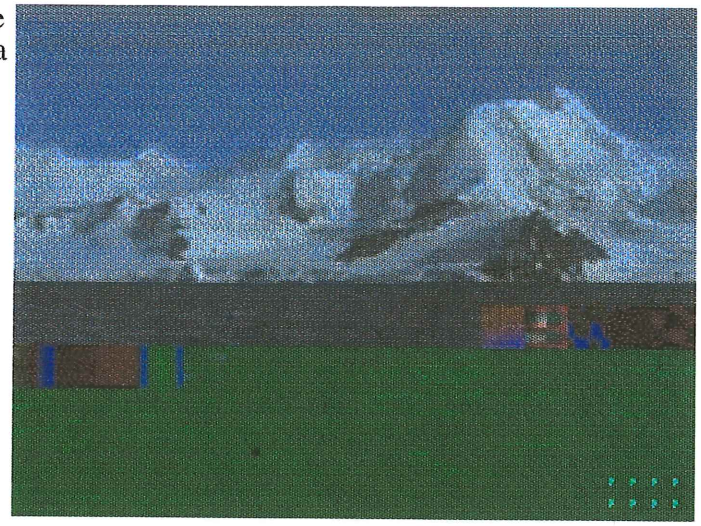


Southwestern Ridge and Deception Island

After we retrieved the seismic gear we surveyed the steep northern margin of the basin and then turned south along the western margin of our previous westward survey. We did a quick survey along the axis of the next ridge to the southwest and then began a sled tow, a sled dip, a CTD lowering and finally a Kastenlot core. We then steamed towards Deception Island where we surveyed the entrance to the caldera. We then continued our multibeam survey of this region but ran into heavy fog and returned to the mouth of Deception caldera where a sled tow was undertaken. After tow we headed east to a flat spot between a circular mound about 300 meters high and a short ridge that is about 2 km long, a half km wide and 250 m high. There we lowered the sled for the last time, took the last CTD cast and a final Kastenlot core. Very early that morning during the final CTD cast, a large **OSU contingent motored the inflatable boat** away from the ship to collect uncontaminated seawater. We then got underway for a final multibeam survey of the northern part of the basin between the southwestern ridge, Deception Island and Livingston Island. Perhaps as an omen, we were treated to a **glorious view of a**



cloud free Livingston Island. We could easily see a large fresh avalanche scar on the island that exposed a large stretch of rock.



Heading Home
At 1200 local on the 21st of November, we were concluded science in the Bransfield Strait region and set sail for Lyttelton, New Zealand. We then ran down the margin of the Antarctic Peninsula to about 68¡ W where we slipped off the continental slope into deep water. Soon after we crossed the first of what will be many fracture zones. The first was about 30 km west of where it had been previously identified. On the 23rd we celebrated Thanksgiving at sea. Six turkeys are history and the stewards put on a great feast.

ZAPS operations summary
The survey for hydrothermal activity in the Bransfield Strait ended this week with several successful operations. In total this project carried out 32 sled lowerings and drifts and 11 rosette casts in the eastern and central Bransfield basins covering all the major volcanic features between Clarence and Deception Islands. Strong indications of hydrothermal activity, including coincident temperature and turbidity anomalies, were detected on three different ridge segments in the central basin. A dissolved manganese anomaly was detected in a plume from one of these sites. All three sites lie along the perceived axis of rifting. This last week was spent isolating these sites with a series of tow-yo and bottom drift operations. This work will aid future geological and geophysical investigations of these areas. Bottom temperature maps were created at two of these sites which narrow the search area to a square kilometer of sea floor. We completed our survey with a hydrographic section of the waters near the **breach in the caldera at Deception Island**. Sixty measurements of radon gas were made onboard and over 300 water samples were collected for laboratory analyses of dissolved manganese, total dissolvable manganese, and rare earth elements. An additional 55 samples were taken for the measurement of helium concentration and isotopic composition back on shore.

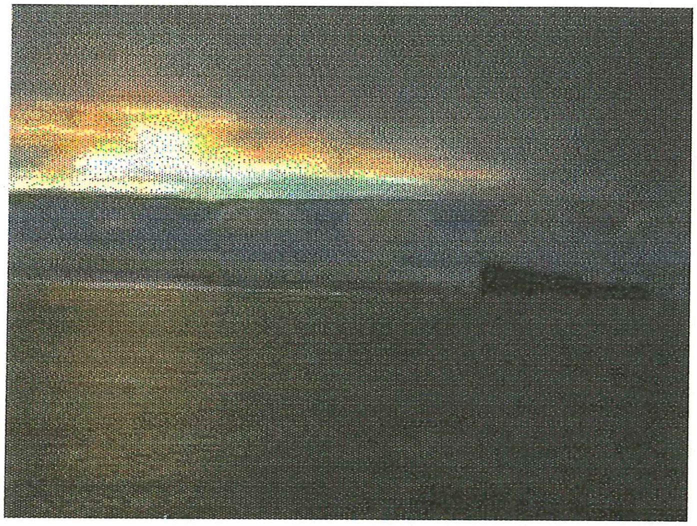
222Rn in sea water
(Mark Rudnicki of Oregon State University is studying radon in seawater on this cruise. He has contributed the following section discussing his work.)

222Rn is a naturally occurring radioactive isotope with an oceanographically short half life of 3.8 days. It is formed in-situ in sea water and in sediments from the decay of its parent isotope 226Ra, thus a water column profile will typically show a bottom enrichment, the extent of which reflects the balance between diffusion from the source and advection by bottom currents. It has traditionally been used to investigate circulation and mixing problems, but has gained new applications following the measurement of large concentrations of 226Ra and 222Rn in the Galapagos Rift hydrothermal vents- the first vents discovered in 1977. Since then, vent and plume 222Rn have been infrequently measured at hydrothermal sites both on the Northern Mid-Atlantic Ridge and in the northeast Pacific on the Juan de Fuca Ridge. With a knowledge of the primary ratio of 222Rn to heat of fluids carried to the non-buoyant plume, and a measure of the 'standing crop', that is, the steady state amount of 222Rn overlying a vent-field, an estimate can be made of the high temperature hydrothermal fluid and heat fluxes.

222Rn is measured by alpha scintillation counting after preconcentration from 10-20 litres of sea water. The sample is drawn directly from the rosette bottles into an evacuated glass bottle. Ultrapure helium is circulated in a closed system through the sample- any radon present is adsorbed onto an activated charcoal column held at about -70 degrees C. After stripping, the charcoal column is heated to about 450 degrees C This expels the radon, which is then drawn under vacuum into a scintillation cell for alpha counting.

The relatively large sample volume requirement for the method results from the low concentrations of 222Rn in sea water. The typical background activity of about 30dpm/100kg (disintegrations per minute, per 100 kg of sea water) corresponds to a 222Rn concentration of about10-21mol/kg. The greater the volume of sea water extracted, the shorter the counting time necessary to obtain good counting statistics (counting errors are generally < 3%, overall accuracy is about 10%). After the sea water is stripped for 222Rn, is it saved for later analysis of the 226Ra content: a mismatch between the two concentrations may indicate a source for either element.

In total, 10 CTD-rosette casts were dedicated to the collection of samples for 222Rn analysis. 6 samples were collected from each rosette cast. In addition, 1 litre unfiltered, 1 litre filtered and filter samples were also collected for subsequent analysis to provide a geochemical setting for the 222Rn measurements. 60 samples of 12-15 litres were saved for shore analysis of 226Ra. The sampling was designed to target particle-rich layers in the water column that might have a hydrothermal origin, and also to sample the water masses present in the Bransfield Strait.

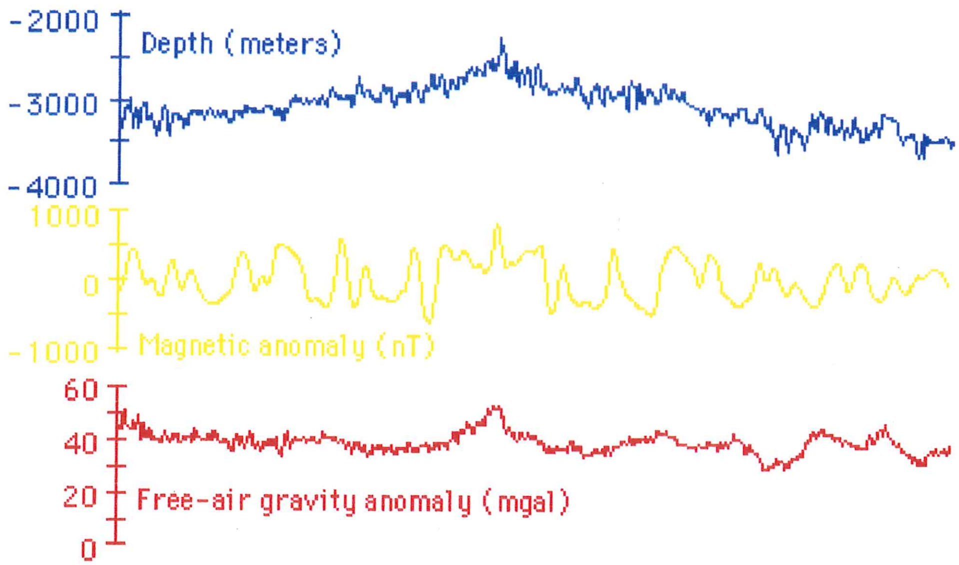


Lawver, Klinkhammer, and the Shipboard Scientific Party

RVIB *Nathaniel B. Palmer*
NBP-9507 Cruise Report
Week Five: November 24-30, 1995

During the fourth week of NBP9507, we worked in Bransfield Strait and made a brief stop at the Chilean Base, Frei, on King George Island. We acquired nearly 800 nautical miles of swath bathymetry, 50 nautical miles of single channel seismic data, lowered the ZAPS sled seven times, acquired four water sample rosettes, retrieved three sediment cores, took one dredge haul, and made one small boat excursion to collect uncontaminated seawater.

Lawver, Klinkhammer, and the Shipboard Scientific Party



NBP9507

Multibeam Data Processing

Benjamin Sloan

Institute for Geophysics
University of Texas at Austin

Raw Data B-1
Editing B-2
Corrections B-4
Final Maps B-4
Conclusions and Recommendations B-5
Appendix I. Processing Recipe B-6
Appendix II. Broken File Pathologies B-7
Appendix III. Annotated List of NBP9507 Seabeam Files B-8

About 800 hours of swath bathymetry data covering some 15,000 km^2 were acquired during cruise *NBP9507* of the *Nathaniel B. Palmer*. This document explains the steps taken in processing the bathymetric data once they were acquired and available on disk. Processing includes daily and hourly plots of the raw data, editing of the data (a group effort), corrections for roll bias, pitch bias, and velocity, and production of final gridded maps. This discussion does not include particulars of the acquisition process nor processing of amplitude nor sidescan data, which are partially covered elsewhere in this report.

Raw Data

The SEABEAM 2112 sonar installed on the *Palmer* collects data in a swath 120° wide. For each one-degree step, or beam, the depth in meters to the seafloor, travel time, cross-track distance, and amplitude are recorded. The 120 beams in a single swath are called a "ping" and are accompanied in the file by 2000 pixels of side-scan data. The sonar sends and receives pings at a rate inversely proportional to the water depth. All the pings for an hour are stored in a file under the name NBP9507.dXXX.YY where XXX is the day of the year and YY is the file number. This first file of the day is 00 and the last was typically about 23. Files are written at the end of each hour and whenever the system is restarted (either manually or because of a crash). Depending on water depth, the files collected on this cruise ranged in size from 2-30 megabytes. The raw data are stored on *challenger*, a Silicon Graphics Challenge-L dual processor server dedicated to data acquisition. At the end of each GMT day, the systems analyst (Dave Leger) transferred all the files for the day to a directory on *discovery*, an SGI machine dedicated to processing. Once they are on *discovery*, they are available for processing. All processing was completed using the MB-SYSTEM (version 4.3) and GMT (version 3.0) software developed at Columbia University's Lamont-Doherty Earth Observatory. The general steps involved in processing are outlined in the documentation for that software, but not all were necessary for this dataset.

Ideally, swath mapping of a given area would consist of a very regular and orderly series of parallel shiptracks and perpendicular cross lines. This "mowing the lawn" approach results in a dataset which is very easily divisible into start and end times for a given survey area. However, because of the nature of NBP9507, which combined multibeam surveying with a variety of station work, dredging, drifting, and seismic acquisition as well as operation in ice-infested waters, our course was often necessarily circuitous. Furthermore, the *Palmer* moved back and forth between several survey areas and collected multiple sets of bathymetric data over some features. Thus, for a given area of interest, the corresponding files are a crazy patchwork quilt from many different days and of different vintages of unequal quality.

From the perspective of a survey team, there were three conditions which degraded the quality of the multibeam data: ice in the water, big waves, and a "characteristic" speed of 4-5 knots. Any ice accumulation substantial enough to make noise when striking the hull produced very erratic sonar records. The heavier the ice, the worse the data. Similarly, seas over about three meters progressively degrade the outermost beams either by waves slapping the hull or introducing air bubbles underneath (and probably other technical reasons best left to the Seabeam engineering report). Finally, steaming at speeds around 4-5 knots (seismic acquisition speed) seemed to produce fairly noisy data.

Within this data set, noisy data occur in the Bransfield basin whenever we encountered ice, which was almost every day. The Scotia Sea data were noisy partly because the seas were rough (the only seas over a few meters during the entire cruise) and partly due to our slow speed for seismic acquisition. Seismic data collected in the Bransfield basin were at relatively fast speeds (up to nine knots) and over calm seas. Transit data were collected at 10-14 knots over calm seas and are quite good in waters shallower than 4,000 meters

Hourly and Daily Swath Plots

The complexity of the mosaic of data collection days and vintages for each survey area made it necessary to carefully track the data within each area. To this end, plots were generated of the entire day of data at the end of each day and, where necessary, plots of individual hours of data. These plots were a very useful resource, referred to many times during the cruise, of where we were during a given day or hour and what nature of data were collected (depth, quality). The hour marks on the daily plots allow one to determine which times correspond to a particular survey area from which, with some trouble, one may determine the corresponding file numbers. The author notes that using ending times as file names would be more useful than the present scheme of sequential numbers which carry little information.

Hourly plots on 8.5x11" paper were generated in areas where our course was particularly circuitous and it was difficult to differentiate station data from survey data. Because the number of hours in this cruise was over 800 it was not feasible to generate a color plot for each hour of data collection although it would have been useful. Hourly plots before and after editing were a useful way to gauge the effectiveness of editing.

Data Editing

Because of artifacts inherent in the data and bathymetric noise introduced by ice or waves, it is necessary to edit each and every multibeam file by hand using the `mbedit` program included in MB-System (Figure 1). As noted previously, about 24 files are generated daily and each contains anywhere from 300 to 2000 pings, depending upon water depth. Editing takes anywhere from one to three hours depending on the severity of editing necessary, size of file, and experience of editor. During NBP9507, all available personnel were pressed into service as data editors. About twelve people completed the bulk of the work, each averaging about two files per day. Because only three IRIS machines were available for data editing, this meant round-the-clock edit work. Editing was possible on the Macintoshes using MacX, but never gained popularity, possibly because their mouses are only single-buttoned. The Sun workstation, *teranova*, was generally used for data processing and the Openwindows software (version 3.0) tended to crash when the editor was started.

The actual editing process and philosophy is difficult to describe without demonstrating it in front of the computer. Essentially, beams which do not "reasonably" match the trend of the ping in which they occur and the trend of beams in adjacent pings ought to be flagged. Most editors tend to flag far too little data, rather than too much (Figures 2a, 2b). In most cases, successive pings should be very nearly identical and any beams which deviate "significantly" from this should be flagged. Deviant beams are best seen at maximum vertical exaggeration, another common mistake among editors, who fail to see wild beams at too-small vertical scales. Time-permitting, a team-leader should review the work of each editor on his first several files, and periodically as the editor's understanding evolves.

Data Processing Methods

Once the data were edited, it was possible to start producing maps of survey areas. The first step in this process is to identify the bounds of a survey area, then to determine the data files which fall in the area and compile a list of those files. The real-time plots and daily plots are the chief source of information for this type of compilation as they allow one to examine location and quality of data. The list may then be used in an invocation of the `mbm_plot` command to generate a swath plot of the data. Typically, a map was generated of colored, shaded, contoured swath data with a labeled ship track. During the cruise, preliminary maps of an area may be used to identify gaps or unsurveyed surrounding regions to target on the next visit to the survey area. It is also useful, at times, to plot such maps at an appropriately large scale and tape them onto the real-time Calcomp plotter as an aid to navigating the next survey.

Corrections

The MB-System software allows one to reprocess multibeam data and make corrections for known roll and pitch bias. During NBP9507 experiments were conducted to assess both errors (see report by Chayes and others). Surprisingly, both tests showed close to zero bias. Thus, corrections for roll bias and pitch bias were not necessary for this dataset.

Navigation. The `mbmerge` program of MB-System allows one to merge multibeam data with cleaned navigation and is a recommended step in the processing sequence. We skip this step because the system on the *Palmer* uses gps data from the NGL system which is prefiltered and produces reasonably good navigation. However, we did experience a few brief gaps in the navigation due to problems with NGL and in these instances (*e.g.* day 334, files 21-23) was necessary to remerge multibeam data with new navigation or heading data. The heading is used in the MB-System software to determine the orientation of the ship and project the cross-track beam locations. The tool `mbnavedit` was used to clean up some heading problems (*e.g.* day 317, files 19-20).

Sound Velocity. Accurate determination of bathymetry from sonar travel times depends upon a good estimate of the velocity structure of the water column. During NBP9507, there were two main methods of estimating the velocity structure: XBT launches and CTD deployments. An expendible bathythermograph (XBT) is a device which is dropped into the water from the stern and sends back water temperature along a very thin copper wire as it descends through the water column. The data are recorded on an IBM PC computer in the dry lab. Software is used which converts the temperature and externally-provided salinity information to density into sound speed in water as a function of depth. XBT's were launched as needed to characterize the water column in which we were operating. During transits this meant about one XBT launch per day. In Bransfield Strait, only one or two XBTs were necessary during the two weeks operating in the same basin. Also, in Bransfield basin the OSU group lowered the water bottle rosette and their ZAPS sled, both of which have Seabird CTD instruments attached which measure temperature and salinity (actually conductivity). Seabird software includes a module to convert the CTD measurements to velocity. In some instances, such as the Scotia Sea where water depths exceed the XBT limits, archival data from the Levitus climatology was used (via the `mblevitus` program).

Once all the data within an area were collected and swath-plotted, it was possible to see the effects of velocity errors which produce curl-up or curl-down acorss the swath over flat bottom. In Bransfield basin the CTD data (Figure 3) yielded velocity structures which were more consistent and plausible than those calculated from the XBTs, which tended to be noisy, possibly from the wire touching the hull. The candidate velocity structures were loaded into the `mbvelocitytool` program (Figure 4) along with a representative multibeam file over flat bottom. The program allows one to specify water velocity structures based on those collected by CTD, XBT, and from Levitus tables and modify them as necessary to produce a flat bottom in the data (Figures 5a, 5b). The resulting velocity model is then applied to the rest of the data, which are then swath-plotted to ensure sound speed-induced errors have been substantially reduced.

Gridded Maps

Once the data have been edited, navigation problems addressed, corrections made for roll and pitch bias and bathymetries recalculated from appropriate velocity models, final maps may be produced. The final map is generally made from a gridded file created using the `mbgrid` command, which makes a GMT format grid file from a list of multibeam files. Gridding is useful because it allows one to interpolate gaps in the data. Also, once the grid file for an area exists, it may be subsampled to produce larger-scale maps of areas of particular interest. Final gridded maps may also include overlays of other data, such as cruise tracks, coastlines, station locations, and so forth.

As of this writing, semi-final maps have been produced for the central and eastern Bransfield basins and for the Scotia Sea work area (Figures 6, 7), although further editing of the data is going to be necessary, particularly for the last area. Most of the remaining data from NBP9507 was taken during transit or covers such a small area that separate processing and velocity modeling may not be reasonable.

Conclusions and Recommendations

Multibeam processing on cruise NBP9507 has been moderately successful. The MB-System software and hardware on the *Palmer* were adequate to the task, although anticipated improvements in both will be welcome. CPU speed on *discovery*, the machine dedicated for processing, was generally sufficient although faster disk access would be desirable. Ghostview (Postscript on-screen previewer) on the SGI machines is intolerably slow and ought to be upgraded to the much faster Pageview software which runs under NEWS on the Sun workstations or Adobe Xpsview. Color 8x11" printing on the HP Deskjet printer is fairly slow and often fails during large jobs (> 4 mb) or when there are more than three jobs in the queue, translating into average print speeds not much faster than multibeam data are acquired. This situation could probably be rectified by a change in the Novell print server configuation, as proven by the Oregon State group who had a similar setup which seemed to work quite well.

The pace of multibeam data acquisition requires at least part-time attention by the data processor for raw data quality control and editing quality control, as well as a dedicated stable of about one dozen editors. Several weeks of post-processing is required (much of which was performed on the long NBP9507 transit). Future cruises should plan for a full-time processor or two. Ideally, these persons should be fluent in UNIX, GMT, and have at least been introduced to MB-System. Finally, on-board technical support, of the sort essential to acquire the data (Seabeam engineer, UNIX systems analyst), are indispensible to the data processor.

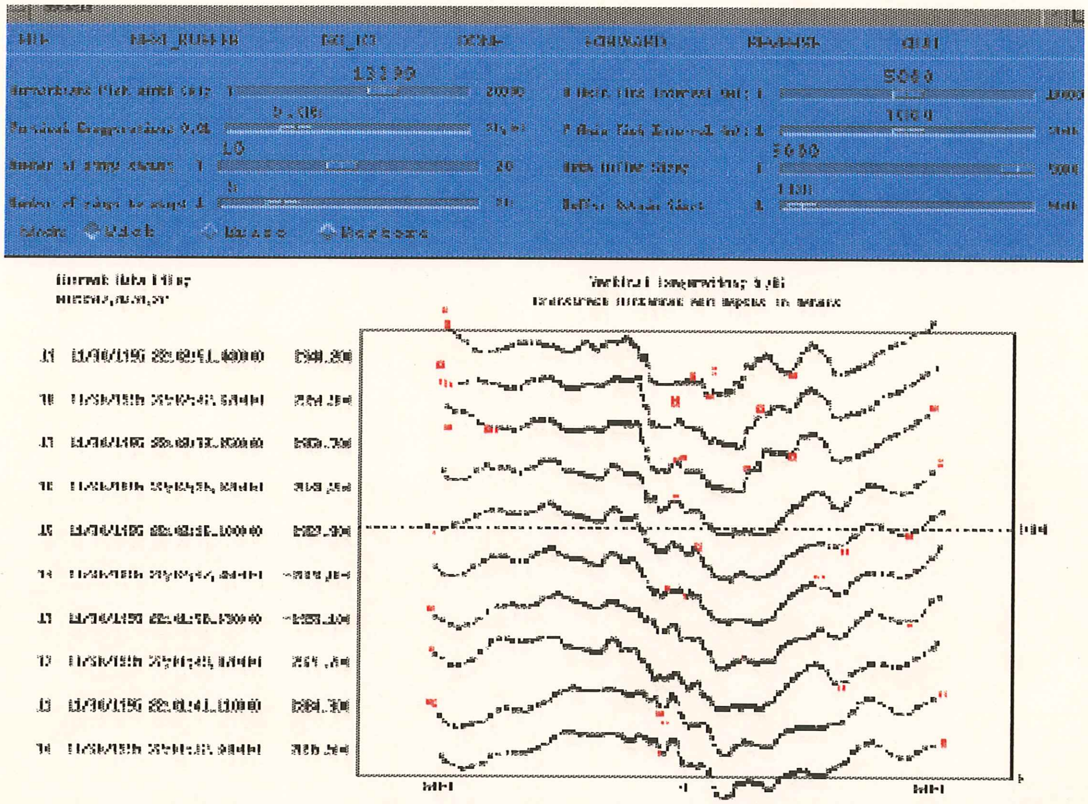


Figure 1. Multibeam editor, `mbedit`, window as it appears on the screen. Lines are pings which are each formed by 120 beams, shown as black or red dots. Red dots are beams which have been flagged.

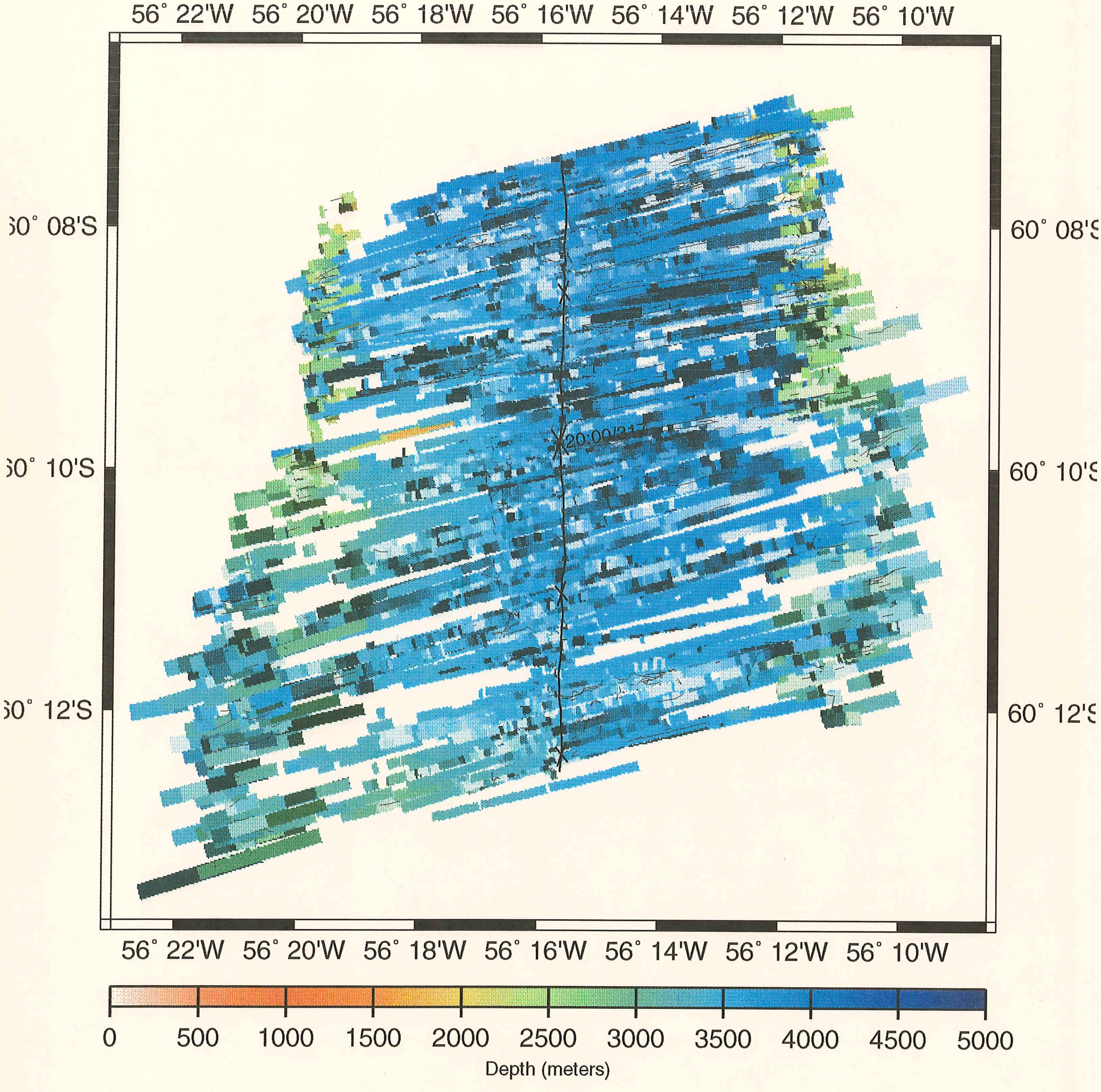


Figure 2a. Example of one hour of fairly noisy raw data from the Scotia Sea.

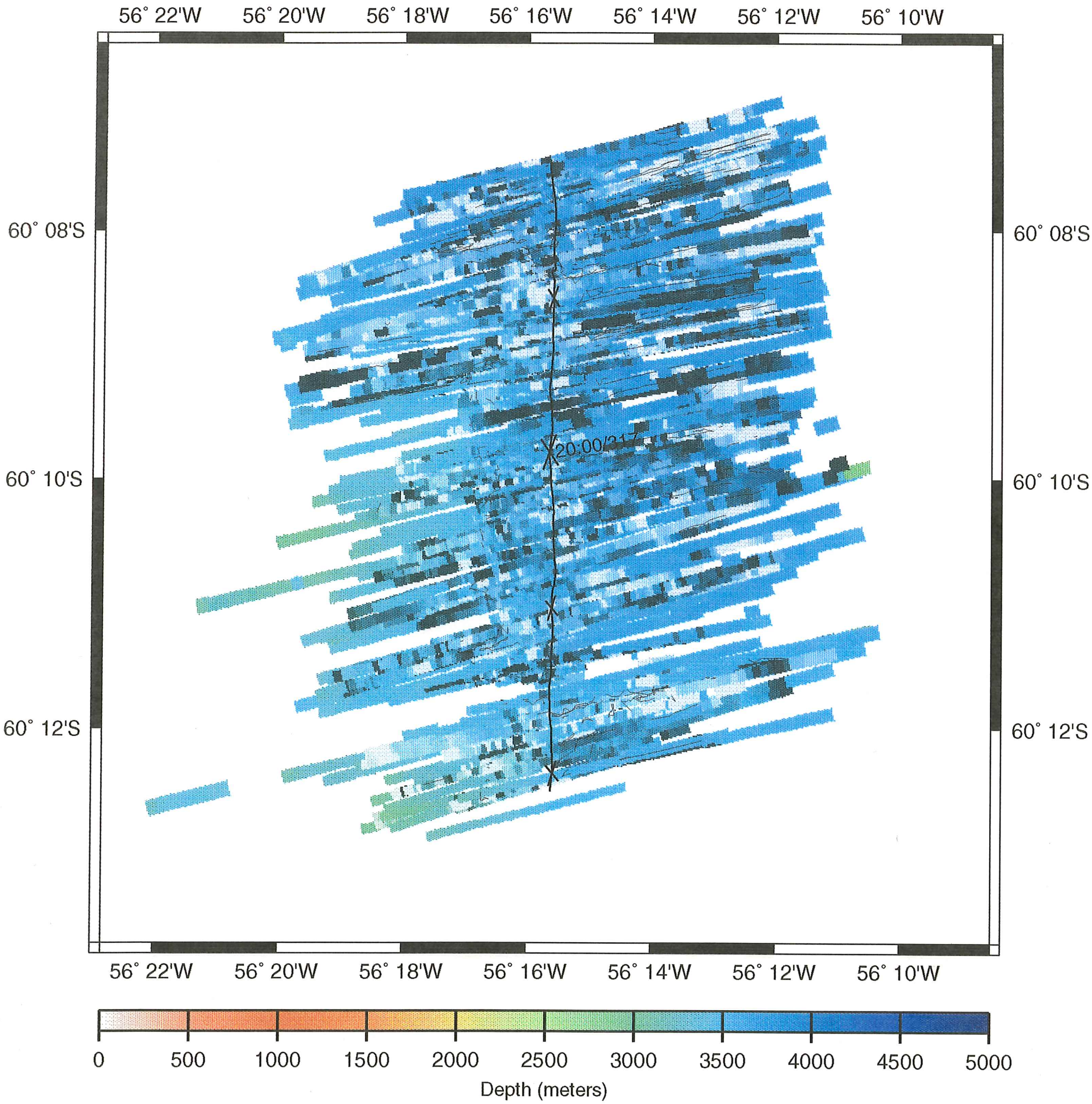


Figure 2b. Example of one hour of data, edited but still noisy.

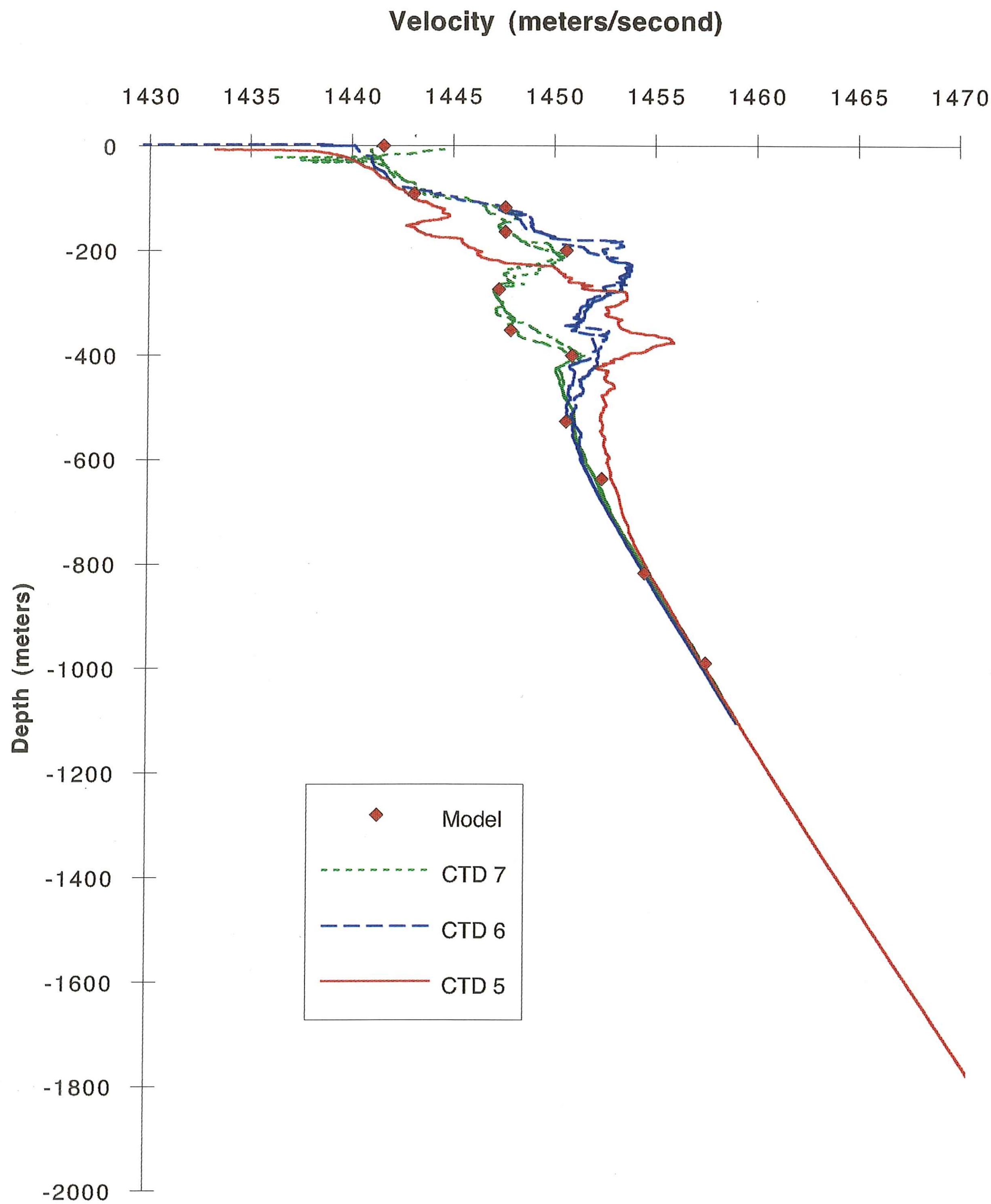


Figure 3. Central Bransfield sound velocity profiles from CTD casts.

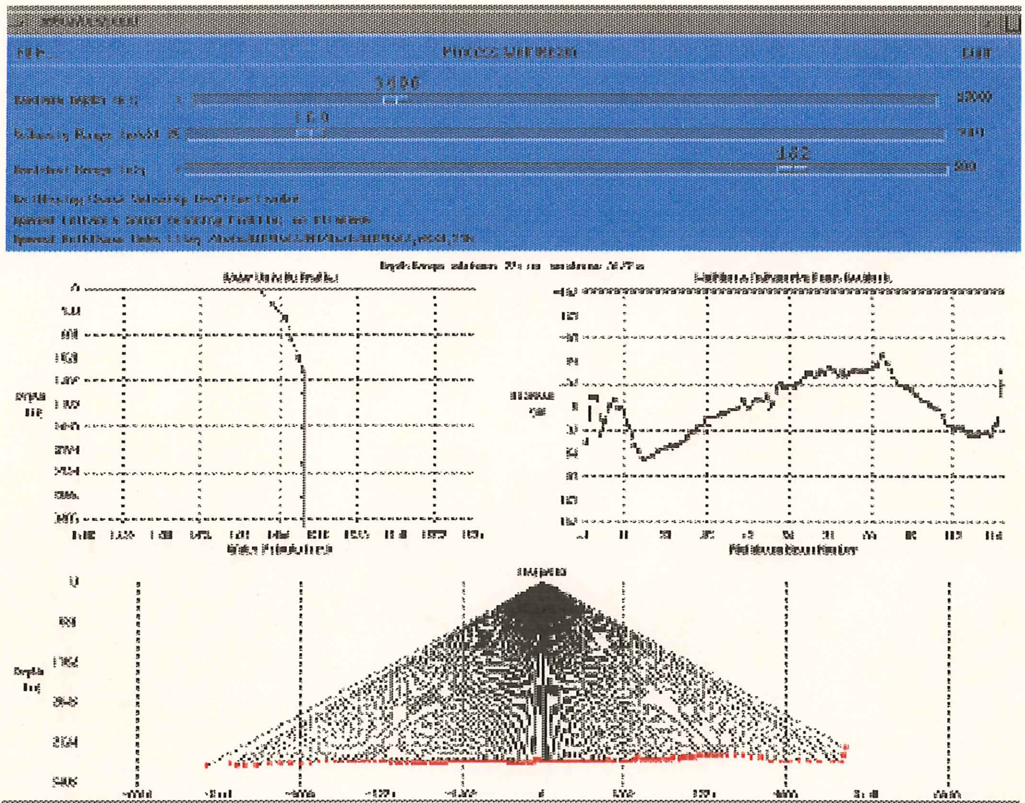


Figure 4. Velocity-modelling tool, `mbvelocitytool`. Window shows an editable velocity profile (upper left). The display at the bottom is the average of some SEABEAM 2100 data which has been loaded, showing raypaths to the seafloor, which is indicated by the red dots. The upper right window is the average residual of each beam after raytracing through the selected velocity profile. If the bottom is flat in this area, the residual should be flat to less than 0.5% of the water depth, if possible.

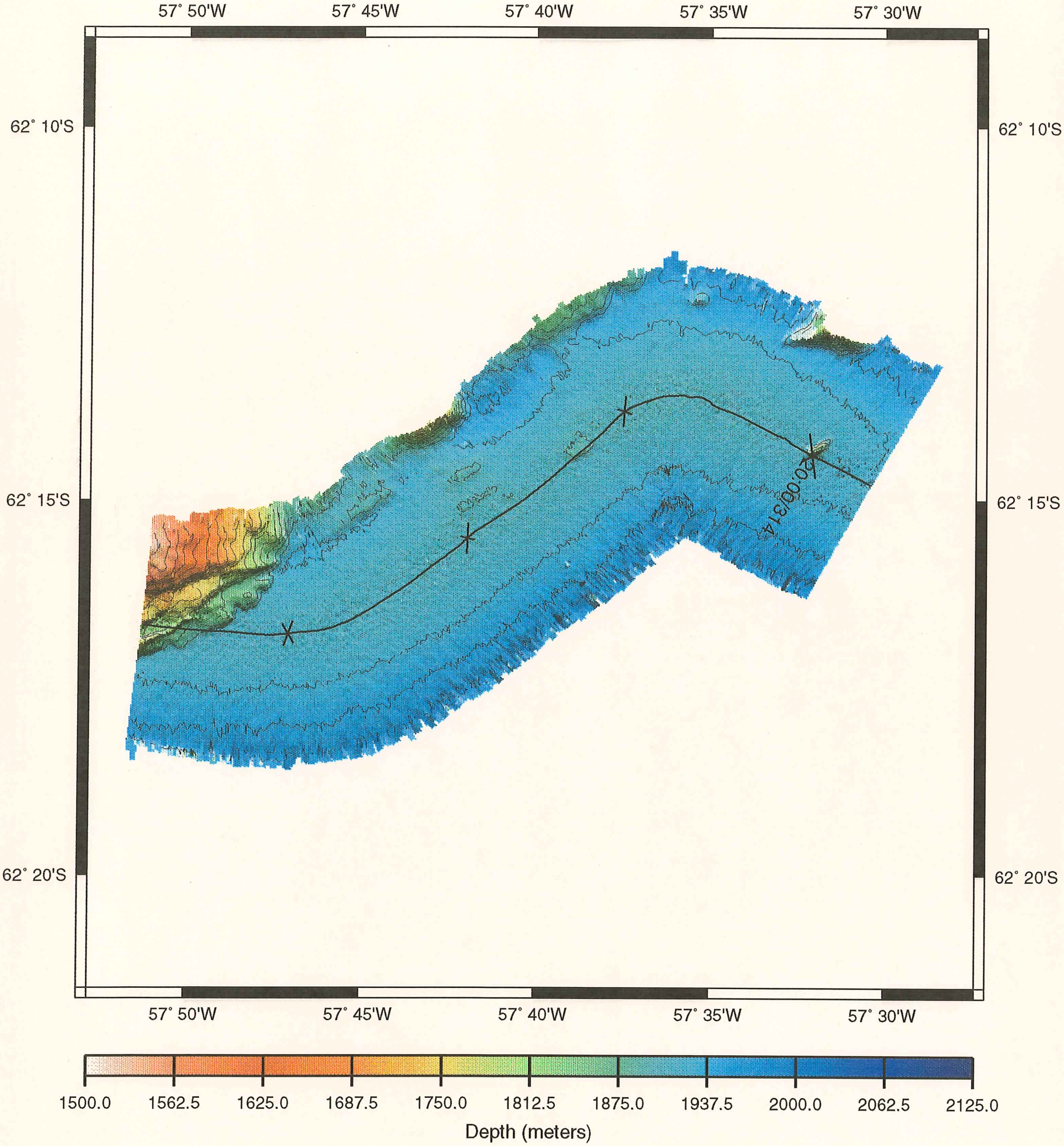
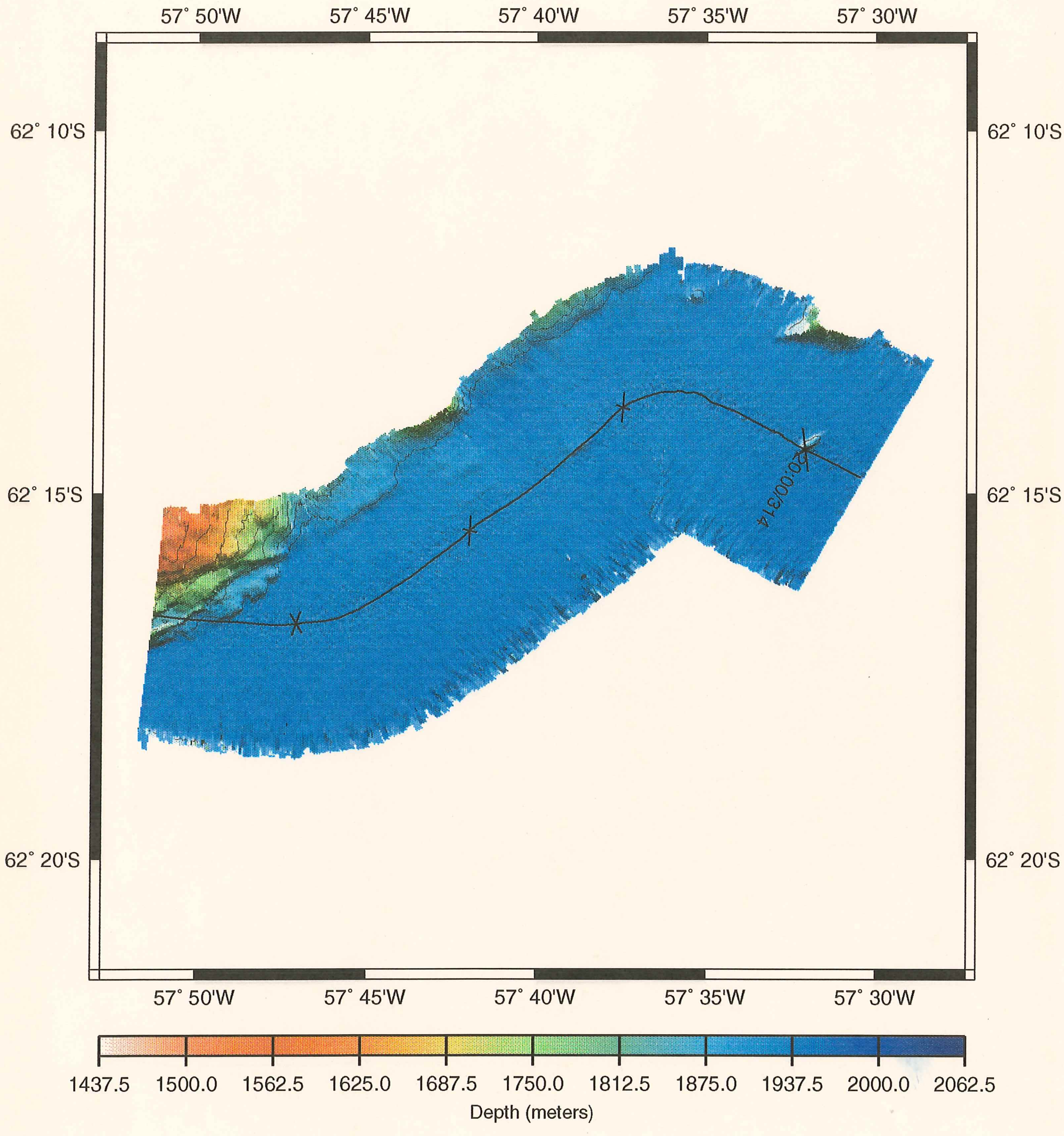


Figure 5a. Raw data have curl-down, most obvious at edges of swath, due to inaccurate velocity estimate.



ıgure 5b. Edited and velocity-corrected data has somewhat cleaner edges, flat bottom.

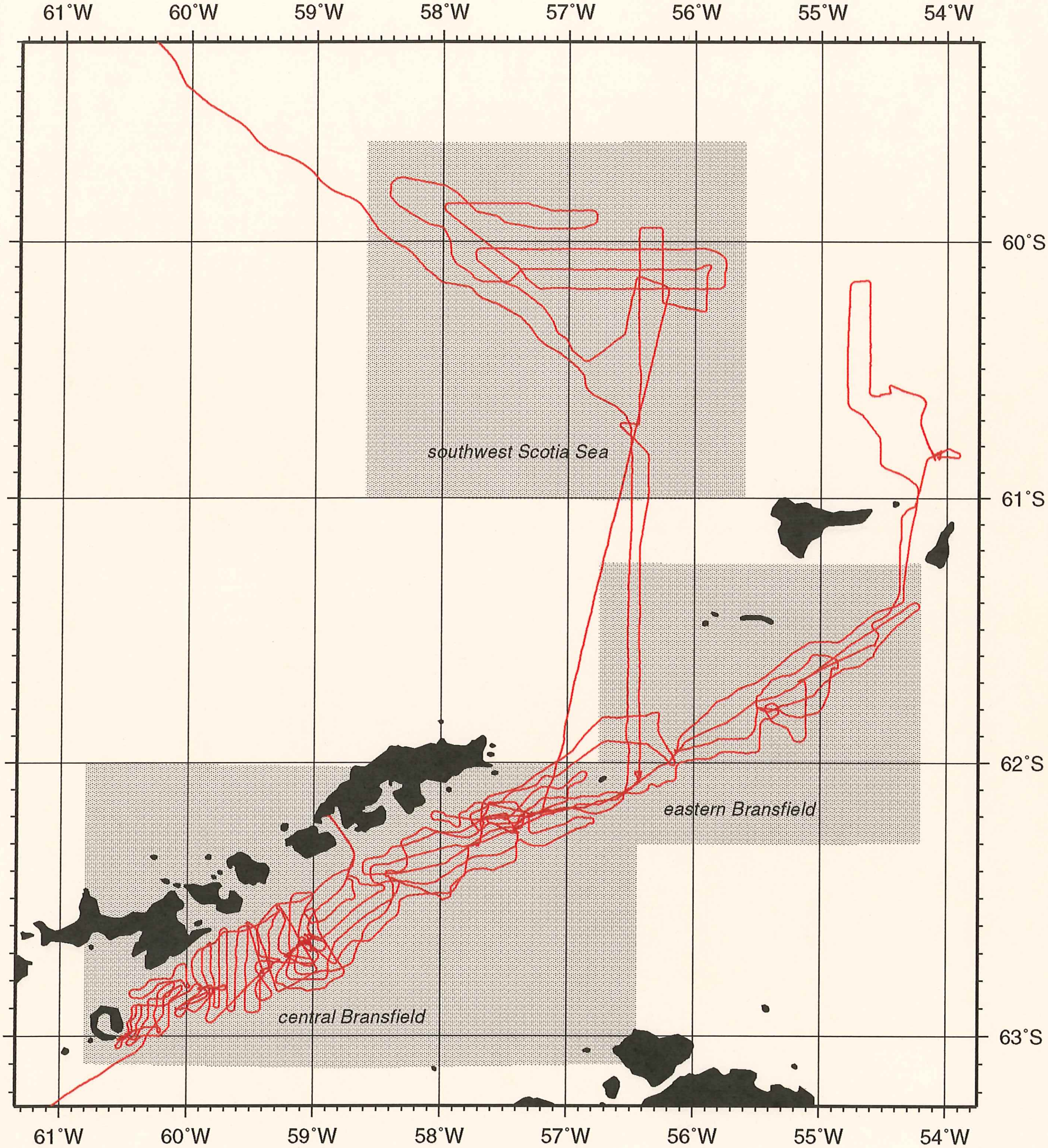


Figure 6. NBP9507 cruise route and locations of three survey areas.

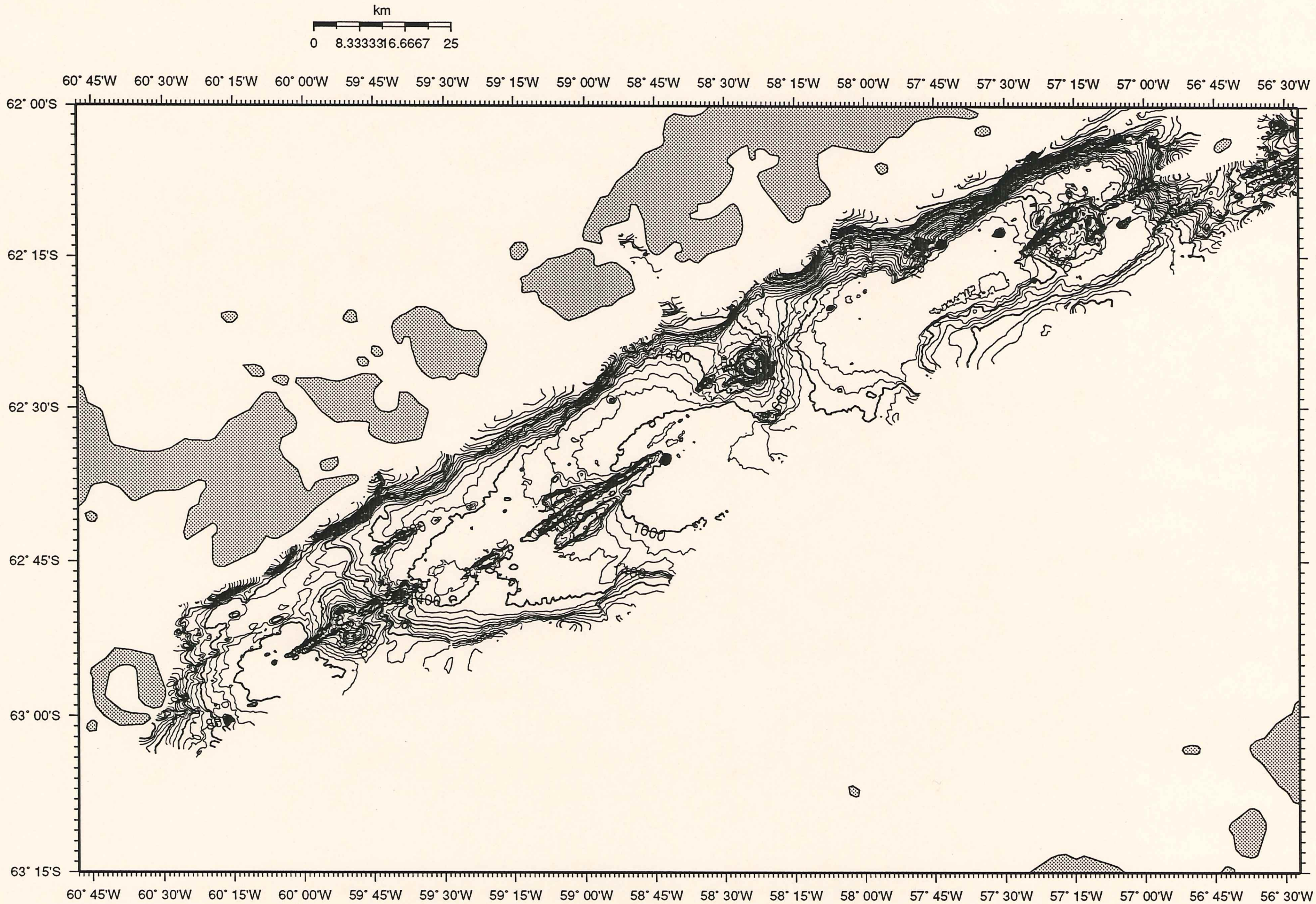


Figure 7. Central Bransfield bathymetry, semi-final gridded contour map.

Appendix I. Processing Recipe

The following is short list of the steps taken in processing Seabeam 2100 data from NBP9507. This procedure ought to apply to other cruises on the *Palmer*.

1. **Plot raw data.** Plot the raw data from each day using `mbm_plot` (`mbswath` or `mbcontour`) and check it for errors in scale, navigation, excessive noise, gaps due to system crashes or glitches in the data.

2. **Unclean data.** Run `mbunclean` on the raw data to unflag the beams which the system autoflags. Data will now be completely unflagged. Place unflagged data with a ".cl" extension in the Unclean directory where editors can find it.

3. **Edit data**. Editors should clean all noise out of data using `mbedit`. Edited files automatically get a ".ed" extension added to their filename. These should be examined, then moved to the Edit directory. The original file can now be deleted from the Unclean directory.

4. **Compile data lists**. Use the daily plots to create a list of all the files which include data for a given survey area. Make sure the file pointed to in the list refers to the location of the best version of the each datafile since some will be raw, some edited, some with new navigation, etc, depending on the particular file.

5. **Preliminary swath plots**. Make shaded and contoured swath plots using `mbm_plot` for a given survey area. Examine the plots and check the data quality. Look for gaps in the data, overlap, and differences in data vintages over the same area. Adjust the data list, re-edit data files as needed and/or make plans to return to the survey area to fill in gaps. Plot the location of XBT or CTD information from the survey area to be used in velocity modeling.

6. **Velocity correction**. Load relevant XBT, CTD and other velocity information (such as Levitus tables) into `mbvelocitytool` along with a piece of Seabeam data from an area of very simple bathymetry, preferably a flat place. Create a reasonable sound velocity profile and save it. Run `mbbath` to re-raytrace a small sample of the data. If it looks okay when you plot it, then apply the new velocity profile to the entire survey area and place the corrected files in a new directory, such as NewVel. You may then delete the originals from the Edit directory.

7. **Final maps**. Use `mbgrid` to grid the data and interpolate gaps. Plot contoured shaded maps using GMT and adding in other information, such as coastlines, stations, cruisetracks, etc., even other bathymetric data. Pull subsets of the map area out of the grid file for blowups.

Appendix II. Broken Seabeam File Pathologies

This is a list of file problems observed on NBP9507 which are of interest to the multibeam processing slave. Some of these will probably occur on future cruises. Files subject to these problems are noted in the list in Appendix 3.

1. **Time warp**. Occasionally the system will write out a ping or series of pings which have the wrong date on them. The quality checking routines run by the multibeam engineers usually find these errors, but beam editors may observe them also. Bad dates may not affect processing if one does not try to use the date information in the files. (This problem is supposed to be fixed now.)

2. **Location warp**. Sometimes a ping will have erroneous latitude and longitude information associated with it. This will be fairly apparent when the data are plotted on a map. One may either remerge new navigation with the file or excise the bad data using `mbcopy`.

3. **Glitch**. A few files had unreadable sections which caused the MB-System software to experience a segmentation fault when they were read with `mblist` or `mbinfo`. This files have to be dissected into good and bad portions.

4. **Depth Times Ten**. An inadvertent invocation of an old version of the `mbunclean` program multiplied seemingly random bathymetries by ten. This caused some excitement when the data were contoured. The fix for this is to re-unclean the data (using the correct version of `mbunclean`), then, if they have been edited, use `mbgetmask` and `mbmask` to apply the editing to the cleaned file.

5. **Overwriting**. When the Seabeam was restarted in the middle of a day, the system would sometimes append data to the first file of the day, rather than starting a new file or appending to the most recent file. In a few cases six or eight files would be badly mixed up and very tedious to sort out. These errors are first caught when examining the time when the files were last modified since the first file would have a modification time later than succeeding files. Then, `mblist` will show the full magnitude of the scrambling.

6. **Pinger**. During some ZAPS stations, particularly later in the cruise, the Seabeam system was left on and picked up signals from the 12 kHz pinger on the sled. These data files are not necessarily "broken", but do not contain strictly bathymetric information and should not be used for mapping.

Appendix III. NBP9507 Seabeam files

FILENAME	LAST MODIFICATION	NOTES
NBP9507.d301.00	28-Oct-95 20:19:00	these files in very shallow water; time warp
NBP9507.d301.01	28-Oct-95 17:05:00	time warp
NBP9507.d301.02	28-Oct-95 10:23:00	
NBP9507.d301.03	28-Oct-95 11:23:00	Seabeam restart
NBP9507.d301.04	28-Oct-95 12:00:00	
NBP9507.d301.05	28-Oct-95 12:13:00	
NBP9507.d301.06	28-Oct-95 13:15:00	
NBP9507.d301.07	28-Oct-95 14:19:00	
NBP9507.d301.08	28-Oct-95 15:19:00	
NBP9507.d301.09	28-Oct-95 15:54:00	
NBP9507.d301.10	28-Oct-95 18:05:00	
NBP9507.d301.11	28-Oct-95 18:59:00	
NBP9507.d301.12	28-Oct-95 20:13:00	
NBP9507.d301.13	28-Oct-95 21:24:00	
NBP9507.d301.14	28-Oct-95 22:24:00	
NBP9507.d301.15	28-Oct-95 23:22:00	
NBP9507.d301.16	29-Oct-95 00:01:00	
NBP9507.d302.00	29-Oct-95 01:03:00	
NBP9507.d302.01	29-Oct-95 02:01:00	
NBP9507.d302.02	29-Oct-95 03:03:00	
NBP9507.d302.03	29-Oct-95 04:00:00	
NBP9507.d302.04	29-Oct-95 05:10:00	
NBP9507.d302.05	29-Oct-95 06:12:00	
NBP9507.d302.06	29-Oct-95 07:11:00	
NBP9507.d302.07	29-Oct-95 08:11:00	
NBP9507.d302.08	29-Oct-95 08:53:00	buoy deployment station
NBP9507.d302.09	29-Oct-95 11:06:00	time gap for ZAPS station
NBP9507.d302.10	29-Oct-95 14:49:00	
NBP9507.d302.11	29-Oct-95 15:49:00	
NBP9507.d302.12	29-Oct-95 16:49:00	
NBP9507.d302.13	29-Oct-95 17:49:00	
NBP9507.d302.14	29-Oct-95 18:49:00	
NBP9507.d302.15	29-Oct-95 19:49:00	
NBP9507.d302.16	29-Oct-95 20:18:00	
NBP9507.d302.17	29-Oct-95 21:19:00	
NBP9507.d302.18	29-Oct-95 22:19:00	
NBP9507.d302.19	29-Oct-95 23:19:00	
NBP9507.d302.20	30-Oct-95 00:01:00	
NBP9507.d303.00	30-Oct-95 01:01:00	
NBP9507.d303.01	30-Oct-95 02:01:00	
NBP9507.d303.02	30-Oct-95 03:01:00	
NBP9507.d303.03	30-Oct-95 04:01:00	

NBP9507.d303.04	30-Oct-95 05:01:00	
NBP9507.d303.05	30-Oct-95 06:01:00	
NBP9507.d303.06	30-Oct-95 07:01:00	
NBP9507.d303.07	30-Oct-95 08:01:00	
NBP9507.d303.08	30-Oct-95 09:02:00	
NBP9507.d303.09	30-Oct-95 10:02:00	
NBP9507.d303.10	30-Oct-95 11:02:00	
NBP9507.d303.11	30-Oct-95 12:02:00	
NBP9507.d303.12	30-Oct-95 13:02:00	
NBP9507.d303.13	30-Oct-95 14:02:00	
NBP9507.d303.14	30-Oct-95 15:02:00	
NBP9507.d303.15	30-Oct-95 16:02:00	
NBP9507.d303.16	30-Oct-95 17:02:00	
NBP9507.d303.17	30-Oct-95 18:02:00	
NBP9507.d303.18	30-Oct-95 19:02:00	
NBP9507.d303.19	30-Oct-95 20:02:00	
NBP9507.d303.20	30-Oct-95 21:02:00	
NBP9507.d303.21	30-Oct-95 22:03:00	
NBP9507.d303.22	30-Oct-95 23:03:00	Seabeam restart
NBP9507.d303.23	31-Oct-95 00:01:00	
NBP9507.d304.00	31-Oct-95 01:01:00	
NBP9507.d304.01	31-Oct-95 02:01:00	Seabeam restart
NBP9507.d304.02	31-Oct-95 03:01:00	
NBP9507.d304.03	31-Oct-95 04:01:00	
NBP9507.d304.04	31-Oct-95 05:02:00	
NBP9507.d304.05	31-Oct-95 06:02:00	
NBP9507.d304.06	31-Oct-95 07:02:00	
NBP9507.d304.07	31-Oct-95 08:02:00	
NBP9507.d304.08	31-Oct-95 09:02:00	
NBP9507.d304.09	31-Oct-95 10:02:00	
NBP9507.d304.10	31-Oct-95 11:02:00	
NBP9507.d304.11	31-Oct-95 12:02:00	
NBP9507.d304.12	31-Oct-95 13:02:00	
NBP9507.d304.13	31-Oct-95 14:02:00	
NBP9507.d304.14	31-Oct-95 15:02:00	
NBP9507.d304.15	31-Oct-95 16:02:00	
NBP9507.d304.16	31-Oct-95 17:03:00	
NBP9507.d304.17	31-Oct-95 18:03:00	
NBP9507.d304.18	31-Oct-95 19:03:00	
NBP9507.d304.19	31-Oct-95 20:03:00	
NBP9507.d304.20	31-Oct-95 21:03:00	
NBP9507.d304.21	31-Oct-95 22:03:00	
NBP9507.d304.22	31-Oct-95 23:03:00	
NBP9507.d304.23	1-Nov-95 00:01:00	
NBP9507.d305.00	1-Nov-95 01:01:00	
NBP9507.d305.01	1-Nov-95 02:01:00	
NBP9507.d305.02	1-Nov-95 03:01:00	

NBP9507.d305.03	1-Nov-95	04:01:00	
NBP9507.d305.04	1-Nov-95	05:01:00	Seabeam restart
NBP9507.d305.05	1-Nov-95	06:02:00	
NBP9507.d305.06	1-Nov-95	06:53:00	
NBP9507.d305.07	1-Nov-95	08:16:00	time gap
NBP9507.d305.08	1-Nov-95	09:16:00	
NBP9507.d305.09	1-Nov-95	10:16:00	
NBP9507.d305.10	1-Nov-95	11:16:00	
NBP9507.d305.11	1-Nov-95	12:16:00	
NBP9507.d305.12	1-Nov-95	13:16:00	
NBP9507.d305.13	1-Nov-95	14:12:00	ZAPS Station 2, CTD 2
NBP9507.d305.14	1-Nov-95	18:55:00	
NBP9507.d305.15	1-Nov-95	19:55:00	
NBP9507.d305.16	1-Nov-95	20:55:00	
NBP9507.d305.17	1-Nov-95	21:55:00	
NBP9507.d305.18	1-Nov-95	22:55:00	
NBP9507.d305.19	1-Nov-95	23:55:00	
NBP9507.d305.20	2-Nov-95	00:01:00	
NBP9507.d306.00	2-Nov-95	01:01:00	
NBP9507.d306.01	2-Nov-95	02:01:00	
NBP9507.d306.02	2-Nov-95	03:01:00	
NBP9507.d306.03	2-Nov-95	03:35:00	
NBP9507.d306.04	2-Nov-95	04:28:00	ZAPS Station 3
NBP9507.d306.05	2-Nov-95	07:32:00	
NBP9507.d306.06	2-Nov-95	08:32:00	
NBP9507.d306.07	2-Nov-95	09:32:00	
NBP9507.d306.08	2-Nov-95	10:32:00	
NBP9507.d306.09	2-Nov-95	11:32:00	
NBP9507.d306.10	2-Nov-95	12:32:00	
NBP9507.d306.11	2-Nov-95	13:32:00	
NBP9507.d306.12	2-Nov-95	14:32:00	ZAPS Station 4
NBP9507.d306.13	2-Nov-95	15:04:00	
NBP9507.d306.14	2-Nov-95	18:25:00	ZAPS Station 5
NBP9507.d306.15	2-Nov-95	18:58:00	CTD Station 3. Seabeam idle 2125-2307
NBP9507.d306.16	3-Nov-95	00:01:00	
NBP9507.d307.00	3-Nov-95	01:01:00	
NBP9507.d307.01	3-Nov-95	02:01:00	
NBP9507.d307.02	3-Nov-95	03:01:00	
NBP9507.d307.03	3-Nov-95	04:01:00	
NBP9507.d307.04	3-Nov-95	05:01:00	
NBP9507.d307.05	3-Nov-95	06:01:00	
NBP9507.d307.06	3-Nov-95	07:01:00	
NBP9507.d307.07	3-Nov-95	08:01:00	
NBP9507.d307.08	3-Nov-95	09:01:00	
NBP9507.d307.09	3-Nov-95	10:01:00	
NBP9507.d307.10	3-Nov-95	11:01:00	
NBP9507.d307.11	3-Nov-95	12:01:00	

NBP9507.d307.12	3-Nov-95 13:02:00	
NBP9507.d307.13	3-Nov-95 14:02:00	
NBP9507.d307.14	3-Nov-95 15:02:00	
NBP9507.d307.15	3-Nov-95 16:02:00	
NBP9507.d307.16	3-Nov-95 17:02:00	
NBP9507.d307.17	3-Nov-95 17:42:00	ZAPS Station 6
NBP9507.d307.18	3-Nov-95 21:25:00	
NBP9507.d307.19	3-Nov-95 22:26:00	
NBP9507.d307.20	3-Nov-95 23:03:00	ZAPS Station 7
NBP9507.d308.00	4-Nov-95 14:46:00	time warp. file scrambled
NBP9507.d308.01	4-Nov-95 04:11:00	
NBP9507.d308.02	4-Nov-95 05:09:00	ZAPS Station 8
NBP9507.d308.03	4-Nov-95 09:02:00	
NBP9507.d308.04	4-Nov-95 10:02:00	
NBP9507.d308.05	4-Nov-95 11:02:00	
NBP9507.d308.06	4-Nov-95 12:02:00	
NBP9507.d308.07	4-Nov-95 13:02:00	
NBP9507.d308.08	4-Nov-95 14:02:00	
NBP9507.d308.09	4-Nov-95 14:11:00	time gap
NBP9507.d308.10	4-Nov-95 14:29:00	
NBP9507.d308.11	4-Nov-95 14:37:00	time gap
NBP9507.d308.12	4-Nov-95 15:45:00	
NBP9507.d308.13	4-Nov-95 16:44:00	
NBP9507.d308.14	4-Nov-95 17:44:00	
NBP9507.d308.15	4-Nov-95 18:02:00	Buoy deployment #2- Seabeam idle
NBP9507.d308.16	4-Nov-95 19:57:00	Slow for streamer balancing
NBP9507.d308.17	4-Nov-95 20:57:00	
NBP9507.d308.18	4-Nov-95 21:57:00	
NBP9507.d308.19	4-Nov-95 22:57:00	
NBP9507.d308.20	4-Nov-95 23:57:00	
NBP9507.d308.21	5-Nov-95 00:01:00	
NBP9507.d309.00	5-Nov-95 14:55:00	time warp. horribly scrambled
NBP9507.d309.01	5-Nov-95 02:01:00	
NBP9507.d309.02	5-Nov-95 03:01:00	
NBP9507.d309.03	5-Nov-95 04:01:00	
NBP9507.d309.04	5-Nov-95 05:01:00	streamer balancing complete
NBP9507.d309.05	5-Nov-95 06:02:00	
NBP9507.d309.06	5-Nov-95 07:02:00	
NBP9507.d309.07	5-Nov-95 08:02:00	
NBP9507.d309.08	5-Nov-95 09:02:00	
NBP9507.d309.09	5-Nov-95 10:02:00	
NBP9507.d309.10	5-Nov-95 11:02:00	
NBP9507.d309.11	5-Nov-95 12:02:00	
NBP9507.d309.12	5-Nov-95 13:02:00	
NBP9507.d309.13	5-Nov-95 14:00:00	Seabeam idle
NBP9507.d309.14	5-Nov-95 14:14:00	time gaps; Seabeam restart
NBP9507.d309.15	5-Nov-95 15:55:00	

NBP9507.d309.16	5-Nov-95 16:55:00	
NBP9507.d309.17	5-Nov-95 17:55:00	
NBP9507.d309.18	5-Nov-95 18:55:00	
NBP9507.d309.19	5-Nov-95 18:58:00	ZAPS Station 9
NBP9507.d310.00	6-Nov-95 21:43:00	time warp. great scrambling of data.
NBP9507.d310.01	6-Nov-95 01:47:00	
NBP9507.d310.02	6-Nov-95 02:20:00	ZAPS Station 10
NBP9507.d310.03	6-Nov-95 05:48:00	
NBP9507.d310.04	6-Nov-95 06:49:00	
NBP9507.d310.05	6-Nov-95 07:49:00	
NBP9507.d310.06	6-Nov-95 08:49:00	
NBP9507.d310.07	6-Nov-95 09:49:00	
NBP9507.d310.08	6-Nov-95 10:49:00	
NBP9507.d310.09	6-Nov-95 11:49:00	
NBP9507.d310.10	6-Nov-95 12:49:00	
NBP9507.d310.11	6-Nov-95 13:49:00	
NBP9507.d310.12	6-Nov-95 14:49:00	
NBP9507.d310.13	6-Nov-95 15:49:00	
NBP9507.d310.14	6-Nov-95 16:49:00	
NBP9507.d310.15	6-Nov-95 17:49:00	
NBP9507.d310.16	6-Nov-95 18:49:00	
NBP9507.d310.17	6-Nov-95 19:49:00	
NBP9507.d310.18	6-Nov-95 20:19:00	Seabeam restart. Data scrambled
NBP9507.d310.19	6-Nov-95 20:35:00	Seabeam restart. Data scrambled
NBP9507.d310.20	6-Nov-95 20:46:00	
NBP9507.d310.21	6-Nov-95 21:12:00	Seabeam restart. Data scrambled. Begin seismic acquisition.
NBP9507.d310.22	6-Nov-95 21:34:00	
NBP9507.d310.23	6-Nov-95 21:47:00	
NBP9507.d310.24	6-Nov-95 22:48:00	
NBP9507.d310.25	6-Nov-95 23:48:00	
NBP9507.d310.26	7-Nov-95 00:01:00	
NBP9507.d311.00	7-Nov-95 07:29:00	Time warp
NBP9507.d311.01	7-Nov-95 02:01:00	
NBP9507.d311.02	7-Nov-95 02:22:00	Seabeam shut off. Time gap. End seismic acquistion
NBP9507.d311.03	7-Nov-95 04:43:00	
NBP9507.d311.04	7-Nov-95 05:43:00	
NBP9507.d311.05	7-Nov-95 06:38:00	Time gap. Scrambling.
NBP9507.d311.06	7-Nov-95 08:29:00	
NBP9507.d311.07	7-Nov-95 09:29:00	
NBP9507.d311.08	7-Nov-95 10:29:00	
NBP9507.d311.09	7-Nov-95 11:29:00	
NBP9507.d311.10	7-Nov-95 12:24:00	ZAPS Station 11; Core 1
NBP9507.d311.11	7-Nov-95 23:22:00	
NBP9507.d311.12	8-Nov-95 00:01:00	
NBP9507.d312.00	8-Nov-95 00:30:00	Seabeam crash; small time gap
NBP9507.d312.01	8-Nov-95 02:14:00	ZAPS Station 12

NBP9507.d312.02	8-Nov-95 03:14:00	on station
NBP9507.d312.03	8-Nov-95 04:14:00	on station
NBP9507.d312.04	8-Nov-95 05:14:00	on station to 04:45
NBP9507.d312.05	8-Nov-95 06:14:00	
NBP9507.d312.06	8-Nov-95 07:14:00	
NBP9507.d312.07	8-Nov-95 08:14:00	
NBP9507.d312.08	8-Nov-95 09:14:00	
NBP9507.d312.09	8-Nov-95 10:14:00	
NBP9507.d312.10	8-Nov-95 11:14:00	
NBP9507.d312.11	8-Nov-95 12:14:00	
NBP9507.d312.12	8-Nov-95 15:31:00	ZAPS Station 13
NBP9507.d312.13	8-Nov-95 16:31:00	
NBP9507.d312.14	8-Nov-95 16:51:00	
NBP9507.d312.15	8-Nov-95 19:23:00	ZAPS Station 14, 15
NBP9507.d312.16	8-Nov-95 22:05:00	ZAPS Station 16
NBP9507.d313.00	9-Nov-95 01:01:00	ZAPS Station 17
NBP9507.d313.01	9-Nov-95 07:48:00	
NBP9507.d313.02	9-Nov-95 08:48:00	
NBP9507.d313.03	9-Nov-95 09:48:00	
NBP9507.d313.04	9-Nov-95 10:48:00	
NBP9507.d313.05	9-Nov-95 11:48:00	
NBP9507.d313.06	9-Nov-95 12:48:00	
NBP9507.d313.07	9-Nov-95 13:48:00	
NBP9507.d313.08	9-Nov-95 14:48:00	
NBP9507.d313.09	9-Nov-95 15:48:00	
NBP9507.d313.10	9-Nov-95 16:03:00	ZAPS Station 18
NBP9507.d313.11	9-Nov-95 18:44:00	drifting
NBP9507.d313.12	9-Nov-95 19:44:00	drifting
NBP9507.d313.13	9-Nov-95 20:44:00	drifting
NBP9507.d313.14	9-Nov-95 21:44:00	drifting
NBP9507.d313.15	9-Nov-95 22:44:00	drifting
NBP9507.d313.16	9-Nov-95 23:44:00	drifting to 23:40
NBP9507.d313.17	10-Nov-95 00:01:00	
NBP9507.d314.00	10-Nov-95 01:01:00	This day originally mbuncleaned with old version. Raw data should be fine.
NBP9507.d314.01	10-Nov-95 02:01:00	
NBP9507.d314.02	10-Nov-95 03:01:00	
NBP9507.d314.03	10-Nov-95 04:01:00	
NBP9507.d314.04	10-Nov-95 05:01:00	
NBP9507.d314.05	10-Nov-95 06:01:00	
NBP9507.d314.06	10-Nov-95 07:01:00	
NBP9507.d314.07	10-Nov-95 08:01:00	
NBP9507.d314.08	10-Nov-95 09:01:00	
NBP9507.d314.09	10-Nov-95 10:01:00	
NBP9507.d314.10	10-Nov-95 11:01:00	
NBP9507.d314.11	10-Nov-95 12:01:00	
NBP9507.d314.12	10-Nov-95 12:37:00	ZAPS Station 19; Seabeam restart
NBP9507.d314.13	10-Nov-95 17:05:00	

NBP9507.d314.14	10-Nov-95 18:05:00	
NBP9507.d314.15	10-Nov-95 19:06:00	
NBP9507.d314.16	10-Nov-95 20:05:00	
NBP9507.d314.17	10-Nov-95 21:06:00	ZAPS Station 20
NBP9507.d314.18	10-Nov-95 22:06:00	on station
NBP9507.d314.19	10-Nov-95 23:06:00	on station
NBP9507.d314.20	11-Nov-95 00:01:00	on station
NBP9507.d315.00	11-Nov-95 01:01:00	on station
NBP9507.d315.01	11-Nov-95 02:01:00	on station
NBP9507.d315.02	11-Nov-95 03:01:00	on station
NBP9507.d315.03	11-Nov-95 04:01:00	on station
NBP9507.d315.04	11-Nov-95 05:01:00	on station
NBP9507.d315.05	11-Nov-95 06:01:00	on station to 05:35
NBP9507.d315.06	11-Nov-95 06:59:00	ZAPS Station 21; Seabeam shutdown
NBP9507.d315.07	11-Nov-95 08:07:00	on station
NBP9507.d315.08	11-Nov-95 09:07:00	
NBP9507.d315.09	11-Nov-95 10:08:00	
NBP9507.d315.10	11-Nov-95 11:08:00	
NBP9507.d315.11	11-Nov-95 12:07:00	
NBP9507.d315.12	11-Nov-95 13:07:00	
NBP9507.d315.13	11-Nov-95 14:07:00	
NBP9507.d315.14	11-Nov-95 15:07:00	
NBP9507.d315.15	11-Nov-95 16:07:00	
NBP9507.d315.16	11-Nov-95 17:07:00	
NBP9507.d315.17	11-Nov-95 18:07:00	
NBP9507.d315.18	11-Nov-95 19:07:00	
NBP9507.d315.19	11-Nov-95 20:07:00	
NBP9507.d315.20	11-Nov-95 21:07:00	
NBP9507.d315.21	11-Nov-95 22:08:00	
NBP9507.d315.22	11-Nov-95 23:08:00	
NBP9507.d315.23	12-Nov-95 00:01:00	
NBP9507.d316.00	12-Nov-95 01:01:00	
NBP9507.d316.01	12-Nov-95 02:01:00	
NBP9507.d316.02	12-Nov-95 03:01:00	
NBP9507.d316.03	12-Nov-95 04:01:00	
NBP9507.d316.04	12-Nov-95 05:01:00	
NBP9507.d316.05	12-Nov-95 06:01:00	
NBP9507.d316.06	12-Nov-95 07:01:00	
NBP9507.d316.07	12-Nov-95 08:01:00	
NBP9507.d316.08	12-Nov-95 09:01:00	
NBP9507.d316.09	12-Nov-95 10:01:00	
NBP9507.d316.10	12-Nov-95 11:02:00	
NBP9507.d316.11	12-Nov-95 12:02:00	
NBP9507.d316.12	12-Nov-95 13:02:00	
NBP9507.d316.13	12-Nov-95 14:02:00	
NBP9507.d316.14	12-Nov-95 15:02:00	
NBP9507.d316.15	12-Nov-95 16:02:00	

NBP9507.d316.16	12-Nov-95 17:02:00	
NBP9507.d316.17	12-Nov-95 18:02:00	
NBP9507.d316.18	12-Nov-95 19:02:00	
NBP9507.d316.19	12-Nov-95 20:02:00	
NBP9507.d316.20	12-Nov-95 21:03:00	
NBP9507.d316.21	12-Nov-95 22:03:00	
NBP9507.d316.22	12-Nov-95 23:03:00	
NBP9507.d316.23	13-Nov-95 00:01:00	
NBP9507.d317.00	13-Nov-95 01:01:00	
NBP9507.d317.01	13-Nov-95 02:01:00	
NBP9507.d317.02	13-Nov-95 03:01:00	
NBP9507.d317.03	13-Nov-95 04:01:00	
NBP9507.d317.04	13-Nov-95 05:01:00	
NBP9507.d317.05	13-Nov-95 06:01:00	
NBP9507.d317.06	13-Nov-95 07:01:00	
NBP9507.d317.07	13-Nov-95 08:01:00	
NBP9507.d317.08	13-Nov-95 09:02:00	
NBP9507.d317.09	13-Nov-95 10:02:00	
NBP9507.d317.10	13-Nov-95 11:02:00	
NBP9507.d317.11	13-Nov-95 12:02:00	
NBP9507.d317.12	13-Nov-95 13:02:00	begin seismic acquisition
NBP9507.d317.13	13-Nov-95 14:02:00	seismic acquisition
NBP9507.d317.14	13-Nov-95 15:02:00	seismic acquisition
NBP9507.d317.15	13-Nov-95 16:02:00	seismic acquisition
NBP9507.d317.16	13-Nov-95 17:02:00	seismic acquisition
NBP9507.d317.17	13-Nov-95 18:02:00	seismic acquisition
NBP9507.d317.18	13-Nov-95 18:08:00	seismic acquisition
NBP9507.d317.19	13-Nov-95 18:29:00	seismic acquisition
NBP9507.d317.20	13-Nov-95 19:29:00	seismic acquisition
NBP9507.d317.21	13-Nov-95 20:29:00	seismic acquisition
NBP9507.d317.22	13-Nov-95 21:29:00	seismic acquisition
NBP9507.d317.23	13-Nov-95 22:29:00	seismic acquisition
NBP9507.d317.24	13-Nov-95 23:29:00	seismic acquisition
NBP9507.d317.25	14-Nov-95 00:01:00	seismic acquisition
NBP9507.d318.00	14-Nov-95 01:01:00	seismic acquisition
NBP9507.d318.01	14-Nov-95 02:01:00	seismic acquisition
NBP9507.d318.02	14-Nov-95 03:01:00	seismic acquisition
NBP9507.d318.03	14-Nov-95 04:01:00	seismic acquisition
NBP9507.d318.04	14-Nov-95 05:01:00	seismic acquisition
NBP9507.d318.05	14-Nov-95 06:01:00	seismic acquisition
NBP9507.d318.06	14-Nov-95 07:01:00	seismic acquisition
NBP9507.d318.07	14-Nov-95 08:02:00	seismic acquisition; Seabeam down five minutes
NBP9507.d318.08	14-Nov-95 09:02:00	seismic acquisition
NBP9507.d318.09	14-Nov-95 10:02:00	end seismic acquisition
NBP9507.d318.10	14-Nov-95 11:02:00	
NBP9507.d318.11	14-Nov-95 12:02:00	
NBP9507.d318.12	14-Nov-95 13:02:00	

NBP9507.d318.13	14-Nov-95 14:04:00	
NBP9507.d318.14	14-Nov-95 15:02:00	glitches in file; can not read all of it
NBP9507.d318.15	14-Nov-95 16:02:00	
NBP9507.d318.16	14-Nov-95 17:02:00	
NBP9507.d318.17	14-Nov-95 18:02:00	
NBP9507.d318.18	14-Nov-95 19:02:00	ZAPS Station 22
NBP9507.d318.19	14-Nov-95 20:02:00	on station
NBP9507.d318.20	14-Nov-95 21:02:00	on station to 21:25
NBP9507.d318.21	14-Nov-95 22:02:00	
NBP9507.d318.22	14-Nov-95 23:02:00	
NBP9507.d318.23	15-Nov-95 00:01:00	
NBP9507.d319.00	15-Nov-95 01:01:00	
NBP9507.d319.01	15-Nov-95 02:01:00	ZAPS Station 23
NBP9507.d319.02	15-Nov-95 03:01:00	on station
NBP9507.d319.03	15-Nov-95 04:01:00	on station
NBP9507.d319.04	15-Nov-95 05:01:00	on station
NBP9507.d319.05	15-Nov-95 06:01:00	on station
NBP9507.d319.06	15-Nov-95 07:01:00	on station; dredge
NBP9507.d319.07	15-Nov-95 08:01:00	on station
NBP9507.d319.08	15-Nov-95 09:01:00	on station
NBP9507.d319.09	15-Nov-95 09:18:00	on station
NBP9507.d319.10	15-Nov-95 10:20:00	time gap; restart; on station to 1400
NBP9507.d319.11	15-Nov-95 15:51:00	
NBP9507.d319.12	15-Nov-95 16:51:00	
NBP9507.d319.13	15-Nov-95 17:54:00	
NBP9507.d319.14	15-Nov-95 18:51:00	
NBP9507.d319.15	15-Nov-95 19:51:00	Core Station 2
NBP9507.d319.16	15-Nov-95 20:52:00	on station to 20:37
NBP9507.d319.17	15-Nov-95 21:52:00	
NBP9507.d319.18	15-Nov-95 22:52:00	
NBP9507.d319.19	15-Nov-95 23:52:00	
NBP9507.d319.20	16-Nov-95 00:01:00	
NBP9507.d320.00	16-Nov-95 01:01:00	ZAPS Station 24
NBP9507.d320.01	16-Nov-95 02:01:00	on station
NBP9507.d320.02	16-Nov-95 03:01:00	on station
NBP9507.d320.03	16-Nov-95 03:22:00	on station
NBP9507.d320.04	16-Nov-95 05:34:00	on station
NBP9507.d320.05	16-Nov-95 06:34:00	on station
NBP9507.d320.06	16-Nov-95 07:34:00	on station
NBP9507.d320.07	16-Nov-95 08:02:00	on station
NBP9507.d320.08	16-Nov-95 11:07:00	on station to 10:59
NBP9507.d320.09	16-Nov-95 12:07:00	
NBP9507.d320.10	16-Nov-95 13:07:00	
NBP9507.d320.11	16-Nov-95 14:07:00	
NBP9507.d320.12	16-Nov-95 15:07:00	
NBP9507.d320.13	16-Nov-95 16:07:00	
NBP9507.d320.14	16-Nov-95 17:07:00	

NBP9507.d320.15	16-Nov-95 18:07:00	
NBP9507.d320.16	16-Nov-95 19:07:00	
NBP9507.d320.17	16-Nov-95 20:07:00	
NBP9507.d320.18	16-Nov-95 21:07:00	ZAPS Station 25
NBP9507.d320.19	16-Nov-95 22:07:00	on station
NBP9507.d320.20	16-Nov-95 23:07:00	on station
NBP9507.d320.21	17-Nov-95 00:01:00	on station
NBP9507.d321.00	17-Nov-95 01:01:00	ZAPS Station 26
NBP9507.d321.01	17-Nov-95 02:01:00	
NBP9507.d321.02	17-Nov-95 03:01:00	
NBP9507.d321.03	17-Nov-95 04:01:00	
NBP9507.d321.04	17-Nov-95 05:01:00	Core Station 3
NBP9507.d321.05	17-Nov-95 06:01:00	on station
NBP9507.d321.06	17-Nov-95 07:01:00	
NBP9507.d321.07	17-Nov-95 08:01:00	
NBP9507.d321.08	17-Nov-95 09:01:00	
NBP9507.d321.09	17-Nov-95 10:01:00	
NBP9507.d321.10	17-Nov-95 11:01:00	
NBP9507.d321.11	17-Nov-95 12:01:00	
NBP9507.d321.12	17-Nov-95 13:02:00	
NBP9507.d321.13	17-Nov-95 14:02:00	
NBP9507.d321.14	17-Nov-95 14:30:00	Seabeam restart
NBP9507.d321.15	17-Nov-95 18:25:00	
NBP9507.d321.16	17-Nov-95 19:25:00	
NBP9507.d321.17	17-Nov-95 20:25:00	
NBP9507.d321.18	17-Nov-95 21:25:00	
NBP9507.d321.19	17-Nov-95 22:25:00	
NBP9507.d321.20	17-Nov-95 23:25:00	ZAPS Station 27
NBP9507.d321.21	18-Nov-95 00:01:00	on station
NBP9507.d322.00	18-Nov-95 01:01:00	on station
NBP9507.d322.01	18-Nov-95 02:01:00	on station
NBP9507.d322.02	18-Nov-95 03:01:00	on station
NBP9507.d322.03	18-Nov-95 04:01:00	on station
NBP9507.d322.04	18-Nov-95 05:01:00	on station
NBP9507.d322.05	18-Nov-95 06:01:00	on station
NBP9507.d322.06	18-Nov-95 07:01:00	on station
NBP9507.d322.07	18-Nov-95 07:34:00	time gap? on station
NBP9507.d322.08	18-Nov-95 10:35:00	
NBP9507.d322.09	18-Nov-95 11:35:00	
NBP9507.d322.10	18-Nov-95 12:35:00	
NBP9507.d322.11	18-Nov-95 13:35:00	
NBP9507.d322.12	18-Nov-95 14:35:00	
NBP9507.d322.13	18-Nov-95 15:35:00	
NBP9507.d322.14	18-Nov-95 16:35:00	
NBP9507.d322.15	18-Nov-95 17:35:00	
NBP9507.d322.16	18-Nov-95 18:35:00	
NBP9507.d322.17	18-Nov-95 19:35:00	

NBP9507.d322.18	18-Nov-95 20:37:00	
NBP9507.d322.19	18-Nov-95 21:37:00	
NBP9507.d322.20	18-Nov-95 22:38:00	
NBP9507.d322.21	18-Nov-95 23:35:00	
NBP9507.d322.22	18-Nov-95 23:56:00	
NBP9507.d323.00	19-Nov-95 01:18:00	Seabeam reboot
NBP9507.d323.01	19-Nov-95 01:45:00	ZAPS Station 28
NBP9507.d323.02	19-Nov-95 03:31:00	on station
NBP9507.d323.03	19-Nov-95 04:31:00	on station
NBP9507.d323.04	19-Nov-95 05:27:00	on station; restart Seabeam
NBP9507.d323.05	19-Nov-95 07:03:00	on station
NBP9507.d323.06	19-Nov-95 08:03:00	on station
NBP9507.d323.07	19-Nov-95 09:03:00	on station
NBP9507.d323.08	19-Nov-95 10:03:00	on station
NBP9507.d323.09	19-Nov-95 11:03:00	
NBP9507.d323.10	19-Nov-95 12:05:00	begin seismic acquisition
NBP9507.d323.11	19-Nov-95 13:03:00	seismic acquisition
NBP9507.d323.12	19-Nov-95 14:03:00	seismic acquisition
NBP9507.d323.13	19-Nov-95 15:03:00	seismic acquisition
NBP9507.d323.14	19-Nov-95 16:03:00	seismic acquisition
NBP9507.d323.15	19-Nov-95 17:03:00	seismic acquisition
NBP9507.d323.16	19-Nov-95 18:04:00	end seismic acquisition
NBP9507.d323.17	19-Nov-95 19:04:00	
NBP9507.d323.18	19-Nov-95 20:06:00	
NBP9507.d323.19	19-Nov-95 21:06:00	
NBP9507.d323.20	19-Nov-95 22:06:00	
NBP9507.d323.21	19-Nov-95 23:05:00	
NBP9507.d323.22	20-Nov-95 00:01:00	
NBP9507.d324.00	21-Nov-95 00:01:00	ZAPS Station 29
NBP9507.d324.01	20-Nov-95 02:06:00	on station
NBP9507.d324.02	20-Nov-95 03:06:00	on station
NBP9507.d324.03	20-Nov-95 04:06:00	on station
NBP9507.d324.04	20-Nov-95 05:06:00	on station
NBP9507.d324.05	20-Nov-95 06:06:00	ZAPS Station 30
NBP9507.d324.06	20-Nov-95 07:06:00	on station
NBP9507.d324.07	20-Nov-95 08:06:00	on station
NBP9507.d324.08	20-Nov-95 09:06:00	on station
NBP9507.d324.09	20-Nov-95 10:06:00	Core Station 4
NBP9507.d324.10	20-Nov-95 11:06:00	on station to 10:39
NBP9507.d324.11	20-Nov-95 11:51:00	restart Seabeam
NBP9507.d324.12	20-Nov-95 13:19:00	
NBP9507.d324.13	20-Nov-95 14:19:00	
NBP9507.d324.14	20-Nov-95 15:18:00	
NBP9507.d324.15	20-Nov-95 16:19:00	
NBP9507.d324.16	20-Nov-95 17:19:00	
NBP9507.d324.17	20-Nov-95 18:19:00	
NBP9507.d324.18	20-Nov-95 19:19:00	

NBP9507.d324.19	20-Nov-95 20:19:00	
NBP9507.d324.20	20-Nov-95 21:19:00	
NBP9507.d324.21	20-Nov-95 22:19:00	
NBP9507.d324.22	20-Nov-95 23:19:00	wrong depths from ZAPS pinger! ZAPS Station 31
NBP9507.d324.23	21-Nov-95 00:00:00	on station
NBP9507.d325.00	21-Nov-95 01:00:00	on station
NBP9507.d325.01	21-Nov-95 02:00:00	on station
NBP9507.d325.02	21-Nov-95 03:00:00	on station
NBP9507.d325.03	21-Nov-95 04:02:00	on station
NBP9507.d325.04	21-Nov-95 05:01:00	ZAPS Station 32
NBP9507.d325.05	21-Nov-95 06:01:00	on station
NBP9507.d325.06	21-Nov-95 07:01:00	on station
NBP9507.d325.07	21-Nov-95 08:01:00	Core Station 5
NBP9507.d325.08	21-Nov-95 09:01:00	
NBP9507.d325.09	21-Nov-95 10:01:00	
NBP9507.d325.10	21-Nov-95 11:01:00	
NBP9507.d325.11	21-Nov-95 12:01:00	
NBP9507.d325.12	21-Nov-95 13:01:00	
NBP9507.d325.13	21-Nov-95 14:01:00	
NBP9507.d325.14	21-Nov-95 15:01:00	
NBP9507.d325.15	21-Nov-95 16:01:00	
NBP9507.d325.16	21-Nov-95 17:01:00	
NBP9507.d325.17	21-Nov-95 18:01:00	
NBP9507.d325.18	21-Nov-95 19:01:00	
NBP9507.d325.19	21-Nov-95 20:02:00	
NBP9507.d325.20	21-Nov-95 21:00:00	
NBP9507.d325.21	21-Nov-95 22:00:00	
NBP9507.d325.22	21-Nov-95 23:02:00	
NBP9507.d325.23	22-Nov-95 00:01:00	

Files from days 326-340 were collected in transit to New Zealand and not examined as rigorously.

Known problems: Files 334.21, 334.22, 334.23 do not have navigation

Seabeam reboots:		
	Nov 22 0210	Dec 2 1043
	Nov 22 1815	Dec 2 1055
	Nov 23 1017	Dec 2 1252
	Nov 23 2040	Dec 2 1321
	Nov 25 1026	Dec 2 2326
	Nov 29 1040	Dec 3 1005
	Nov 29 1650	Dec 3 1141
	Nov 30 1626	

Seabeam Side-Scan Data Processing

James E. Lundy

The format 41 Seabeam 2112 data being recorded on cruise NBP-9507 on board the Research Vessel Nathaniel B. Palmer includes binary side-scan data along with the ASCII bathymetry data. Since side-scan data basically characterizes the spectral reflectance of the incident surface, it might be useful for identification of the smoothly sedimented terrains as opposed to the rougher, rocky terrains of the ocean floor. In the field this information would be useful when choosing dredge or coring sites. To this end, a test area was chosen to be used to develop a processing methodology for side-scan data. The area chosen corresponded to a six hour track where single channel seismic data were also collected. (The idea being that accuracy of the results of a sediment detection effort could be corroborated by comparison with the seismic profile.)

The MB-System routines (current release 4.2F) are a collection of commands created by the group at Lamont-Doherty Earth Observatory of Columbia University specifically for the processing of the various types of Seabeam data. The general methodology for processing the side-scan data developed here uses a selection of the MB-System routines. The sequence involves the following steps: 1) using 'mbcopy' to copy out data within the region of interest to another file for processing (this was done to help reduce the total amount of data fed to later processing steps to minimize overall processing time), 2) then using 'mbanglecorrect' to correct for beam grazing angle and ocean bottom bathymetry, 3) then passing the data through 'mbfilter' to apply high and low pass filters to enhance or smooth the features of interest, 4) then applying 'mbcut' to remove the natural noise that occurs in side-scan data for beams directly below the ship, and 5) finally using 'mbgrid' to fit the data to a regular grid and dump ASCII format data suitable for use with other visualization programs such as Math Works' MatLab. Math Works' MatLab was a particularly well suited for its ease in rendering and manipulating 2- and 3-D images.

Parts of seven of the eight to ten megabyte Seabeam data files covered the test area. Operation of a majority of the above steps proceeded rapidly but some required up to twenty minutes to complete per file making processing on the available computer equipment with other jobs currently running somewhat tedious and cumbersome. Also, a few small discrepancies or bugs were discovered between the operation of the MB-System commands and that described in the documentation.

The goal for this test area of using the side-scan data for sediment detection was not accomplished within the scope of this cruise. However, the above methodology appears promising. With enough processing power and time to experiment with different filters and filter parameters, the author believes the goal should be obtainable to at least some degree.

NBP9507 Seismic Reflection

Mark Wiederspahn, UTIG

We recorded digital and analog seismic reflection profiles in several sessions totalling about 25 hours. Two streamers were used; one for the first time. We describe experiences with each streamer and associated systems and suggest improvements here.

We collected 100 nm of 48 channel data in the Scotia Sea with a five gun array, in 4000m depth, shooting every 12 seconds at 5-6 kts; this is approximately 20 fold coverage. The weather was marginal, but typical for the area, with 12-15 ft seas and 20-25 kts of wind moderating slightly during the survey.

We also collected 45 nm of single channel data in Bransfield Straits shooting two guns every 5 seconds at 6 to 9 kts. The depth ranged from 800m to 1500m. The weather here was much better, with seas of a few feet and moderate wind of 5-10 kts

Our thanks go to Barney Kane and his ASA crew, who worked hard to rig and deploy the gear in sometimes difficult conditions. Jim Lundy of UTIG volunteered many tedious hours soldering tiny wires to splice the seismic cable pieces together.

Streamers

The multichannel streamer used during this cruise was a newly delivered 48 channel Innovative Technology Inc. ST-5/48. Unlike previous designs from this company, the outer jacket is a tough cut-proof urethane and the internal spaces are filled with waterblock goop, but otherwise, the cable is quite similar in philosophy and construction to other ITI streamers.. A kevlar strength member provides the structural integrity and carries the wires and molded jacket along with it. At intervals, hydrodynamic urethane moldings house a hydrophone. Each single polyvinylidene (PVDF) sensor sheet comprising the hydophone element is wrapped around a tubular core, wired into its appropriate wire pair, and the assembly is molded to the jacket and the wires. The phone spacing is 2.5 m; there are 5 such phones per 25 m group. Inside the inboard phone of each group is a preamp for the group which provides a low impedance differential drive up the cable to the ship. These amplifiers require power from the ship on two conductors shared by all channels. In addition, there is a wire pair with 6 depth sensor/cable leveler (bird) inductive coils approximately equidistantly spaced along the cable. A non-buoyant leader of about 300 m keeps the head of the active section from being pulled up by towing forces. The cable was weighted by 120 lead weights (each 0.833 pounds) taped on halfway between phones, every other phone.

The cable is deployed while steaming at 2-3 kts through the water. The winch, while large, is not particularly fast. Deploying takes around an hour, and retrieval twice as long. Retrieval was done by steaming into the wind at minimal steerage speed to shelter people on the back deck while limiting the pull on the cable as it is wound in. In better weather than we had it might be possible to back down on the cable if the winch could keep proper tension on the cable to lay it properly.

The towing force is transmitted to the leader by a chinese fingers around the leader, with a bungee between the tow point and the fingers to absorb transient towing loads. During one deployment, we measured a peak load of nearly 1300 pounds, which is above the working load the cable is rated for. This should be studied further the next time the cable is towed.

As discussed later, we believe the cable is slightly too light everywhere, and suggest addition of 40 leads of 4 inches x 6 inches (0.416 pounds), or a total of 25 pounds, the next time it is deployed. It might be useful to mark these by using brown bulldog tape to differentiate the weight value from the black .833 pound leads in case it ever need be taken off.

The 20 m 20 phone single channel ITI streamer was used for higher speed work in more icy conditions. It intentionally is balanced very shallow, and has no birds to affect this, nor depth sensors to verify it. It is quite noisy at frequencies less than 50 Hz.

Wiring

The streamer was shipped to the Palmer in three pieces: the leader, and two halves of the active section. There are thus three mechanical and electrical splices in the under tension portion of the cable. Apparently there is also a splice at bird location 5, an undesigned-in addtion which was located at a splice when the cable was worked on before it was shipped.

The deck lead which connects the reel end of the streamer to the lab is actually a piece of the leader cable. However, it was cut off too short for the run and there is a splice from the yellow deck leader to three black smaller diameter cables about 20 feet from the forward end of the conduit run. The three black cables separate the three kinds of signals in the cable: power to the preamps in the cable provided by an ITI ST5 24 volt supply, signals from the preamps which terminate in paired banana plugs plugged into the seismic patch panel, and and a bidirectional bird control wire pair plugged into the Syntron bird control unit. The seismic patch panel connects each hydrophone group signal to the corresponding input of the topmost OYO seismic recorder. These connections are too short to reach the spare OYO mounted in the rack just below, nor are the input connectors for both OYO's the same.

The seismic run to the lab shares the conduit with the two gradiometer cables. There is a grounded foil shield around all three cables, but it is possible to see the gradiometer polarize pulse (perhaps as large as 80 volts, at up to 2 amps) at high gain (48 dB OYO preamp and 60 display gain) if the lead-in is open and not connected to a powered up streamer. This issue should be evaluated with the cable powered up if magnetics and seismics are to be done at the same time.

Analog Recording

One seismic channel (near trace, channel 1) was selected for analog monitoring. A parallel connection to the OYO input at the seismic patch panel was made into an Ithaco model 455 differential preamp at 50 dB gain to send this monitor signal through Kronhite model 3700 filters to an EPC model 4800 recorder. A second similar recorder and preamp/filter combination (at -10 dB gain) was used for sonobuoy display. The preamps and filters are recent acquisitions and were in very fine condition.

The 4800's continue to be a joy to use, except they do not have a very flexible deep water delay. This is especially a problem for sonobuoy work. It would be nice to be able to trigger the EPC's at field time break time, rather than at nav closure time. Currently there is only a buffered nav trigger signal available. This introduces the nav trigger to aim point delay (that of the Syntron gun box) of 35 msec into the analog records. As long as this fact is recorded on the analog records the delay is too small to be a problem.

Digital Recording

The OYO DAS-1 48 channel digital recorder is a mid-size land and marine seismic recorder and replaces the EG&G 2420. At present there are two OYO's; they are substantially similar except for their seismic input connectors and internal tape drive. Few problems were experienced with them, but their limitations might be a problem with other uses. The single HP DAT drive in the upper unit is a medium speed DDS drive. Two are needed if no data is to be lost at tape change time; we typically lost 8 shots (1.5 minutes) during tape changes. 10 seconds of 1 msec sample interval data using IBM floats (8048 format) took 5-6 seconds to write to DAT. Arguably, this is an unusual combination of long record length and high sample rate. The second OYO took 16 seconds to write this 10 seconds of data.

We recorded mostly 48 channels at 1 msec and 8 seconds every 12 seonds. Deep water delay or a larger sample interval would have increased our time between tape changes from 3.5 hours to more reasonable numbers.

The second OYO was used to record the sonobuoy signal from the -10 dB output of the Ithaco on its AUX channel. This arrangement worked without surprises.

If a paper record is made a shot typically is lost. There is no deep water delay possible with the OYO, and plot scale or window changes can't be made while taking data. To stop, change plot scale, and restart takes almost a full minute.

When you restart the DAS program, the preamp gains always default and must be reset using function F2. We used version 1.24 of DAS-1 software, which seems to have a **serious bug** when writing 8015 format; the data comes out in 8048 format, with an 8015 label on it. This is impossible to read unless you have flexible software which lets you override the tape format; not a common capability. We just wrote new copies with the correct format label. Email correspondence with the company reveals that only 8048 has ever worked under MARINE mode!

As an aside, the reason we attempted 8015 (2.5 bytes/sample) instead of 8048 (4 bytes/sample) format was to reduce the length of records to less than 65536 byes so our Sun running SunOS (Solaris 1) could read them. The SGI's on the ship and Sun Solaris 2.4 or later can read longer records.

We strongly urge prospective users to fully examine sample data recorded with the internal sine wave generator. We recorded a 20 mv 20 Hz internal oscillator signal on all 48 channels with the special test cables at 24 dB gain and saw numbers on tape of 0.362 volts., with a repeat interval of 50 msec. (Apparently the raw trace numbers on tape do not include the 24 dB preamp gain, and unless you multiply the trace by the header scalar, you'll get an incorrect value). The internal fft function verifies this amplitude and frequency. The gains of both OYO's were slightly higher than they should have been. To verify that the trigger is operating as it should, we suggest you verify its characteristics with an analog scope, and record it on the aux channel to convince yourself that you are triggering on the correct edge.

It seems obvious in hindsight, but the clocks in the OYO's must be set and checked from time to time. We did not check this initially, with the result that our tapes 1-5 have time offsets, as follows:

correct time 11/18 day 322 07:55:00 oyo #1 reads 11/16 08:09:50

correct time 11/18 day 322 07:56:00 oyo #2 reads 11/15 03:00:41

The OYO emits record number at each shot, but at the start of writing to tape, not at the start of shot, due to problems in its internal architecture. This output correlates external time of receipt with record number. Because this output occurs before a write to tape is attempted, it can't be used directly to detect a missing shot.

Guns and Gun Control

Six SSI GI 210 cu. in. air guns operated in GI mode were towed in port and starboard 3 gun linear strings on a single tow bar. The gun depths were controlled by ballons attached to the gun tow bar. The resulting signature is very repeatable. This towing scheme is shortly to be replaced by a linear 6 gun string with a single large hose/signal cable bundle. During the single channel recording, two guns fitted with 50 cu. in. reducers were towed on a single bar. The smaller size as well as the shallwer tow depth should increase the frequency content.

The Syntron gun controller worked quite well. As with all array controllers, it is very dependent on having a working blast phone for each gun, so each blast phone and each solenoid should be deck tested before any array goes into the water. Towing from tow points above main deck level (top of the A-frame!) was attempted for a short time, with very poor results. Overall, gun reliablity was good, except one gun of the 6 consistently gave problems throughout the cruise. Gun fire jitter was typically less than 1 msec with occasional 1-2 msec glitches for several guns. No antifreeze was injected into the air lines. This limits the time a gun can be towed before it must be fired; this may be an undesirable operational constraint.

Depth Control

Syntron RCL-3 birds were positioned in 5 of 6 possible locations along the cable. Each bird has an electronics and battery unit with variable angle wings, and a flotation tube to make the whole assembly neutrally buoyant. These birds report both depth and wing angles, and so provide a good measure of how the cable is towing in different sea conditions. Unfortunately, none of this information is presently logged. There is a serious lack of coverage because the coil at position two (near channel 12) does not work. An alternative to having no control at all is pre-programming a bird for a set depth in this location. We chose to leave the bird off, in part to see if we had a problem or not, and partly to allow choosing a deeper depth if the cable was not stable at 30 ft with the relatively large seas. We would have preferred to tow the cable at the same depth as the guns, to prevent two ghost notches from two sets of surface relections. The cable, as now balanced, is slightly light everywhere at 5 kts, with wing angles generally plus minus 5 degrees. The heavy leader will probably cause the head to drop for slower speeds; during recovery of the guns bird #1 was at 200 feet.. There are tendencies at the head and the tail to be quite light in higher seas (12-15 ft), causing large sustained down wing angles.. Because we could not monitor the area around bird two, only towing noise can be use to infer balance. There are suggestions that this area may be light. This might mean that the entire cable balance might need to be adjusted if it were to be used without birds (in heavier ice conditions).

The Syntron bird control unit must be set up to synchronize to the recording cycle. Interogation takes 5 * 0.2 seconds for all birds resulting in a band of high frequency noise across all channels. We found that setting the interrogate delay to the seismic record length gave acceptable results. The actual pertubation for an 8 second setting when triggered by the nav buffer box contact closure lasts from 9 to 10 seconds, or approximately just before the next shot. The timer resets on every trigger, so the interval can't be set for longer than one shot time.

Sonobuoys

We attempted 3 type SSQ/41b automatic gain control sonobuoys. All turned on and lasted a short while, but only the third lasted any appreciable time (1.5 hours). We attribute this partly to a low quality antenna (a hasty jury rig of NBP9301's jury rig) and partly to high seas. The antenna location, cable run, and tuner/amplifier chain were identical to that used before. We have not carefully analysed the digital data yet, but no breakouts were observed on the analog records.

We removed the plastic outer cases, and dropped the inner aluminum electronics tube from the upwind side of the wing bridge railing without other disassembly. None fouled in any of the towed gear.

Towing Noise

We collected a few towing noise records during the end of the 18 hour segment when weather conditions were best. The rms noise information was generated by subtracting the dc offset from each trace, and finding the square root of the sum of the squares of each sample less this bias. The values are adjusted for the preamplifier gains. The plot of channel number vs. rms noise shows the after half of the cable towing more quietly than the front half. At best, the noise is about 1/2 microvolt. There is a much noisier area from channel 10 to 20, which roughly corresponds to the area which bird 2 controls. This noise is often seen in other records.

The "signal to noise" plot was made using the MATLAB spectrum() function on each channel averaged over two shots and four noise records. The actual method used by spectrum() is not fully described, but the ratio between two such power spectra is likely to be more or less unbiased. The signal to noise plot shows useful signal from 30 Hz up to a notch around 100 Hz (from the cable-surface ghost) to perhaps as much as 150 Hz, where the gun to surface ghost notch should begin. This plot is only an indication; it is strictly true only for the Scotia Sea. Also note that 5 seconds of the 8 second "signal" is just towing noise, so the relative amplitude is probably not important.

The noise record also shows low frequency noise moving away from the ship at an apparent velocity of 1625 m/sec. As we were sideways to the seas at the time, it may be waves arriving slightly obliquely, or it may be longitudinal tugging noise propagating down the strength member or the jacket. We've seen similar faster than water velocity arrivals in earlier data from this streamer iwhen the ship was steaming into the seas, so we think the latter does occur.

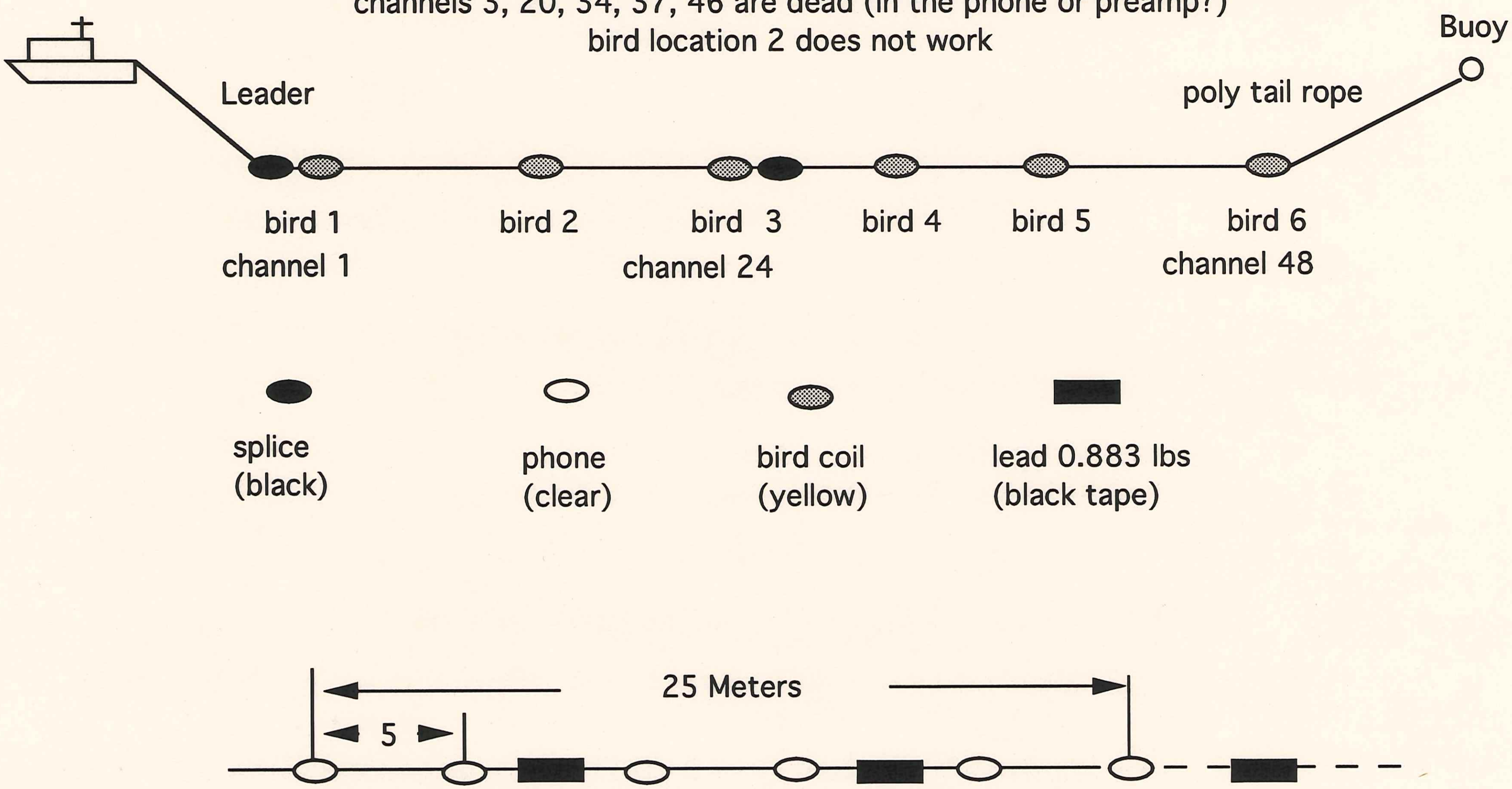
Offsets and Depths

GPS antenna to stern	44m	based on ship's plans, frame 0-72
multi-channel:		
stern to gun offset	53m	based on tow geometry and visual
gun to 1st active	265m	based on middle of dwave at 1451 m/sec water velocity
streamer depth	30 ft	(not ideal but it was rough)
gun depth	15 ft	set by floats
single channel:		
stern to gun offset	53m	based on tow geometry and visual
gun to active	145m	based on middle of dwave at 1451 m/sec water veolocity
gun depth	10 ft	set by floats
streamer depth	--	unknown, but near surface

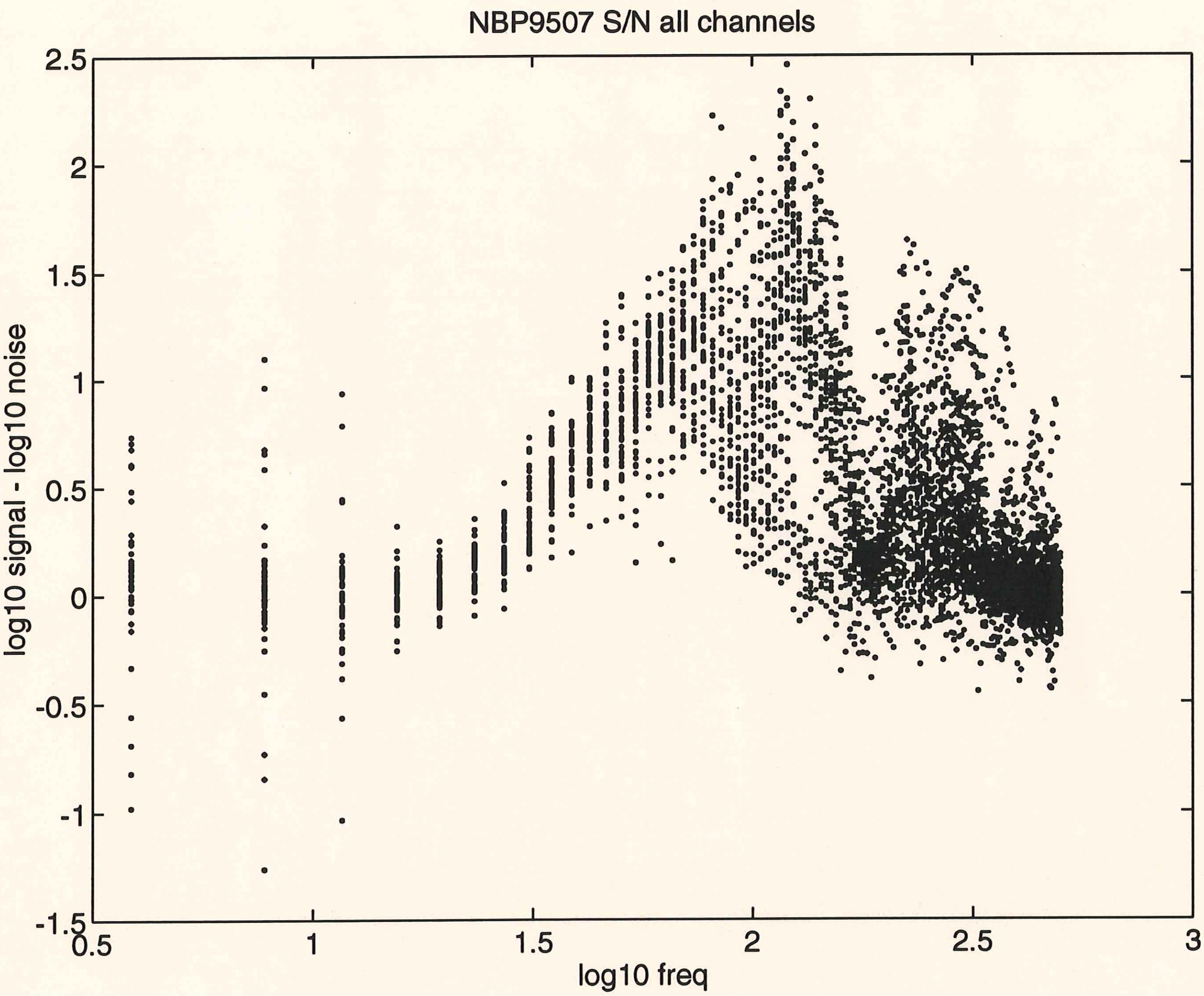
NBP 9507 Multichannel Streamer

ITI serial number 9536

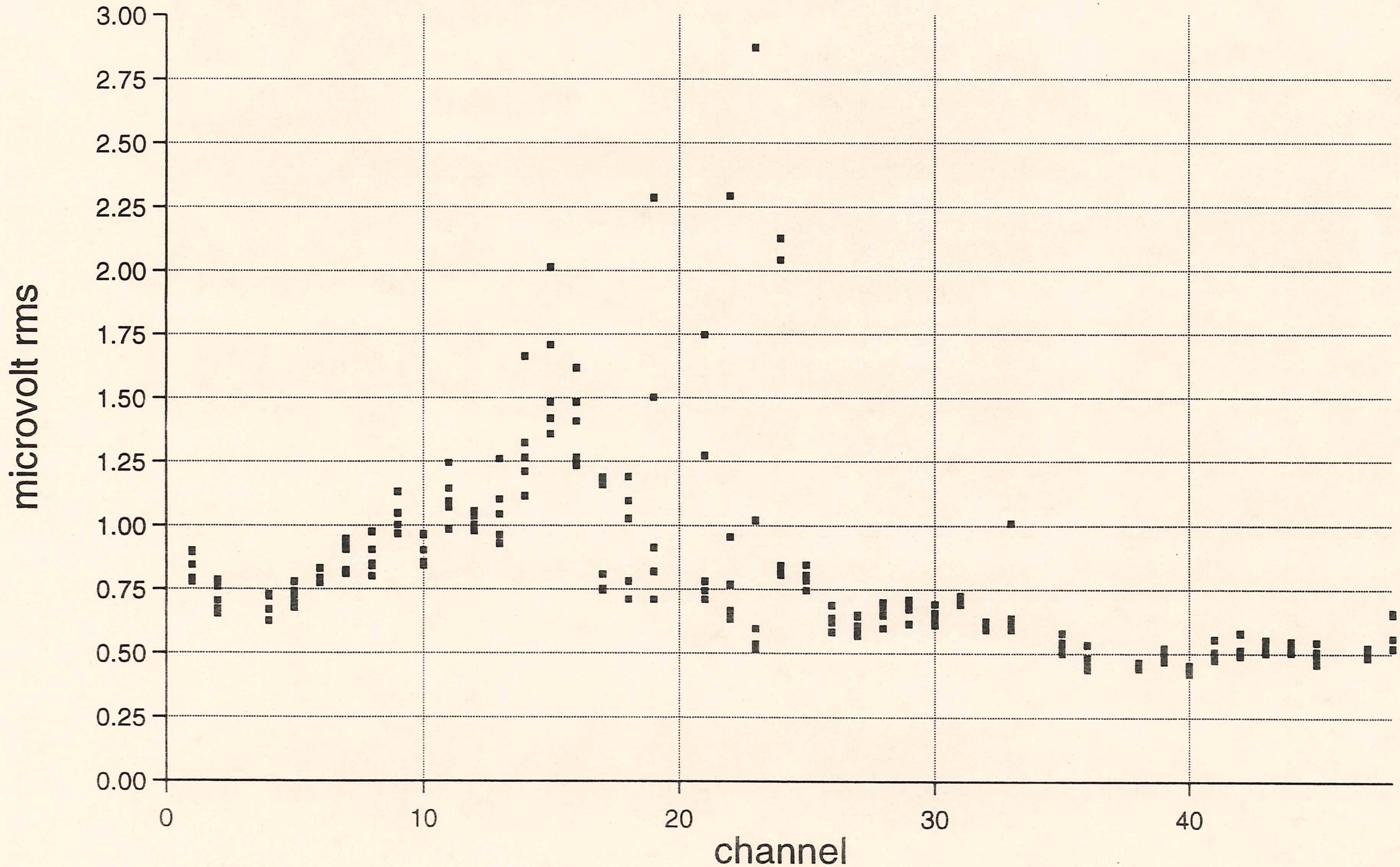
48 channels / 1200 m / 25 meters per group / 5 phones per group
channels 3, 20, 34, 37, 46 are dead (in the phone or preamp?)
bird location 2 does not work

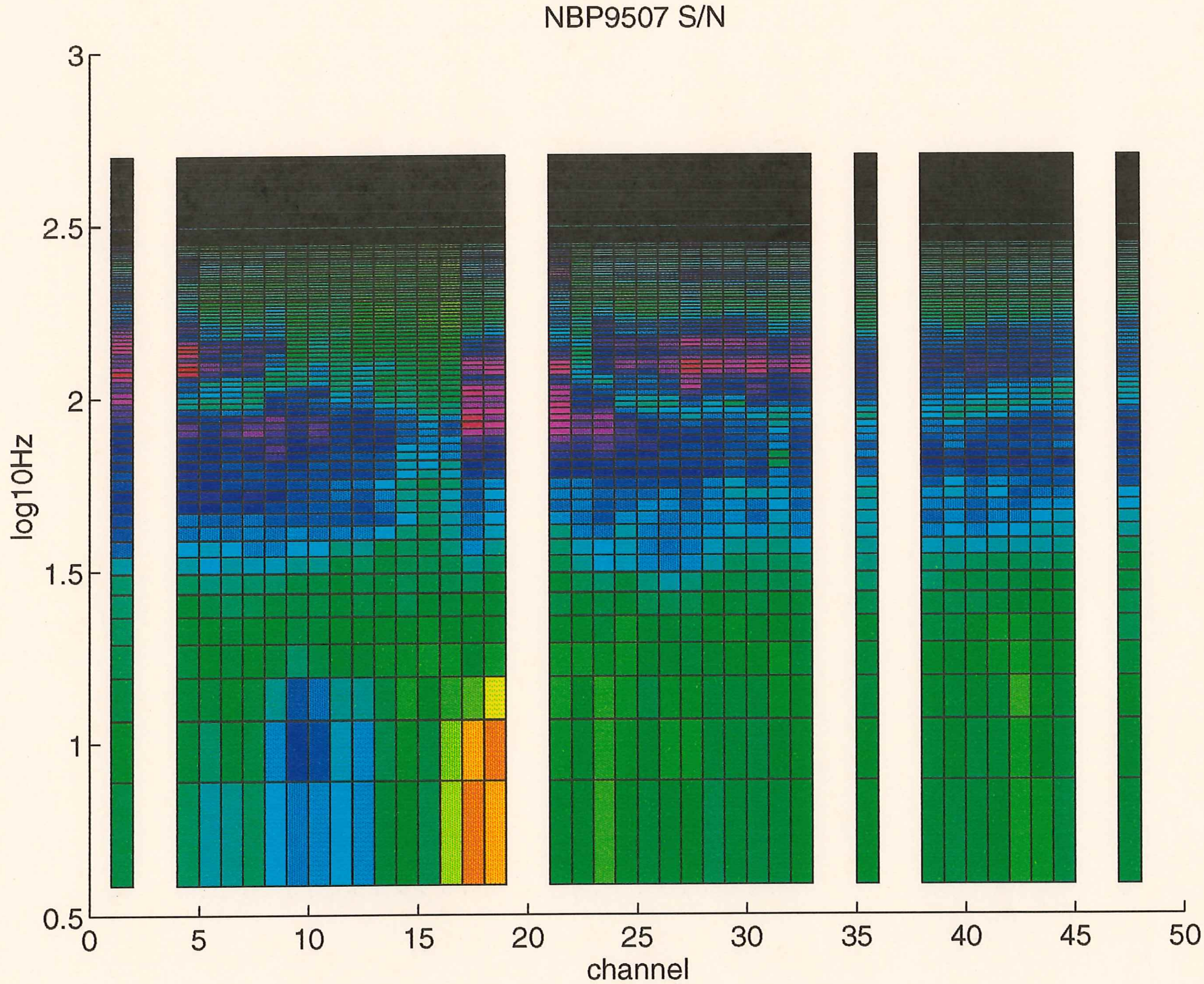


Single channel group of 5 phones -
preamp is inside forward phone


NBP9507 S/N all channels
log10 signal - log10 noise
log10 freq
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0.5
1
1.5
2
2.5
3

NBP9507 Tow noise





NBP9507 S/N
3
2.5
2
1.5
1
0.5
log10Hz
0
5
10
15
20
25
30
35
40
45
50
channel

Kasten Coring Report- *NBP9507*

Amelia Shevenell

A Kasten coring system was used on the *NBP9507* cruise to collect 3 meter long, high volume sediment cores from the central Bransfield basin, Bransfield Strait, Antarctica. The device is a modified version of the Kastenlot coring system and has been proven an effective method for sampling soft, fine grained sediments, while preserving the sediment water interface. The system was successful in the region and five cores were collected in seven deployments.

The Kasten Coring Device

The stainless steel kasten coring device (fig. 1) consists of a 91.5 cm long weight stand, a 305 cm by 12.7 cm square core barrel, and a nose piece. Each piece has been designed to minimize core deformation upon collection. Extensive modifications have been made to assure this.

The weight stand is open at the top to allow unrestricted flow of water through the corer during descent. In addition, a 30 kg sliding weight, placed on the barrel of the core, serves to lower the center of mass of the system, insuring vertical orientation upon descent. This reduces the risk of angled penetration and eliminates the high pressure bow wave usually present upon penetration of the sea bed by controlling the penetration speed. The elimination of the bow wave aids in the almost perfect preservation of the sediment water interface.

The 300 cm barrel is attached to the weight stand by two quick release retaining pins. The thin walls of the barrel (0.27 cm) are designed to minimize core shortening and disturbance during penetration.

The cutter nose, located at the end of the barrel, is the first part of the device which penetrates the sea floor. Thin stainless steel flapper doors recessed inside the nose piece are designed to close upon pullout, thus securing the sediment core within the barrel.

Finally, the barrel has five removable panels (60.96 cm long) which provide post collection access to the entire length of the core. Panels held in place by metal screws may be easily removed on deck immediately after the core is brought on board in order to identify and contain the sediment water interface. The ease with which this is done on the deck further encourages the preservation of an intact sediment water interface (Kuehl and others, 1984).

Kasten Coring Techniques

During the cruise *NBP9507* of the *R/V Nathaniel B. Palmer*, Ben Sloan of the University of Texas Institute for Geophysics and Amelia Shevenell, an undergraduate at Hamilton College and student of sedimentologist Eugene Domack, were in charge of the kasten coring operations, assisted by Antarctic Support Associates Marine Technicians: Barney Kane, Mark Talkovic, Rhonda Kelly, and Christie Campbell. Deployments were generally successful and improved with practice.

The first deployment was attempted from the aft A-frame. The device, which was configured with an additional 1000 pounds of lead weight, was lowered at a rate of 50 m/min. However, as the winch payout approached the depth reading given by the Bathy 2000 3.5 kHz sub-bottom profiler, a tension decrease indicative of bottom penetration had yet to be observed. An additional 20 m of wire were paid out, still a tension decrease did not occur. The device was retrieved at 50 m/min. and was recovered. Upon recovery, the barrel was free of sediment, indicating that the device had never touched the bottom. We believe that the depth soundings from the various depth indicators may have been slightly off and that the core never touched the bottom. Given the unsuccessful recovery attempt at the aft, the coring device was moved to the starboard A frame, where Kasten coring had been extremely successful during the Domack and Anderson cruise earlier in 1995.

The following six core lowerings were deployed from the starboard A- frame. The second core recovery attempt initially appeared to be successful. The device was lowered at 50 m/min. and stopped for a minute, 100 meters from the bottom, as estimated from an average of Bathy 2000, Simrad, and multi beam center beam readings. The corer continued its descent into the bottom at 15m/ min. Penetration and collection appeared to be successful, as a decrease in tension upon penetration was observed, followed by a tension increase upon pullout. The core ascended at a rate of 50 m/min. to the surface where marine techs were on hand to bring the core on board. However, as the core emerged from the water, the sediment began to fall from the core. What was estimated to be at least a meter of sediment was lost before the device could be brought on deck. Quite a disappointment.

Upon examination of the cutter nose, it was determined that the thin doors had never closed after pullout. The doors were flush against the walls of the cutter nose and were stuck. Barney removed screws that had previously been flush with the walls of the nosepiece, behind the recessed doors, and replaced them with longer screws which served to create a small space between the doors and the walls, thereby preventing suction. From the successful collections which followed core 1-B, it was apparent that the modification was successful.

Five core lowerings followed and all were successful. The procedure was similar to that described above, with a few slight modifications. Instead of the wire cable which had previously been used to suspend the collar weight, a rope was used, with the assumption that it would be less likely to get caught on the weight stand. Also, there were a few slight changes in the descent rates. Succeeding cores descended to 100 m above the bottom at a rate of 75m/min. The device was then stopped for a minute to allow the wire to straighten . The descent rate into the sediment varied from 6 to 10 m/min.; however, by a process of trial and error we determined that the slower rate of 6m/ min. was more effective in obtaining an intact sediment water interface without over penetration.

After the core was brought on deck, the barrel was separated from the weight stand, the collar weight was removed, and placed horizontally on the deck. Pieces of foam were pushed into the barrel to prevent sediment loss. If over penetration had not occurred, the plates were removed until the soupy sediment water interface was visible. The foam pieces were pushed down the barrel until contact with the sediment occurred. This processes insured an intact sediment water interface until processing. The core barrel was moved into the wet lab for processing.

Core Processing

Sloan and Shevenell processed the cores and took a number of samples to be brought back to the United States for further sedimentologic and foraminiferal analyses. First, the outer core barrel was cleaned and the cover panels removed. The core surface was scraped clean using a wide spackling knife. Scraping the core across the width of the barrel made the sedimentary structure more visible, but avoided any cross contamination which may have occurred had the core been scraped down its length. After a clean sediment surface had been created, a tape measure was placed down the length of the core, and visual descriptions and a photographic log were made.

Before archive samples were taken, Ben Sloan took samples to be used in micropaleontologic studies. He sampled the top 10 cm of the cores by pushing a 10 cm long by 2 cm diameter syringe into the top of the core The plunger was removed, cleaned and placed in the opposite end of the syringe to obtain an uncontaminated sample of the sediment water interface. Then, one cm thick samples were extruded from the syringe, cut with a clean knife and placed in whirl packs. Then, a small amount of a 10% formaldehyde solution [mixed with rose bengal protoplasm stain until the solution is the color of cherry Kool- Aid] was added. The samples were kneaded gently to disperse the stain throughout the sample. Ten samples from the top 10 cm were processed in this way for each core.

Following the descriptions and foraminiferal sampling, sedimentologic samples were taken. First, Plexiglass archive trays 30 cm long, 12.7 cm wide and 2.5 cm thick were pressed into the core down its length. The trays were labeled with cruise, core number, depth interval, and the stratigraphic up direction was indicated with an arrow. Then a Plexiglass sheet was placed into the grooves of the tray and pushed horizontally into the sediment, along the core. This archiving process preserves a series of 2.5 cm thick slabs for the entire length of the core and eliminates the need to archive the entire core. The trays are removed after the sheet is in place, cleaned, and the ends taped to prevent sediment loss during shipping. The process is crude and takes a lot of strength especially with coarse sediments. An extra Plexiglass sheet placed vertically into the sediment, at the end of each tray, acted as a stopper to prevent sediment compaction and pushing into the next tray. Soupy sediments may have gotten a bit disturbed in the process, especially at the sediment water interface. The samples will be taken back to Hamilton College, x-rayed, and archived.

After the archive samples were secured, a series of samples were taken every 10 cm to be used for further sedimentologic and foraminiferal analyses. A clean syringe barrel, 10 cm long and 2 cm in diameter, was pushed into the core every 10 cm. A 10 cm long, 2 cm wide sample was collected and placed in labeled whirl pack bags. The syringe was carefully cleaned between each sampling interval to avoid contamination between samples. Two sets of samples were taken, one will be carried to UTIG and the other to Hamilton College. Following the completed sampling process, the core barrel was brought to the deck and its contents were washed over the side.

After a few initial problems with the deployment of the kasten corer, the system worked extremely well. The five high volume sediment cores provided many samples which will prove valuable to future sedimentologic and foraminiferal research. We would have liked to collect more cores in the central Bransfield basin but time and science schedules did not permit this. We lost some time in the initial stages of the coring project due to logistical problems and some trial and error collection. To reduce time lost in future coring attempts we would suggest using the starboard winch on the Palmer, stopping the wire 100 meters from the bottom. From this point, we suggest a descent rate at 6m/ min. or less for the collection of an intact sediment-water interface.

Kasten Core Lowerings-NBP9507

No.	Julian Day	START Time (z)	Latitude	Longitude	Depth (m)	Hit Time (z)	Pullout Time (z)	Max. Tension
1-A	311	12:31	62°18.40'S	57°41.80' W	1997.70	*	*	*
1-B	311	17:17	62°18.59'S	57°42.22' W	1995.00	18:03	18:05	3000
1-C	311	21:06	62°18.57'S	57°41.82' W	1998.20	21:42	21:43	3100
2	319	19:25	62°12.45'S	57°29.63' W	1973.00	20:01	20:03	3100
3	321	05:17	62°39.63'S	59°05.96' W	1422.10	05:49	05:50	2500
4	324	09:40	62°54.24'S	60°04.70' W	1070.80	10:17	10:18	2000
5	325	07:30	62°59.20'S	60°13.10' W	1012.00	07:42	07:43	1800

Visual Description of NBP9507 Cores

Core 1-A: Location: Near high heat flow region, Central Bransfield Basin
Sea State: 3-5 foot swells
Multi- Beam Depth: 1925 m
Winch: Aft
Rates: Descent: 50m/min., 20m/min., Ascent: 60m/min.
Tension at pullout: none observed
Results: no recovery, no mud on barrel

Core 1-B: Location: Same as 1- A
Sea State: 1-2 m chop
ZAPS Depth: 1940m
Winch: Starboard
Rates: Descent: 50m/min., 15m/min., Ascent: 50 m/min.
Penetration Payout: 1962 m
Tension at pullout: 3000#
Results: wash out at surface- no recovery

Core 1-C: Location: Same as 1- A

Sea State: 1-3 m swells

ZAPS Depth: 1940m

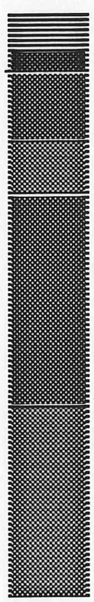
Winch: Starboard

Rates: Descent: 75m/min., 15m/min., Ascent: 60 m/min.

Penetration Payout: 1962 m

Tension at pullout: #3100

Results: 3 m core recovered, over penetration, no sediment-water interface



Core 2: Location: Central Bransfield Basin, between small hill and Fish Ridge

Sea State: 1.5 m chop

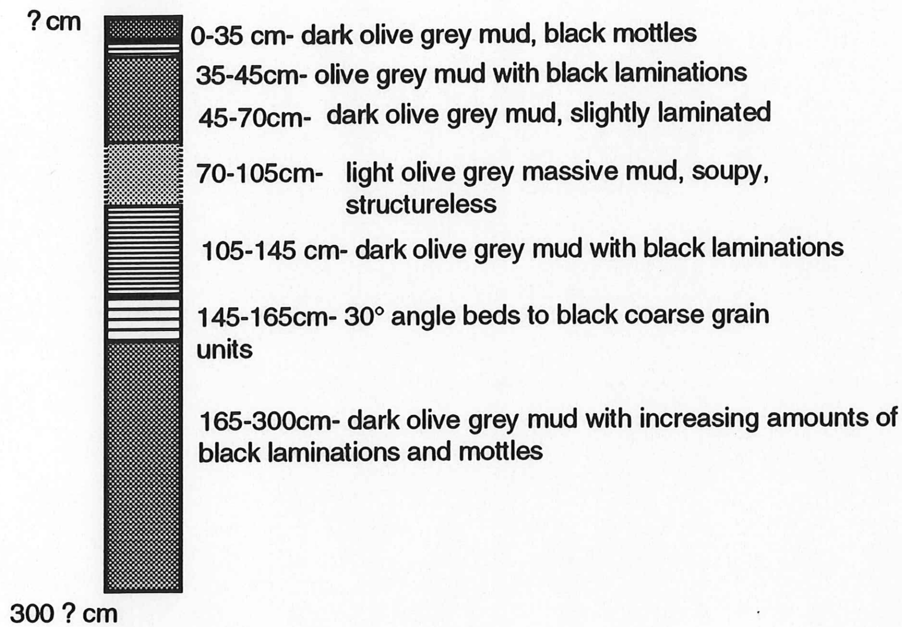
Depth: 1965m (Bathy 2000)

Winch: Starboard

Rates: Descent: 75m/min., 10m/min. Ascent: 75m/min.

Penetration Payout: 1924m

Results: 300 cm core without intact sediment-water interface



Core 3: Location: Valley between two of Three Sisters ridges

Sea State: 3- 4m seas

Depth: 1433 m (Simrad)

Winch: Starboard

Rates: Descent: 75 m/min., 7m/min. Ascent: 50m/min.

Penetration Payout: 1394m

Tension at pullout: #2500

Results: 295 cm recovery with sediment water interface intact

0cm

0-10 cm- soupy olive brown mud
10-40 cm- dark olive grey laminated mud
40-55cm- black coarse grained unit
55-85 cm- motttled olive grey and black mud
85-100cm- coarse sand and gravel, fining upward
100-115cm- dark olive grey/ black laminated mud
115- 152cm- black sand and cinder unit with some olive grey mud
152-200cm- dark olive grey mud with black motteling
200-220cm- very coarse black sand
220-297cm- structureless, homogeneous olive grey mud

297cm

Core 4: Location: Flat bottom at west end of Labrys Ridge

Sea State: calm

Depth: 1080m (Bathy 2000)

Winch: Starboard

Rates: Descent: 75 m/min., 10 m/min. Ascent: 55m/min.

Penetration Payout: 1036m

Tension at pullout: #2000

Results: 42 cm core recovered with intact sediment water interface

0cm

42cm

0-8cm- moderate olive brown soupy mud
8-30 cm- olive grey mud with faint black laminations
30-42 cm- olive grey mud with increasing black laminations, stiff

Core 5: Location: 20 km from Deception Island

Sea State: calm

Depth: 1009 m (Simrad)

Winch: Starboard

Rates: Descent: 75 m/min., 8 m/min. Ascent: 75m/min.

Penetration Payout: 973 m

Tension at penetration: #1800

Results:35 cm core recovered with intact sediment water interface, short due to contact with coarse, hard cinder layer at 35 cm

0 cm

35 cm

0-8cm- olive brown, soupy mud
8-30 cm- olive grey mud with some thin black laminations
30-35cm- black coarse sand, very dense

Appendix 1: Kasten Core Inventory

Coring Apparatus

1 weight Stand
1000 pounds lead weight
3 square core barrels
1 nose piece
1 30 kg sliding weight
2 barrel retaining pins
2 lines to suspend sliding weight

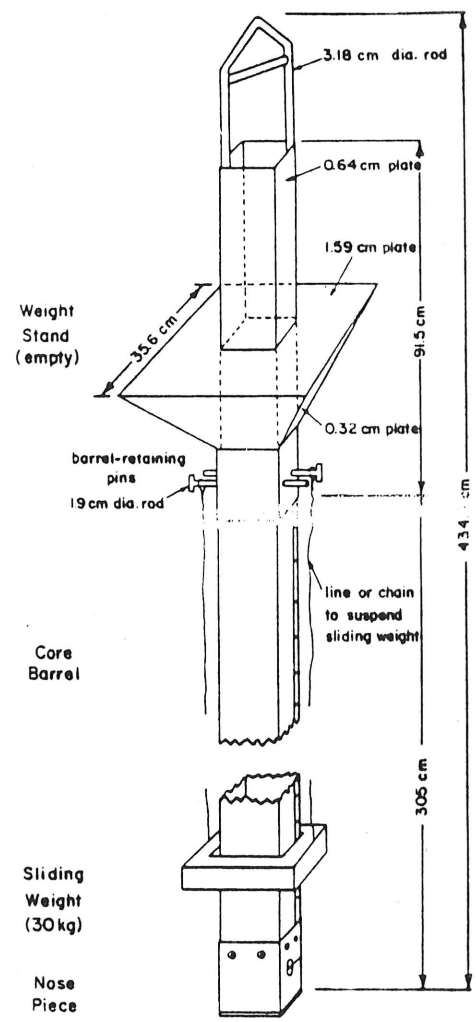
Sampling Inventory

Sub sampling trays
1 wide spackling knife
1 Rock Color chart
1 tape measure (Metric)
Whirl Pack sampling bags
Camera
5 Syringes- 10 cm long x 2 cm diameter
1 rinse bottle Formaldehyde/ Rose Bengal solution
2 boxes large Ziploc freezer bags
1 roll Duct tape
2 boxes large Kimwipes

Appendix 2: Kasten Core Deployment Procedure

1. Rig Coring Device
2. Alert ASA computer techs to enable winch display
3. Deploy from starboard A-frame
4. Descend at a rate of 75 m/min.
5. Stop 100 meters above the shallowest bottom reading
6. Wait for one full minute to straighten wire
7. Descend at a rate < 10 m/min.
8. Watch for the tension reading to fall to about 1000#
9. Payout 1-2 meters after tension drop
10. Stop wire, note time and payout
11. Pullout slowly, note tension (1000- 1500#)
12. Ascend at 60m/min.
13. MT's should bring core on deck using one tag line
14. place the core on deck, remove the barrel and weight from the weight stand
15. secure the sediment-water interface using foam pads
16. Bring the core inside for processing

Fig. 1. Kasten coring device used on cruise NBP9507
(from Kuehl et al, 1985)



Reference: Kuehl, S.A., Nittrouer, C.A., DeMaster, D.J., and Curtin, T.B., 1985. A Long Square Barrel .Gravity Corer for Sedimentological and Geochemical Investigation of Fine-Grained Sediments. Marine Geology, vol. 62:365-370.

Dredging Report for NBP9507

L.A. Lawver with assistance by Randall Keller

EQUIPMENT

Dredge

We used the large dredge that had been used on NBP9301. There was a smaller dredge on board but it was not used. Both dredges consist of a chainbag attached to a rectangular mouth. One is approximately one meter wide, and the other is a little over half that size.

The iron rings that make up the chainbag on the dredge were unusually large (4"), so fishnet that had been purchased in 1993 was used to line the lower part of the dredge. In 1993, the fishnet was made into bags slightly larger than the chainbag, and was meant to increase the chances of recovering small samples (not necessarily a good thing as it turned out). A burlap sack was added to NBP9507 Dredge #3 but it was not tied in and was not present when the dredge was recovered.

In 1993, the dredge was rigged with a weaklink system designed to break well before there was any danger of damage to the wire if the dredge became stuck on the bottom. Connected directly to the dredge handle was a 3/4" (4.75-ton) shackle. This shackle was the weakest link in the dredge rigging, and was meant to break first. Above this weaklink was a 7/8" (6.5-ton) shackle, a 5-ton swivel, and then a 1" (8.5-ton) shackle attached to the wire . Also connected to the 7/8" shackle was a length of 5/8" chain that ran down the handle of the dredge and looped around the side of the mouth of the dredge. This chain was doubled up and tied together with 3/8" nylon rope, and was attached to the dredge handle with hose clamps and light chain. The rope was intended to absorb some of the shock of the weaklink breaking, and then the chain would yank the dredge to the side, hopefully dislodging the dredge. In 1995, the dredge setup was slightly modified from the above. While a weak link was included, it was not as elaborate as the system described above. Since the largest pull that we got was 5000 lbs on the uncalibrated tensionmeter, and our dredging targets were more defined we did not preceive the need for quite so elaborate of a setup.

Winch

All dredging was conducted using the aft A-frame and winch with three-strand, 19 lay, 9/16" wire. The winch has a high (~20-70 m/min) and a low (~10-50 m/min) gear, but it is difficult or impossible to switch gears when there is any more than very light tension on the wire. In high gear the dredge can be lowered and raised at about 70 to 80 m/minute but the high gear can not be run at less than 20 m/min. The time to change gears costs about 3 to 5 minutes. In the case of dredging, the benefits of more control in low gear at low speeds while on the bottom outwayed the benefits of the higher speeds of high gear for the descent and return. In deeper water depths it would be reasonable to run the dredge in high gear until it was near the bottom and then switch to low gear. The winch controls are located in the aft control house, which is far from the area of the lab where we had the depth recorders. In 1993, two persons in constant radio contact were required to monitor the tensiometer in the winch house and the bottom return on the depth recorder. In 1995, the Simrad bottom depth was displayed on the monitor so we did not need a watchstander relaying depths to us. Instead, since we had already surveyed the dredge sites with Seabeam multibeam bathmetry, we were quite confident of the areas that we planned to dredge. Consequently it was far more important to make sure that the ship went where we wanted it to go. To this end we had Carol Chin on the bridge with a Seabeam derived map of the target site. She would plot our real time positions on the map relative to the dredge targets and make sure that the officier on watch understood where we wanted to go. This system worked remarkably well and the watch officiers, usually Vladimir Repin, did a superb job of keeping the ship absolutely along course even in relatively strong winds which tend to make the ship crab.

Technique

The actual dredging was done by stopping the ship downwind from where the dredging target actually lay. The dredge was lowered to near the bottom at 50 m/minutes while the ship was holding station on the preferred dredge course which had been plotted as "into the wind as possible". The 50 m/minute is based on the fact that the dredge weighs very little compared to the weight of the wire. The first 50 meters or so were let out even slower, around 25 to 30 m/minute so that the dredge will not get entangled in the dredge wire. As enough wire is let out to keep the tension on the wire the lowering rate is increased to 50 m/min.

A brief stop about 50 meters or so above the bottom allows the wire to straighten out, gives the bridge time to check for ship drift and to adjust the ship's heading, and allows the dredger to reconfirm the water depth. The stop is also used to make sure the water depth has not changed and that the position of the ship with respect to the dredge target is still good. After all the checks are made, the dredge was dropped onto the bottom and about another 40 to 50 extra meters of wire were put out. As the dredge is started down to the bottom and while the extra wire is being put out, the bridge is asked to get the ship underway at about 1 kt or so on the planned course.

As the ship gets underway, more wire is slowly (~10 m/min) put out until the ship reaches the dredge target point. At that time, the winch is stopped. Usually when the dredge first touches bottom there should be about a 150 to 200 lbs. drop in the tension seen on the tensionmeter. As the ship starts up with the dredge on the bottom and more wire is put out, there should be little fluctuation in the tensionmeter other than that normally produced by ship roll and pitch. As the winch is stopped and with the ship underway, pulls should then be seen on the tensionmeter. If no pulls are seen, either the dredge is not on the bottom or the bottom is very soft and probably covered with mud. When dredging rocks on shallow slopes, tension will probably not exceed 5000 lbs or so. On NBP9307, we dredged very steep slopes looking for massive fresh basalts. There we found pulls in excess of 12,000 lbs. Once the dredge has crossed the target area, estimated by amount of excess wire out and wire angle, the ship can be stopped and the dredge can be continued to be slowly brought in until the dredge is off the bottom. Dredging should be done by retrieving wire at about 10 m/min in the immediate vicinity of the target, otherwise the dredge may skip over the bottom and not catch on prominent outcrops. Once the ship and dredge are beyond the main target(s), the dredge can be brought in faster but it would be unwise to bring it in much faster than 20-25 m/min while the dredge is still on the bottom. When the amount of wire out is less than the water depth, it is safe to assume the dredge is off the bottom even though there may be no clear indication of an increase in tension due to the dredge bag fully weighing on the wire.

Immediately upon recovery, the rocks were removed from the chain bag. In the case of NBP9507 dredge #2, there were only two rocks so that was not difficult. The third dredge contained mostly mud and some biological specimans that were attached to a few very small rocks. Only the first dredge had a large quantity of rocks. We used the handtruck to move the dredge to outside the double doors of the wet lab. We then handpicked the samples out of the dredge. The samples were placed on burlap sacks on the floor of the wet lab. The rocks were not rinsed off. Biological samples were collected off the rocks by Steve Stevenoski, a high school teacher from Wisconsin Rapids, Wisconsin. The tables of his biological samples are included in the report elsewhere.

Dredging Rationale

Until the 1993 NBP9301 cruise, the only substantial samples of volcanic rocks from the seamounts in Bransfield Strait were from several dredges near 62.2°S, 57.4°W. These rocks were compositionally transitional between island arc basalts and mid-ocean ridge basalts, and thus similar to some back-arc basin basalts. The fact that all of the available dredge samples were from two neighboring seamounts meant that the amount of compositional variation along the length of the Bransfield rift was unknown. Partial geochemical analysis of a small fragment of fresh basalt inadvertantly recovered by piston-core from 62.7°S, 58.0°W suggested that volcanism in that part of the rift was more similar to mid-ocean ridge basalt. In 1993, it was clear that a thorough sampling of as many seamounts as possible in Bransfield Strait was necessary to properly determine the nature of the volcanic activity there. The Klepeis and Lawver compilation of bathymetric data in Bransfield Strait showed that there were at least a dozen eligible dredging targets. All that was needed was a few days of shiptime. The 1993 dredges substantially accomplished the goal of sampling as many seamounts as possible with the addition of a number of dredges done in cooperation with the British Antarctic Survey group.

On the NBP9507 cruise, the dredging was meant to sample possible hydrothermal vent sites. The first two dredges were done at a probable vent site along "Fish Ridge". The third dredge was targeted on a very small caldera-bearing feature near the southwest end of "Two-fingered Jack", the probable southern continuation of the middle of the Three Sisters Ridge.

Dredging Results

Dredging from the RVIB Nathaniel B. Palmer is relatively simple, and the dredging operations during both NBP9507 and the previous cruise NBP9301, were very successful. Two of the three attempted dredges on NBP9507 recovered clearly in situ volcanic rocks (Table 1). Fragments of vesicular basalt were the most common form, followed by rubbly chunks. A few of the samples had a glassy surface and most contained 20% or so vesicles.

The first dredge contained an abundance of biological specimens. Numerous brittle stars, three fish, a seapen, small spider like crab and other small crustaceans clinging to and in the cravasses in the rocks. Besides a majority of vesicular basalts, there were some glacial erratics, one of which was a granite, and a few less vesicular basalts. There was very little glassy rind to the basalts and some appeared to be nearly obsidian. The proximity to Bridgeman Island suggests that some airfall samples may be included in NBP9507 dredge #1.

Dredge Logs

Dredge 1

Dredger, L. Lawver; Officier on bridge, Vladimir Repin; Bridge scientist, Carol Chin; Marine techs, Mark Talkovic and Christie Campbell

Begin: JD 319, 0745z, 62°11.90'S, 57°16.0'W, Depth 1354 m

1400 meters of wire total were let out. Since the target was a relatively steep slope, no extra wire was put out once the extra 40-50 m was let out.

Major pulls:	0827z	2000 lbs
	0840z	?
	0841z	3000-3500 lbs. 3 to 4 pulls
	0845z	3000 lbs.
	0849-0850z	3500-4000 lbs, 3 to 4 pulls with one at 4500 .lbs.
	0852z	5000 lbs. pull and then off bottom with 1050 m wire out

End: JD 319, 0921z, 62°11.70'S, 57°16.0'W, Depth 1142 m

Recovery: 150-200 lbs rocks and biota

Dredge 2

Dredger, L. Lawver; Officier on bridge, Vladimir Repin; Bridge scientist, Carol Chin; Marine techs, Mark Talkovic and Christie Campbell

Begin: JD 320, 0615z, 62°11.70S, 57°11.9'W, Depth 1089 m, Heading 250°

We were about 0.2 n.m. from the start point at 62°11.9'S, 57°17.3'W. We wish to dredge a point at 62°11.9'S, 57°17.65'W. All water depths are from the Simrad.

0612z	62°11.7'S, 57°16.9'W	1094.7 m	lowering the dredge at 50 m/min
0621z	62°11.8'S, 57°17.0'W	1181 m	500 m out
0632z	62°11.9'S, 57°17.1'W	1164 m	1000 m out
0636z		u/w at 1 kt, holding dredge at 1050 m, we had drifted north of target.	
0644z	62°11.8'S, 57°17.3'W	1217 m	
0648z		On bottom with 1230m of wire out, stopped at 1250m	
0650z	62°11.9'S, 57°17.5'W	1162 m, u/w 270°	
0652z		2500 lbs pull, 1250 m wire out	
0655z	62°11.9'S, 57°17.6'W	1156 m	
0657z	62°11.9'S, 57°17.8'W	Wire in at 10m/minute	
0700z		Off bottom with 1220m wire out	

Dredge 3

Dredger, L. Lawver; Officier on bridge, Vladimir Repin; Bridge scientist, Carol Chin; Marine techs, Mark Talkovic and Christie Campbell

Begin: JD 323, 0829z, 62°46.0'S, 59°24.4W, Depth 1352 m, Heading 130°

This dredge presented a difficult problem. The feature to be dredged, the caldera of a small seamount only had a relief of 50 m or so in the coarse of about 400 m or less. The attempt was made to dredge across the area of interest and up the "steepest" wall of the caldera, which really was not much of a target and not very steep. We lowered the dredge at 50 m/minute and stopped above bottom with 1152 m of wire out. We stopped on one rim of the caldera, had to dredge down into it and then up the other side.

0830z	62°46.1'S, 59°24.4'W	1352 m, Start down (46'03.9"S, 24'22.5"W)
0854z	62°46.1'S, 59°24.4'W	1352 m, 1000 m wire (46'05.9"S, 24'22.3"W)
0857z	62°46.1'S, 59°24.4'W	Stop with 1152 m wire (46'05.5"S, 24'23.8"W)
0906z	62°46.1'S, 59°24.2'W	1346 m, Start down (46'06.2"S, 24°09.8"W)
0910z	62°46'04.9"S, 59°24'10.3"W	1320m, 1400 lbs tension
0911z		1420 m wire out, 1346 m depth
0912z		1374 m, on bottom
0914z	u/w at 1 kt o/c 130°	1381 m, Wire out at 10 m/min
0920z	62°46'09.9"S, 59°23'56.7"W	1394 m depth with 1489 m wire out
0929z	62°46'16.0"S, 59°23'53.5"W	1318 m depth, start winch in at 10 m/min
0930.5z		1500-1800 lbs pull with one at 2000 lbs.
0932z		1310 m, 1800-2000 lbs, 1454 m wire out
0934.5z	62°46'17.2"S, 59°23'45.1"W	1304 m, 1500 lbs, 1431 m wire out
0937z		1298 m, high point of dredge, 1402 m wire out
0941.3z		1302 m, 1500-1800 lbs, 1360 m wire out
0944z		1500 lbs, 1334 m wire out, probably off bottom
0947z	62°46'28.6"S, 59°23'32.6"W	1414 m, 1300 m wire, start up at 50m/min

Summary of Biological Collection Techniques: Cruise NBP9507
by S. Stevenoski

On three occasions, November 15, 16, and 19, 1995 dredges of the sea floor in the proximity of suspected hydrothermal vents were conducted in the Bransfield Strait. Dr. Larry Lawver, UTIG and observer Carol Chin, OSU were primarily responsible for the dredging procedure. Rock samples which were obtained were logged and prepared for shipment to Oregon State for further research and investigation by Randy Keller, OSU.

During a cruise on the Palmer in 1993 Lawver and Keller had conducted several dredges in the Bransfield Strait area. During that time a number of biological samples were obtained in the dredge.. Those specimen were subsequently lost due to inadequate resources and information for preserving biological materials on the Nathaniel B.Palmer.

As a precaution, R. Keller had contacted Dr. Craig Cary, Marine Microbiologist formerly of Oregon State to provide a "BIOBOX" for this cruise. The BIOBOX was shipped to the N. Palmer in Punta Arenas and was placed in the ship's bio lab in the event that biological samples were collected.

The Introduction to the BIOBOX Protocols states: "Historically, there is rarely a biologist on board to sample the "biologicals" that may have been collected and many felt that valuable samples were being lost. . . . Our primary goal is to stabilize the specimens in a number of ways so that they may remain "usable" by a variety of investigators. . . . What we decided to do was to put together the bare minimum in sampling with shortest time commitment in that hope that this would yield the greatest results."

The first dredge was conducted on November 15, 1995 and yielded the greatest number and variety of biological samples. The majority of these samples were in excellent condition considering that their presence in the dredge was unexpected. Samples were originally place in unhydrated containers as they were removed from among the rock samples. These samples were later rehydrated in sea water prior to preservation. On subsequent dredges, containers of sea water were on hand to transfer biologicals and prevent dehydration.

Preservation required mixing a solution of 3.7% formaldehyde in sea water using 37% formaldehyde. The 37% formaldehyde was not present in the BIOBOX, and was provided by ASA staff from the ship stores. A total of 3000 ml of formaldehyde fixative was prepared for the preservation of the thirty six (36) specimens.

All specimens were placed in 3.7% fixative and allowed to sit at room temperature for at least one hour. All large samples excluding the three fish specimen, were fixed a second time by pouring off the first volume of fixative and replacing it with a second fresh volume of fixative.. The samples were placed in NASCO WHIRL-PAKS of the appropriate size with a sufficient amount of 3.7 fixative to cover the specimen for preservation and freezing at -40 degrees C. The WHIRL-

PAKS available in the BIOBOX were not large enough for the fish, so sealable plastic bags were borrowed from the OSU group to preserve these specimens.

A written description of each specimen with pertinent measurements were written in a spiral log book for use as a future reference. Care was taken to note condition of the samples, color, and any unique physical characteristics.

The protocol for the BIOBOX requests that samples be classified in one of three categories: worms, bivalve, and other. A more specific identification was made for some of the samples, but the three category was maintained. For example the fish were identified as Other/Fish for classification purposes.

Each specimen was given a collection number. This number was based upon these following scheme: first digit = # of dredge second two digits designating the # of the specimen. ie. Specimen 101 would be fish specimen, first dredge.

A notation of the method of preservation was also included in the log. All of the above information including the date of collection and dredge number were recorded on the specimen collection packs. A typical specimen would be labeled as follows:
Dredge # __________ Date _____________
Sample # _________ Description: _______________
Method of Fixation: _____________

Following the preservation of the samples from the first dredge, Dr. Cary was contacted by email to inform him that samples had been acquired and to request information concerning their future handling and shipment. Following a number of email messages, and discussions among the principal investigators, it was determined that the samples would be hand carried to the U.S. rather than using air freight. The samples would then be sent directly to Dr. Cary upon arrival in the U.S.

Problems and concerns:
Although in theory it makes sense to have non biologists prepare and log biological samples that are inadvertently collected, it will only work in practice if three main points are covered prior to the cruise departure.

1. All fixative and preservation materials must be complete and meet the needs of any size organism collected. In the case of the cruise NBP9507, there was no formaldehyde in the BIOBOX and the plastic packs provided were too small for some of the specimens collected.

2. There must be a permit acquired for the cruise prior to the cruises departure and that permit should be acquired by the biologist to which the samples will be sent. Even if there are no biological samples collected, this is essential. The additional effort required to obtain a permit may be sufficient cause to prevent non biologists from making the effort to preserve samples.

3. A container of sufficient size with appropriate shipping information must be provided to the PI prior to departure. In the case of the NBP9507 cruise, it was necessary to construct a container using cardboard and Styrofoam to accommodate the samples. A specific address or Fed Ex number with method of payment should be provided prior to cruise departure by the requesting biologist.

In general, the collection of the biological samples was a valuable addition to the overall cruise. It provided interesting variety to the geophysics and geochemistry conducted on the cruise. This can only be a successful program if the burden of permit acquisition and shipping is taken care of prior to cruise departure.

Cruise NBP9507 Biological Collection Summary

Dredge # 1 Date: November 15, 1995

Location: 62 11' South Latitude x 57 16' West Longitude Bransfield Strait

Time of Start: 7:45 GMT On Deck: 9:21 GMT

Depth: 1100 meters to 1425 meters

Description of Dredge site: Area was considered a possible location of hydrothermal activity. Primary purpose of the dredge was to collect rock samples. Rock samples were predominantly smooth glassy basalts.

Chief Scientist: Dr. Lawrence Lawver, UTIG Observer: Carol Chin, OSU

Name of Archiver: Steven Stevenoski, Lincoln High School, Wisconsin Rapids, WI

Description of Animal	**Specimen #**	**Fixative**	**Comments**
Fish	101	3.5 Form + Freeze	Chaenocephalus Length = 45 cm color gray and white
Fish	102	3.5 Form + Freeze	Chaenocephalus Length = 28 cm color gray and white Caudal fin absent. Cut behind right pectoral fin
Fish	103	3.5 Form + Freeze	Ophthalmolycus or Lycenchelys Length = 17 cm. Color = blackish gray, olive along dorsal area. Minimal caudal and dorsal fins
Worm	104	3.5 Form + Freeze	Length = 11 cm Diam = 1.6 cm Color Dark gray to olive Body tubular with circular mouth, segmented
Sea Fan	105	3.5 Form + Freeze	Length = 31 cm Color whitish gray to tan. Area of attachment to surface brown. Thin featherlike extensions from central shaft
Flat worm	106	3.5 Form + Freeze	Length = 4 cm Width = .6 cm Color white to light tan. Body flattened. Parallel venation dorsally, segmented with flagellar like projections.
Brittle Star	107	3.5 Form + Freeze	Diameter of main body = 3 cm. Color brown with reddish tint. 3 of 5 legs partially in tact. Two legs completely severed
Brittle Star	108	3.5 Form + Freeze	Diameter of body = 2.5 cm All legs severed. Color brown with reddish tint.
Brittle Star	109	3.5 Form + Freeze	Diameter of body = 3.5 cm All legs severed. Color Brown with reddish tint.
Brittle Star	110	3.5 Form + Freeze	Diameter of body = 3.5 cm All legs severed. Color brown with reddish tint..

Brittle Star	111	3.5 Form + Freeze	Diameter of body = 2 cm Organism is severely damage. No legs present. Color brownish
Other	112	3.5 Form + Freeze	Severely damaged specimen. Fragments of a hard chitenous shell with a few residual organs attached.
Sea Fan	113	3.5 Form + Freeze	Length = 10 cm Color gray. Main shaft and holdfast present. fragments of the filamentous appendages present.
Spider	114	3.5 Form + Freeze	Length of body = .5 cm Average leg length = 1.5 cm Color white to tanish. 8 legs, single articulation joint.
Worm	115	3.5 Form + Freeze	Length = 16 cm Color white to gray. Found attached to basalt rocks collected in dredge.
Worm	116	3.5 Form + Freeze	Length 4.5 cm Color gray to olive. Tubular body
Worm	117	3.5 Form + Freeze	Color is white. Appears to be a fragment of a larger segmented organism. Tubular body
Worm	118	3.5 Form + Freeze	Length = 4.2 cm Color reddish brown. Body shows segmentation, tubular shape, with a single extension/appendage on each side of the segment. Mouth tapered.
Worm	119	3.5 Form + Freeze	Color reddish brown. Prominent line from mouth to anus along midline. Prominent mouth structure, appears to be adapted for attachment.
Worm/worm casing	120	3.5 Form + Freeze	Color white. Flexible hollow shaft. Appears to be a protective structure produced by a round worm.
Other	121	3.5 Form + Freeze	Length 3 cm Color gray with mottled reddish spots. Noticeable flattening of body at one end only. Remainder of body is tubular
Other	122	3.5 Form + Freeze	Color brownish Fragment
Other	123	3.5 Form + Freeze	Colonial type organism removed from surface of basalt rock collected in dredge. Shape flat. Spreading colonial form with large porelike structures

Cruise NBP9507 Biological Collection Summary

Dredge # 2 Date: November 16, 1995

Location: 62 11.9' South Latitude x 57 17.1' West Longitude Bransfield Strait

Time of Start: 06:15 GMT On Deck: 07:28 GMT

Depth: 1089 meters to 1202 meters

Description of Dredge site: Area was considered a possible location of hydrothermal activity. Primary purpose of the dredge was to collect rock samples. Only one large basalt was recovered. All specimens were removed from this sample.

Chief Scientist: Dr. Lawrence Lawver, UTIG Observer: Carol Chin, OSU

Name of Archiver: Steven Stevenoski, Lincoln High School, Wisconsin Rapids, WI

Description of Animal	Specimen #	Fixative	Comments
Worm	201	3.5 Form + Freeze	Length = 1 cm Width = .7 cm Color white with prominent brownish red midline the length of organism. Body flat with filament like projections over entire dorsal surface..
Worm	202	3.5 Form + Freeze	Length = 2cm Width = .2 cm Color white, tissue translucent.. Digestive tract visible with bulbous region at middle of body. Flattened body with filamentous projections on along entire length of dorsal side.
Other	203	3.5 Form + Freeze	Fragment of larger colonial organism found on surface of the rock collected in dredge. Tissue varies in color from white to orangish. Firmly affixed to rock surface. Pore like protrusions at regular intervals along colony.

Cruise NBP9507 Biological Collection Summary

Dredge # 3 Date: November 19, 1995

Location: 62 46.3' South Latitude x 59 23.9' West Longitude Bransfield Strait

Time of Start: 08:29 GMT On Deck: 10:14 GMT

Depth: 1314 meters to 1422 meters

Description of Dredge site: Area was considered a possible location of hydrothermal activity. Primary purpose of the dredge was to collect rock samples. Rock samples were predominantly small basalt fragments and glacial erratic. A significant amount of sediment was also collected.

Chief Scientist: Dr. Lawrence Lawver, UTIG Observer: Carol Chin, OSU

Name of Archiver: Steven Stevenoski, Lincoln High School, Wisconsin Rapids, WI

Description of Animal	Specimen #	Fixative	Comments
Urchin	301	3.5 Form + Freeze	Color purplish to olive with white spines. Spines are mostly smooth with small spiny projections at base. Total number of spines ~ 28. Average length of spine = 2.5 cm. Diam of body = 2 cm
Other	302	3.5 Form + Freeze	Color light tan. Long slender tube attached to inflated saclike body region. Recovered attached to glacial erratic. Length of tube = 11 cm. Diam of sac region = 2.5 cm
Other	303	3.5 Form + Freeze	Color light tan. Long slender tube attached to inflated saclike body region. Recovered attached to glacial erratic. Length of tube = 11 cm. Diam of sac region = 2.5 cm
Other	304	3.5 Form + Freeze	Color light tan. Long slender tube attached to inflated saclike body region. . Length of tube = 12.5 cm. Diam of sac region = 2.5 cm
Worm/Worm Casing	305	3.5 Form + Freeze	Length = 19 cm Color olive to dark gray. Body is tubular with evidence of segmentation. Body is hard with a significant amount of sediment within body cavity.
Worm/Worm Casing	306	3.5 Form + Freeze	Length = 9.5 cm Color olive to dark gray. Body is tubular with evidence of segmentation. Body is hard with a significant amount of sediment within body cavity.
Other	307	3.5 Form + Freeze	Color white. Diam = 6 mm. Sample appears to be an egg or some type of polyplike mass of tissue broken off of a larger organism.

Other/Sea Squirt	308	3.5 Form + Freeze	Organism was found attached to small glacial erratic. Body is nearly transparent with visible digestive tract and other vesicles present varying in color from yellow to olive. Length = 8 cm. Width = 3 cm.
Other/Sea Squirt	309	3.5 Form + Freeze	Body is nearly transparent with visible digestive tract and other vesicles present varying in color from yellow to olive. Specimen appears to be two organisms connected by a single holdfast. Length = 8 cm. Width = 3 cm. for each organism.
Other/Sea Squirt	310	3.5 Form + Freeze	Appears to be a fragment from a an organism similar to samples 308 and 309. Body transparent, with identifiable vesicles. No holdfast present.

NBP9507 Camera Lowerings

Benthos Camera Work NBP9507

Mark Wiederspahn, UTIG

We successfully used the Benthos 371/381 camera system to shoot two rolls of film during two lowerings to about 1000 m in clear water in Bransfield Straits. About half of the 60 possible frames had some useful image.

The camera and strobe seem not to have been used since NBP9301, when we pressure tested the equipment to ca.1000 m, but took no pictures other than tests in the lab. The equipment condition seems the same as when last used. When triggered on the bench and in the cold with the 2 year old 510 volt photoflash battery (480 v measured) and new 9 volt batteries, the camera and strobe operated satisfactorily. The corrosion in the o-ring grooves is still a concern.

The frame with pressure vessels, switch and interconnecting wires without the strobe and camera electronics was lowered with the starboard A-frame on the light mechanical wire to 900 m to test the integrity of the enclosures. No problems were found.

The camera was installed on the Benthos frame at approximately 45 degrees from vertical. We could not decide which was better: vertical camera or slanted camera. We opted for slanted camera due to possible better angle and depth of field. The strobe unit was attached at the other end of the frame, pointing down. The intersection of the two axes is approximately 7 feet from the camera focal plane and about 6.5 feet from the strobe bulb. The bottom trip switch was weighted with a single 2 pound diver's belt weight at 7 feet vertical distance from the lense, or about at the intersection of the camera and strobe axes.

We loaded the camera with Polaroid PolaPan black and white ASA 125 film. Based on previous experience, we expected to get about 30 exposures from a 36 exposure roll. The camera focal distance was set at 6.5 feet, at f 3.5. After the first lowering gave satisfactory results, but lacked areal coverage, we set the trip to 9.5 feet, with focal distance at 7 feet. This seemed to be too large a distance for the strobe because the area is not illuminated consistently out to the photo limits. We set the trip wire for about 8 feet for a planned third lowering.

A 12 Khz pinger was mounted on and within the frame to enable near bottom detection; both the OIS and Datasonics pingers were used. The OIS worked quite well; we sliced the plastic transducer cover during lowering 1, and it was not repaired before lowering 2. The Datasonics pinger was not usable for bottom bounces even at the relatively shallow 1000 m we worked at.

We used the ODEC Bathy 2000 in 12 Khz mode to attempt to track the pinger. The Pinger mode could not be made to work, nor would the 750 m full scale be high enough resolution for bottom bouncing even if it did. We used Single Ping mode at a transmit power of -12 dB and the pulse width at 0.5 sec, in 57 dB Hydro receiver mode, to attempt to keep the ship to bottom bounce out of the pinger signal. With a full scale span of 200 m, finding the pinger signal within the window was a matter of chance. (There is no slew, nor analog output from the Bathy2000.) We set the bottom min-max limit to very tight limits to hasten re-sync of bottom lock. It was quite possible to see the change in echo characteristics when the pinger was at the bottom; the echo becomes much more focused in time. We were able to move up and down about 10 m to repeatedly attempt to trip the camera switch at 6m/min. Any slower engaged the winch brake.

We did not have have a wire out or tension readout in the lab (still). During the second lowering, with the useless Datasonics pinger attached, we found it possible to see the tension decrease from 750 punds to about 700 when the frame touched. This is probably too gross a technique to use unless one is desperate. We think that we dragged the frame over the bottom several times. We had problems with at least one instance of multiple trips during one bottom visit.

After the first lowering, we added more weight to the trip wire, as we found we tripped going down in the water column at 30 m/minute. During the second lowering, no water trip occurred.

We had mud on both the lower legs of the frame, and on the upper strut ends also. after the first lowering. An overzealous marine tech washed off the frame after it came on deck after the second lowering, so we're not sure about the situation then.

At the conclusion of the science leg, the equipment was packed so hurriedly that it was not possible to verify that the camera system was still working before packing, although it was working when it was loaded for the third lowering which never happened. Batteries were removed. All o-ring grooves were cleaned, and fresh grease applied to o-rings. Silica gel packs were put into the canisters before closing.

Lowering Number 1, jday 319 1995

09:52Z lowering at 30m/min from surface to about 1175 m, stopping about 200 m above the depth sounder bottom to feel our way the rest of the way with a new 12 Khz system.

trip	time	comments	
1	10:48	1152 m simrad ek500 (37 Khz) depth @1500m/s	
2	10:57		
3	11:01	62°11.8'S 57°16.5'W 1130m	
4	11:13		
5	11:16		
6	11:19		
7	11:21		
8	11:23		
9	11:25		
10	11:29		
11:	11:32:25		
12	11:42:04	1156 m simrad	
13	11:44:45	1173	
14	11:47:15	1153	
15	11:51:30	1150	1150 wire out
16	11:53:40	1148	
17	11:56:00	1147	
18	11:58:36	1159	
19	12:01:50	1129	
20	12:03:04	1109	poor contact? pinger off screen
21	12:10:15	1171	
22	12:13:15	1155	
23	12:16:06	1147	1137 wire out
24	12:18:34	1132	
25	12:20:54	1136	
26	12:23:26	1143	
27	12:25:35	1126	
28	12:27:38	1088	
29	12:30:16	1092	
30	12:39:06	1083	
31	12:42:03	1090	
32	12:44:12	1081	1081 wire out (!)
33	12:46:24	1092	
34	12:48:46	1136	
35	12:51:10	1122	1088 wire out

12:52 30 m/min to surface

62° 11.65'S 57°16.49'W 1089m

Lowering Number 2, jday 320 1995

07:39Z at surface; 08:13 at 950 m wire out

no pinger bounce usable; all trips done by tension meter change observed in the after winch room.

trip	time	comments		
1	09:07:15	1169 simrad 37 khz @ 1500m/s		
2	09:08:26	1170		
3	09:10:06	1175		
4	09:12:03	1160		
5	09:13:55		1155 wireout	
6	09:21:46	1181	1165	
7	09:24:59	1160	1165	
8	09:26:18	1169	1163	
9	09:27:12	1168	1162	
10	09:28:51	1159	1160	
11	09:30:48	1158	1159	
12	09:33:36	1178	1156	
13	09:36:00	1181	1157	
14	09:??:04	1177	1163	time written as 09:35:04 but probably 09:39:04
15	09:42:17	1167	1170	
16	09:43:38	1163	1167	
17	09:44:43	1165	1165	
18	09:45:50	1167	1161	
19	09:47:05	1178	1158	
20	09:49:49	1171	1152	
21	09:50:33	1163	1153	
22	09:52:27	??	1151	
23	09:54:15	1156	1147	

62°11.9'S 57°17.8'W
1167 m

62°11.9 57°17.7'W

up at 30-40 m/min. on deck at 10:19Z.

NPB9507 Cruise Report: OSU Chapter

written by the Oregon State University Geochemistry Group:
K. Brooksforce
C. Chin
A. Flaveluke
G. Klinkhammer
M. Rudnicki
C. Schneller
J. Simpkins
P. Stoffregen
C. Wilson

1. PROJECT OBJECTIVES

The primary objective of Event S-060 "Hydrothermal Survey of Bransfield Strait, Antarctica" was to undertake a geochemical analysis of the water column above the neovolcanic zone in this back-arc rift area in an attempt to find conclusive evidence for the presence or absence of crustal fluids. The secondary objective of this work was to provide a greater understanding of the hydrography of the Strait. These objectives were undertaken using a two-tiered approach. First real-time information was acquired during the cruise which formed the framework for an underway exploration strategy. Second, water samples were collected for analysis in shore-based laboratories.

2. HARDWARE AND SOFTWARE

2.1 OSU instrument package

The OSU instrument package was developed over the last five years as a tool for the geochemical characterization of the water column. During NBP9507 it consisted of a stainless steel frame holding a SeaBird 911 *plus* CTD, SeaTech Transmissometer (25 cm), Chelsea Instruments Aquatracka Mk III nephelometer, SeaPoint turbidity meter (backscatter device), SeaTech backscatter sensor, ZAPS flow-through chemical sensor, magnetically-coupled gear pump, General Oceanics 12 bottle rosette, Simrad altimeter, and several acquisition, power, digital control, and diagnostic modules including tilt, pitch, and heading. The package weighed 400 kg in air and was deployed from the Baltic Room on the 0.35" conducting cable. The termination of this wire was modified to access all three conducting cables and a special electrical box was constructed to make it possible to switch over between sled and rosette operations.

Topside the system consisted of three computers used for data acquisition, digital control, and navigation as well as an optical disk for data storage. A custom-built deck unit supplied the package with 400V (150W) of power and supported a 14400 baud modem channel for digital control of the ZAPS spectrometer and transmission of 4 data channels, as well as the standard 8640 baud rate SeaBird channel for telemetry of the remaining signals.

Two data streams were sent up the sea cable from the sled: one carried the Seabird CTD data, the other carried the data from ZAPS and other sensors. Once these raw data streams were on board they were merged and then split, one data set was captured immediately on a hard disk the other was passed along for real-time display. The real time data was merged with the ship's GPS navigation, and sent on for processing and real time display using custom-designed software originally written for the Cambridge- IOSDL BRIDGET deep-tow, and subsequently modified at OSU to accommodate the additional sensors of the ZAPS sled. Data processed by the main control and display computer was logged on an optical disk.

The 'fishcomm' program managed the creation of the CTD data file, the real-time display of the sensor data and control of the sled's instruments. The CTD data file was written at the full 24Hz Seabird data rate; other sensor information is posted in the CTD data frame as and when it is received. The data can be displayed numerically or graphically in a variety of formats.

Individual data streams could be viewed in a commands window, which was also used to send commands down the sea cable to sensors on the sled. For ZAPS, a graphical interface is used to control numerous operational parameters. These may be provided manually, or defined in a setup script. The rosette water sampler may also be controlled via a graphical interface. The rosette window displays the current state of the rosette and manages water sampling. Rosette firing and ZAPS setup information is recorded in a separate 'events' file.

After a deployment, typical post-processing of the CTD data file involves averaging the data to a one second data rate, and conversion of the binary format CTD file to ASCII. These tasks are accomplished by the 'one_second' and 'rvstoascii' utility programs.

Navigation data was also logged separately on another computer that displayed the ship's position during each operation. This computer was also used to plot waypoints during tows and drifts. This screen was broadcast on the bridge using the Palmer's video system and used as a common image when talking with the mate about underway maneuvering of the ship.

2.2 The ZAPS probe

Instrumental design

The ZAPS (zero angle photon spectrometer) instrument, developed in our laboratory and deployed during this project, combines the radiant power of xenon light flashes, the sensitivity of photomultiplier tube (PMT) detection, and the versatility of fiber optics. Details of this instrument are given elsewhere (Klinkhammer, 1994). Briefly, in ZAPS a xenon lamp housed in a pressure case produces flashes of white light. These flashes pass through a lens, quartz pressure window, and a narrow-band interference filter that selects the wavelength of interest. Monochromatic light from the interference filter is focused onto the polished end of a bundle of fused silica, low-fluorescence optical fibers potted in a stainless wishbone-shaped tube with epoxy. The other end of the excitation bundle is surrounded by a concentric ring of detecting fibers. Light impinging on the ring passes through a second interference filter and quartz window before reaching the PMT and self-contained power supply. Photons hitting the PMT produce current pulses which are converted to voltage and amplified to give a 0-5 volt output using a circuit designed and fabricated in-house. The ZAPS Probe can operate between 200 and 900 nm and at depths down to 6000 meters.

Key operating parameters of the ZAPS spectrometer are digitally controlled by two-way modem communication with the ship using the 'fishcomm' program. Flash lamp intensity, PMT bias voltage, flash rate, integration time, and pump rate were controlled through interactive software on board the ship. The pump was a special Nd-Fe-B magnetically coupled device that was designed and constructed in our laboratory to deliver a constant volume to the chemical sensor. This pump was deployed for the first time for this project and performed well. In addition to controlling the flow rate, 'fishcomm' also monitored the rpm and current of the pump.

***In situ* measurements of dissolved manganese**

Other workers have shown that Mn influences the oxidative coupling of N,N'-diethylaniline (DEA) in the presence of periodate. This chemistry is specific for Mn and sensitive at subnanomolar concentrations (Hirayama and Unohara, 1984). Previous methods using this coupling relied on detecting the colored product of oxidation (N,N,N',N'-tetraethylbenzidine). The ZAPS technique, on the other hand, monitors the concentration of DEA directly from its fluorescent signature. DEA fluoresces at 350 nm when excited at 250 nm (Sadtler, 1974). Reduced forms of Mn speed up the oxidation of DEA by periodate such that the amount of fluorescence at a fixed time after periodate and DEA are mixed together is indirectly related to the Mn concentration in the sample stream. Only Mn in a reduced state will affect the coupling of DEA and be detected by this technique. This probably includes Mn in the +3 (Kostka et al., 1995) as well as the +2 oxidation state.

In the ZAPS Mn technique ambient sea water is pumped through two tandem cartridges and a flow-cell: the first cartridge contains periodate, the second DEA. The periodate is imbedded in acrylic beads and the DEA is retained in a porous fluorocarbon (ZITEX). The bed of periodate beads filters the sample and adds periodate to the sample stream. The fluorophore is leached from the ZITEX rod in the second cartridge by capillary action as sea water passes over and through it on the way to the flow-cell. These cartridges slowly release periodate and DEA into the sample stream maintaining concentrations of about 5 μM for several days. The decrease in fluorescence with time due to bleeding of reagents is equivalent to about a 0.1% change per hour such that the supply of reagents during short deployments like those discussed in this report is virtually constant. Sea water is continuously pumped through the cartridges and flow-cell at a rate of 30 ml min^{-1}; this flow rate corresponds to a 30 second residence time in the instrument. This time and the velocity of the package through the water determines the vertical resolution of the measurement which was kept at 15 meters during this cruise.

3. SURVEY APPROACH

3.1 Field strategy

Sled operations

An instrument package similar to the one we deployed in the Bransfield had been used extensively for hydrothermal surveys on the Mid-Atlantic Ridge (MAR). Several sites on the MAR had been detected and found using this system. It was our hope that we would find MAR-like signals in the Bransfield and thus be able to use our experience to locate hydrothermally active sites. Another important goal of this project was to produce a complete picture of the water column in the Strait. We began the survey by completing a series of 'dips' or single lowerings with the hope that one of these operations would encounter a hydrothermal plume. We increased our odds by focusing these dips near volcanic features mapped by SeaBeam. Meanwhile these regularly spaced dips gave us the areal coverage required to produce a complete hydrographic cross section. These early dips were carried out in the eastern part of the central basin and the eastern basin. Some enticing signs of hydrothermal activity were encountered during this part of the project, but none that stood out and begged for closer examination.

This all changed during SL13 when our package went through a feature that looked almost exactly like the TAG hydrothermal plume on the MAR at 26°N, a place that many of us had been to several times. This lowering was carried out in a valley between two of three parallel ridges that became known as "Three Sisters" (see ZAPS Fig.1). As shown in this figure we spent the next four lowerings visiting the three ridges. We collected water samples on Middle Sister near the plume anomaly with rosette station number 6 and then carried out a tow-yo of the middle ridge during SL18. We detected turbidity anomalies throughout the first part of this tow on "Middle Sister", as shown in ZAPS Fig.2. Later on in the cruise we had the opportunity to return to this area undertake a combination of tow-yo and bottom drifts (SL25 and SL26).

ZAPS Fig.3 is a composite of the potential temperature (θ) – salinity (S) anomalies produced by the operations on Middle Sister. In most areas of the oceans deep water is stable and well stratified and as a result plotting potential temperature against salinity produces a straight line because both of these parameters are conservative. Breaks in the θS line are caused by the intrusion of different water masses or mixing with hydrothermal fluids. Several water types are present in the Bransfield Strait and the areal survey we carried out as part of this project will add to what we know about regional circulation. For example, the intermediate waters in the Strait contain waters are thought to originate in the Bellingshausen Sea. However, anomalies such as those shown in ZAPS Fig.3 possess several characteristics that mark them as hydrothermal. First, these offsets are small; anomalies of this size would be mixed out if transported over any great distance which suggests that they are therefore of local origin. Second, unlike advected water mass features these anomalies change in shape and position and even disappear over short distances. Third, such anomalies are only found in small localized areas near volcanic features and are associated with turbidity anomalies (ZAPS Figs.4 and 5). Finally, the temperature structure of bottom water (<20 meters) near such anomalies is often abnormally spiky (ZAPS Fig.6). From our experience on the MAR such criteria are only met in hydrothermally active areas.

In summary, our survey strategy in the Bransfield involved three different types of sled operations. Individual lowerings or dips gave us the areal coverage we needed to develop the regional hydrography and provided us with the first signs of hydrothermal activity. Some of the ridges in the Bransfield were selected for more detailed tow-yo operations. Three promising areas were found in this way and information developed from these tows were used to select small areas of sea floor (<2km^2) for bottom drifts during which the package was kept within 20 meters of the sea floor for extended periods of time.

The three areas examined in detail were "Middle Sister" (62°40'S; 59°05'W), "Hooked Ridge" (62°11'S; 57°17'W), and "Little Volcano" (62°46'S; 59°24'W). All of these sites lie along what would be interpreted as the emerging rift or neovolcanic zone. Each of these sites are marked by turbidity anomalies with plume-type morphology (ZAPS Figs. 4 and 5), anomalies in θS in the depth range of the turbidity signal (like those in ZAPS Fig.3), and anomalous temperature spikes near bottom (ZAPS Fig.6). An anomaly in dissolved manganese was detected at the Hooked Ridge site at the same depth as the turbidity plume (ZAPS Fig.7).

Follow-up work at these sites was not restricted to the ZAPS bottom drifts. Two dredges and two camera lowerings were carried out at "Hooked Ridge"; one dredge was done at "Little Volcano". Results from these operations are discussed elsewhere in the report.

Radon measurements

^{222}Rn is a naturally occurring radioactive isotope with an oceanographically short half life of 3.8 days. It is formed *in-situ* in sea water and in sediments from the decay of its parent isotope ^{226}Ra, thus a water column profile will typically show a bottom enrichment, the extent of which reflects the balance between diffusion from the source and advection by bottom currents. It has traditionally been used to investigate circulation and mixing problems, but has gained new applications following the measurement of large concentrations of ^{226}Ra and ^{222}Rn in the Galapagos Rift hydrothermal vents- the first vents discovered in 1977. Since then, vent and plume ^{222}Rn have been infrequently measured at hydrothermal sites both on the Northern Mid-Atlantic Ridge and in the northeast Pacific on the Juan de Fuca Ridge. With a knowledge of the primary ratio of ^{222}Rn to heat of fluids carried to the non-buoyant plume, and a measure of the 'standing crop', that is, the steady state amount of ^{222}Rn overlying a vent-field, an estimate can be made of the high temperature hydrothermal fluid and heat fluxes.

^{222}Rn is measured by alpha scintillation counting after preconcentration from 10-20 litres of sea water. The sample is drawn directly from the rosette bottles into an evacuated glass bottle. Ultrapure helium is circulated in a closed system through the sample- any radon present is adsorbed onto an activated charcoal column held at ≈-70°C. After stripping, the charcoal column is heated to ≈450°C. This expels the radon, which is then drawn under vacuum into a scintillation cell for alpha counting.

The relatively large sample volume requirement for the method results from the low concentrations of ^{222}Rn in sea water. The typical background activity of ≈30dpm/100kg (disintegrations per minute, per 100 kg of sea water) corresponds to a ^{222}Rn concentration of $\approx 10^{-21}$mol/kg. The greater the volume of sea water extracted, the shorter the counting time necessary to obtain good counting statistics (counting errors are generally < 3%, overall accuracy is about 10%). After the sea water is stripped for ^{222}Rn, is it saved for later analysis of the ^{226}Ra content: a mismatch between the two concentrations may indicate a source for either element.

In total, 10 CTD-rosette casts were dedicated to the collection of samples for ^{222}Rn analysis. 6 samples were collected from each rosette cast. In addition, 1 litre unfiltered, 1 litre filtered and filter samples were also collected for subsequent analysis to provide a geochemical setting for the ^{222}Rn measurements. 60 samples of 12-15 litres were saved for shore analysis of ^{226}Ra. The sampling was designed to target particle-rich layers in the water column that might have a hydrothermal origin, and also to sample the water masses present in the Bransfield Strait.

3.2 Laboratory analyses

Manganese

Mn determinations with the fiber optic spectrometer are calibrated by running standard solutions on shore before the field operation. These calibrations are adjusted after the cruise by comparing field data with Mn in samples collected with the rosette in the ZAPS package. Samples covering the full range of concentrations were collected from the Bransfield. Aliquots will be analyzed for dissolved Mn using a Fisons VG PlasmaQuad II Plus ICPMS interfaced to a Dionex Chelation Concentration Module. The Dionex automated ion chromatography system preconcentrates and separates Mn from the salt matrix using cation exchange columns; elution is regulated precisely with gradient pumps. Using a computer-controlled flow valve aliquots from the final Dionex column are eluted with 2 N HNO_3 directly into the Ar plasma of the ICPMS after the elution stream is combined with an In solution. The In count rate is used for normalization to eliminate variations in plasma efficiency (Falkner et al., 1994) and the normalized count rates are used to calculate Mn concentrations by comparison with data from an appropriate standard.

After the Bransfield samples are used to determine dissolved Mn, the samples are acidified and run through the Dionex-ICPMS again. This second pass determines the level of "total dissolvable Mn" or TDM (Klinkhammer et al., 1977). The TDM concentration includes any labile particulate Mn. TDM profiles have been measured at most vent sites and thus provides us with another way of comparing hydrothermal activity in the Bransfield with other areas.

Rare earth elements

Filtered and unfiltered water samples were collected for rare earth element (REE) analysis back on shore. These measurements will be made by using a combination of isotope dilution thermal ionization mass spectrometry (ID-TIMS) at Cambridge University (Greaves et al., 1983), and ion chromatography inductively coupled mass spectrometry (IC-ICPMS) at Oregon State University (Falkner et al., 1995). REE concentration and pattern data for hydrothermal plumes and fluids can tell us about the history of particle formation, the degree of dilution, the rate of removal, and the chemistry of crustal fluids (Klinkhammer et al., 1983; German et al., 1990; Klinkhammer et al., 1994a; Klinkhammer et al., 1994b; Klinkhammer et al., 1995)

Helium analysis

Over 100 water samples were collected in copper tubes that will be taken back to OSU and analyzed for He isotopic composition by Dave Graham and John Lupton at the NOAA facility in Newport, OR. He is a non-reactive gas that is highly enriched in hydrothermal fluids relative to deep ocean water. He can therefore be used as a tracer of the fluid, much like Mn. However, since He is non-reactive its distribution in hydrothermal areas tells us about the mixing of fluids without complications resulting from removal, as in the case of Mn, or input from other sources, as in the case of Rn.

4. OPERATION NARRATIVES

In all we carried out 32 sled operations and 12 rosette lowerings, most of these in the central and eastern basins (Fig.4). This section is a chronological narrative of these activities. See the logs in the Appendix of this report for further descriptions, details or the timing of individual events within each operation.

ZAPS Table 1. Operation narratives: NBP9507

Date	Operation	Location	Comments
29 Oct.	SL01	Scotia Sea	CTD damaged during shipment. Pressure test.
	R01	same place	pressure test
1 Nov.	SL02	central basin, west of hooked ridge depth 1700 m	aborted, wire termination problem
2 Nov.	SL03	same place	strong intermediate water component (300-600 meters)
	R02	same place	
	SL04	E of hooked ridge depth 1860 m	similar to last lowering
	*SL05	SE of hooked ridge depth ≈1700 m	small turbidity anomaly at 1000 meters and near bottom
	R03	same place	
3 Nov.	*SL06	first dip in E basin in deep water depth 2120 m	small, broad turbidity anomaly centered around 1700 m, also strong nepheloid layer
	SL07	depth 2778 m	very distinct bottom turbidity layer
4 Nov.	SL08	at ridge tip in eastern part of E basin below 1400 m	gradually increasing turbidity and pot. temp
5 Nov.	R04	at eastern end of E basin 2200 m	

	SL09	same place just W of Clarence Is depth 2305 m	nepheloid below 1600
6 Nov.	SL10	north side of eastern most E basin depth≈2200 m	particles increased below 600! all the way to bottom
7 Nov.	SL11	central basin high heat flow area	ordinary profiles modest nepheloid layer
	R05	same place	
8 Nov.	SL12	east flank of Orca Smt.	very flat profiles
	*SL13	just N of Middle Sister depth≈1350	anomalies at about 900 m separated from strong bottom anomaly
	*SL14	on top of North Sister depth≈1200 m	anomalies centered at 1050 separated from strong bottom anomaly
	SL15	North Sister..further east	only small anomaly at bottom
	SL16	top of South Sister	similar flat profiles broad TS anomaly between 900 and 1075 m
	SL17	on top of Middle Sister	small anomalies near bottom
	R06	Middle Sister, 2 miles SW of SL17	dido
9 Nov.	SL18	tow-yo starting at SW end of Middle Sister and covering about 2/3plume of the ridge	bottom anomalies at beginning, large TAG-like at 59°10'
10 Nov.	SL19	inside Orca volcano no signals in deep water	caldera sill effect at 750 m
	R07	same place	
	*SL20	tow-yo..Hooked Ridge started on W end	very large turbidity signal on east end of ridge, 900- 1100 m
	SL21	dip on ridge spur depth 1160 m	small anomaly at 900 and near bottom

14 Nov.	SL22	north side of ridge in E basin, SE of Bridgeman Is.	increasing turbidity below 700 m
15 Nov.	*SL23	Hooked Ridge	first bottom drift between 1000 and 1300m...temp. spikes!
	R08	same place as upcast	
16 Nov.	*SL24	Hooked Ridge (last operation here)	second bottom drift...more temp. spikes, classical plume signals on upcast dissolved Mn anomaly
	SL25	Middle Sister tow-yo and bottom drift ended on N.Sister spur	no spikes but interesting TS
17 Nov.	SL26	north flank of Middle Sister	results similar to SL25
	*SL27	tow..small ridge, SW extension of Middle Sister	wow! nice plume in caldera of Small Volcano located at SW end of ridge
18 Nov.	R09	in collapsed caldera	
	R10	same caldera	OSU water sample cast
	*SL28	in Small Volcano	bottom drift..temp spikes!
19 Nov.	SL29	tow at Labrys Ridge SW of Small Volcano	no signals
20 Nov.	SL30	dip SW end of Labrys	increasing turbidity below 700m
	R11	same place	
	SL31	Deception Is.	tow-yo across entrance
	SL32	SW of Labrys	small bottom anomaly
	R12	same place	

5. CONCLUDING REMARKS

In about 8.2 days of ship time (excluding transit) we surveyed 342 km of the Bransfield Strait with at least one profile every 20km. To our knowledge this is the best hydrographic coverage ever carried out in the Strait. We discovered 3 sites that look as hydrothermally active as any of the vent sites on the Mid-Atlantic Ridge. These sites appear to contain high-temperature, black-smoker type vents which produce the kind of sulfide and iron-rich fluids capable of supporting abundant chemosynthesis. We also found evidence that there are other active vent locations in the Bransfield that we did not isolate. This work is the first direct evidence of hydrothermal sources in a polar region. The discovery of such areas opens up many questions for future research ranging from the biogeographical distribution of vent fauna to the relationship between spreading rate, crustal production, and hydrothermal activity.

REFERENCES

Falkner K. Kenison, G.P. Klinkhammer, C.A. Ungerer and D.M. Christie, 1995, Inductively coupled plasma mass spectroscopy in geochemistry, Annu. Rev. Earth Planet. Sci., 23: 409-449.

German, C.R., Klinkhammer, G.P., Edmond, J.M., Mitra, A. and Elderfield, H., 1990. Hydrothermal scavenging of rare earth elements in the ocean. Nature. 345: 516-518.

Greaves M.J., H. Elderfield, G.P. Klinkhammer, 1983. Determination of the rare earth elements in natural waters by isotope-dilution mass spectrometry. Anal. Chim. Acta, 218: 265-280.

Hirayama, K.and Unohara, N., 1984. A new catalytic method for determination of ultratrace manganese (II) based on oxidation of N,N-diethylaniline by potassium periodate. Bunseki Kagaku, 33: E517-E524.

Klinkhammer, G.P., 1994. Fiber optic spectrometers for in-situ measurements in the oceans: the ZAPS Probe. Mar. Chem., 47: 13-20.

Klinkhammer, G., H. Elderfield and A. Hudson, 1983. Rare earth elements in seawater near hydrothermal vents. Nature, 305: 185-188.

Klinkhammer, G., German, C.R., Elderfield, H., Greaves, M.J. and Mitra, A., 1994a. Rare earth elements in hydrothermal fluids and plume particulates by inductively coupled plasma mass spectrometry. Mar. Chem., 45: 179-186.

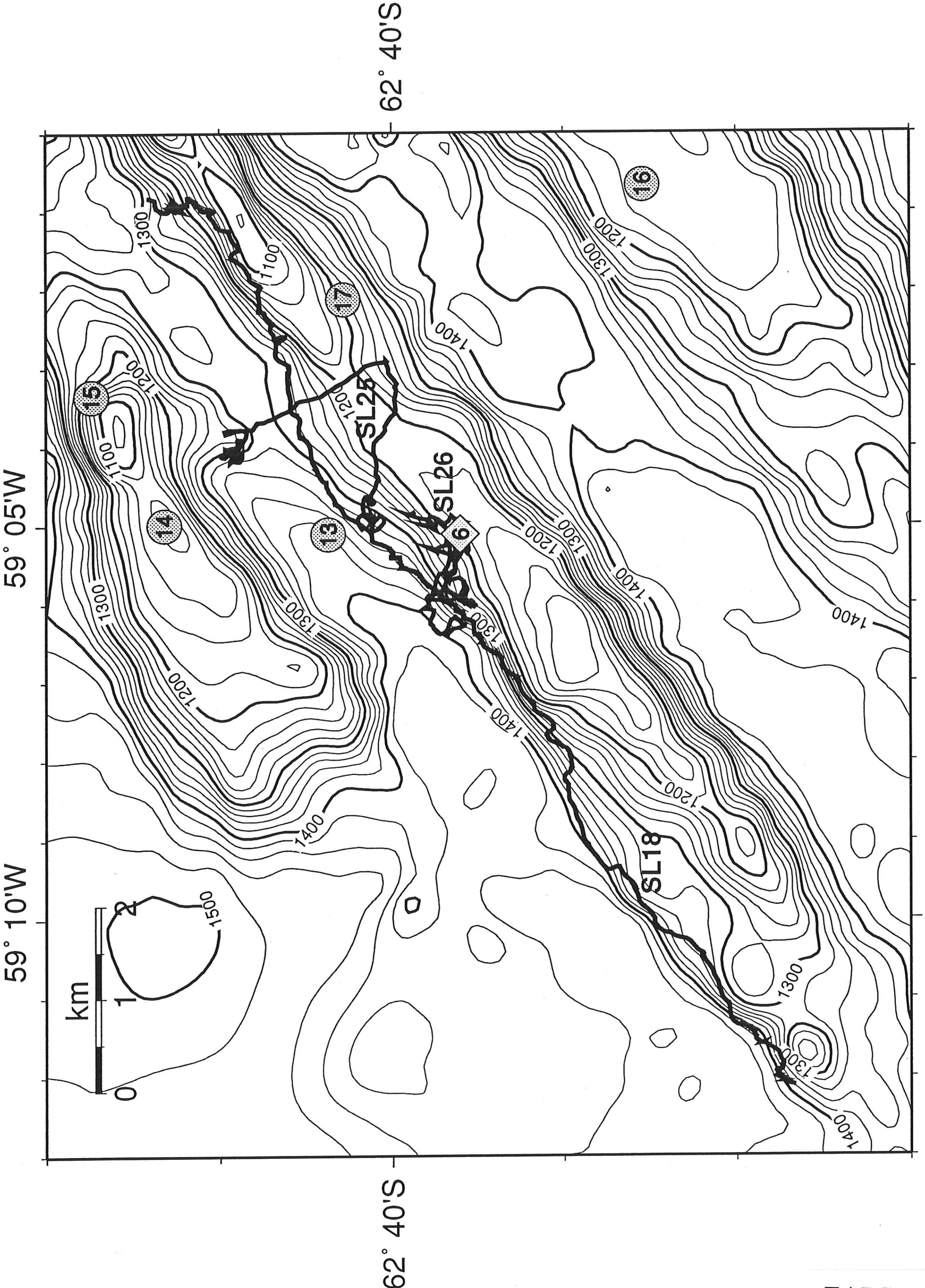
Klinkhammer, G.P., Elderfield, H., Edmond, J.M., and Mitra, A., 1994b. Geochemical implications of rare earth patterns in hydrothermal fluids from mid-ocean ridges. Geochim. Cosmochim. Acta, 58: 5105-5113.

Klinkhammer, G.P., Weiss, R.F. and Bender, M.L. , 1977. Hydrothermal manganese in the Galapagos Rift. Nature, 269: 319-320.

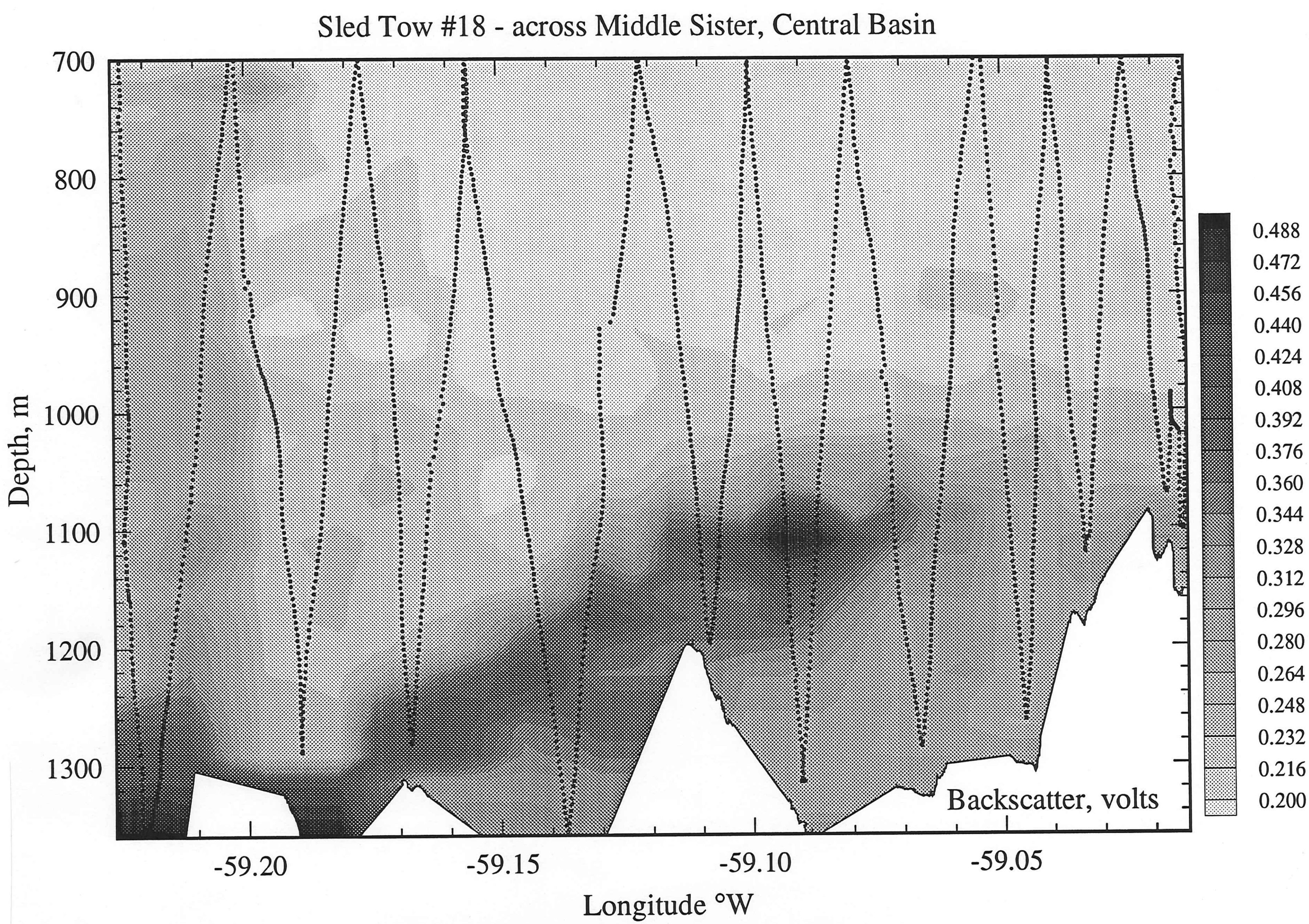
Klinkhammer G., Wilson, C., Chin, C, and German, C., 1995. Rare earth element data for hydrothermal fluids and other results from the Lucky Strike hydrothermal field on the MAR at 37°17'N. In: *Hydrothermal Vents and Processes*, L.M. Parson, C.L. Walker, and D.R. Dixon (eds), Geol. Soc. Spec. Publ. 87, 87-96.

Kostka, J.E., Luther III, G.W. and Nealson, K.H., 1995. Chemical and biological reduction of Mn (III) -pyrophosphate complexes: Potential importance of dissolved Mn (III) as an environmental oxidant. Geochim. Cosmochim. Acta, 59: 885-894.

Sadtler, 1974. *Sadtler Standard Spectra: Standard Fluorescence Spectra*, Sadtler Res. Lab., Philadelphia, PA.

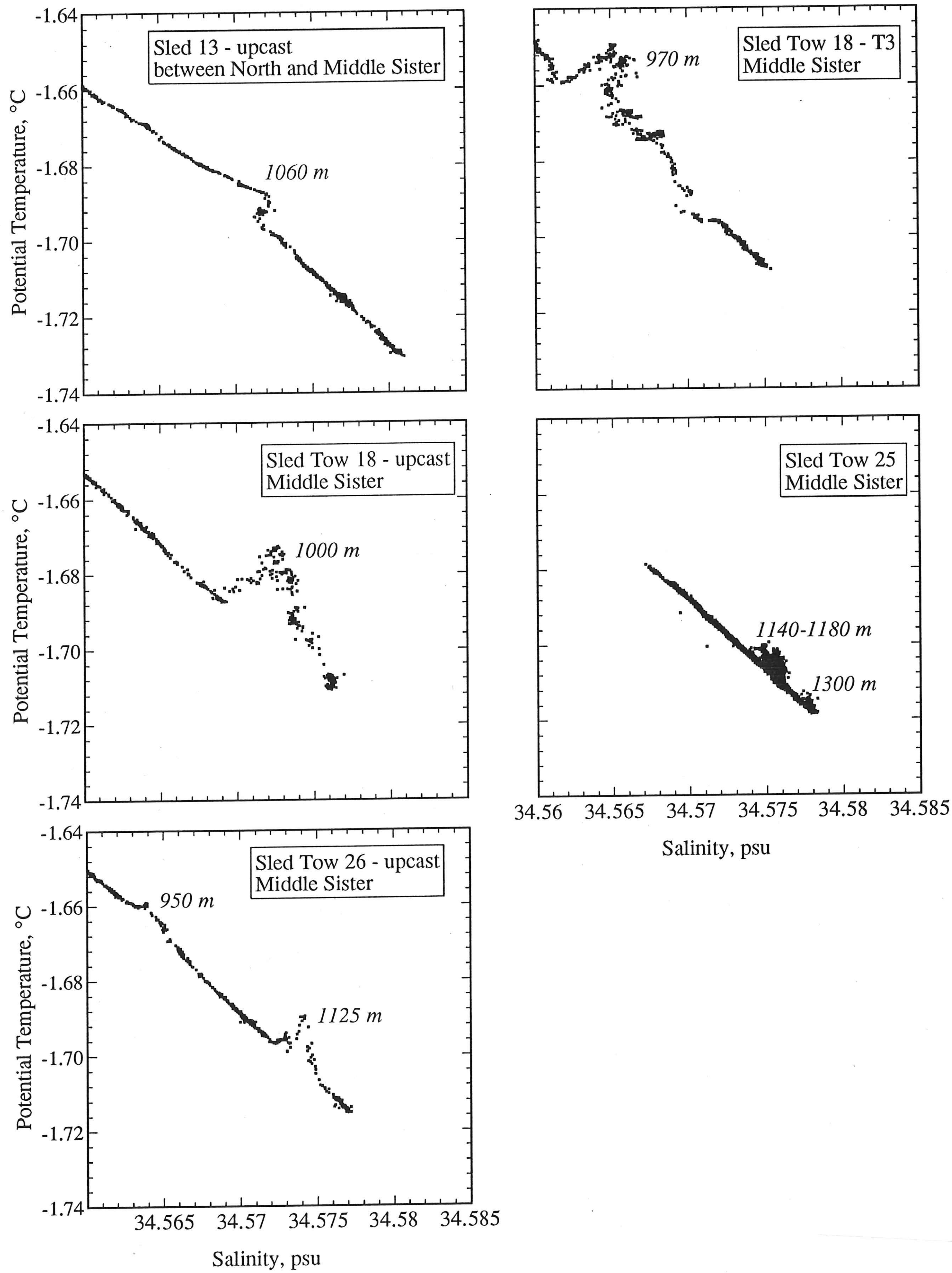

62° 40'S
59° 05'W
59° 10'W
62° 40'S
59° 05'W
59° 10'W
km
0
1
2
SL18
SL25
SL26
13
14
15
16
17
6
1100
1200
1300
1400
1500

ZAPS Fig.1

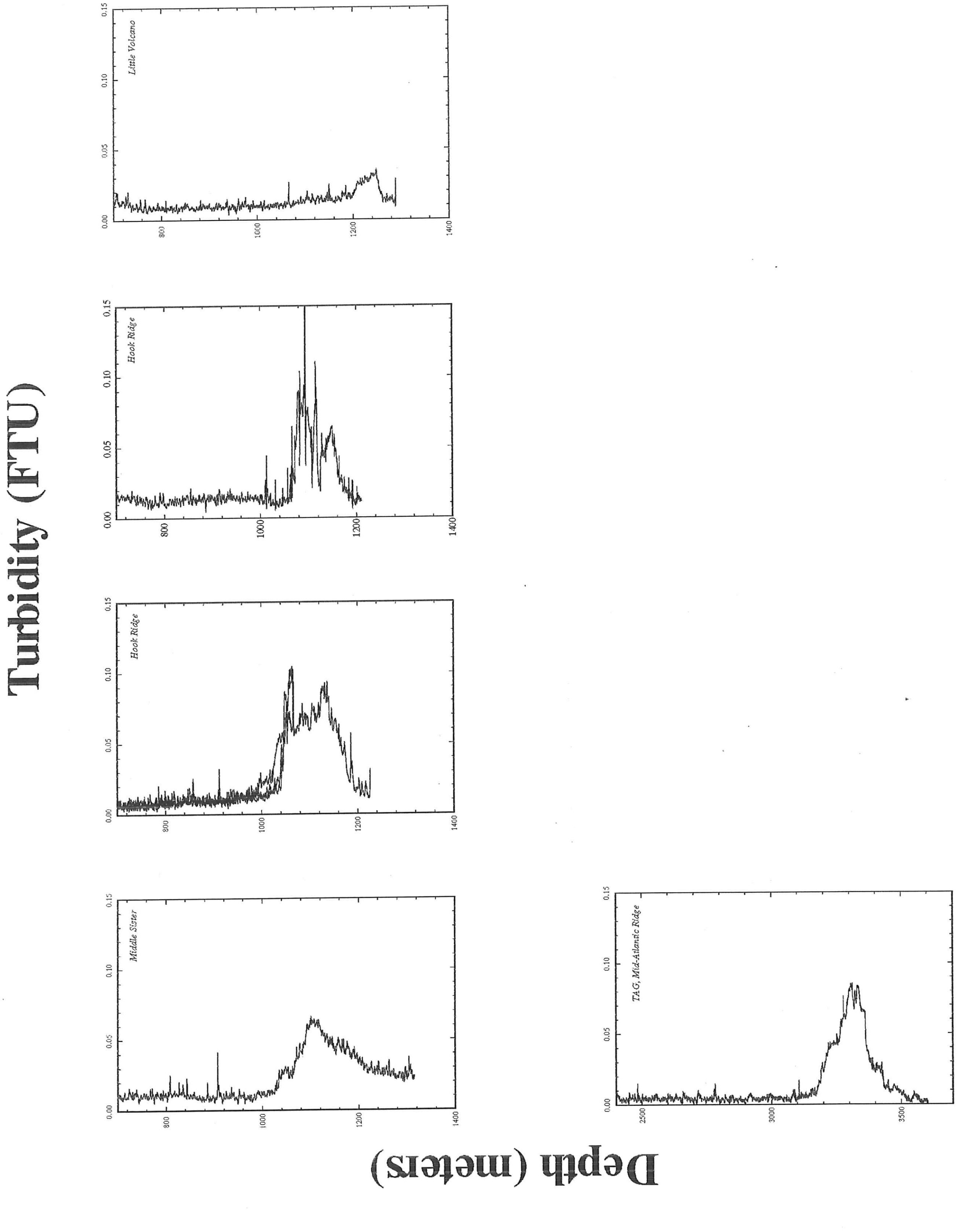


Sled Tow #18 - across Middle Sister, Central Basin
Depth, m
700
800
900
1000
1100
1200
1300
-59.20
-59.15
-59.10
-59.05
Longitude °W
Backscatter, volts
0.488
0.472
0.456
0.440
0.424
0.408
0.392
0.376
0.360
0.344
0.328
0.312
0.296
0.280
0.264
0.248
0.232
0.216
0.200

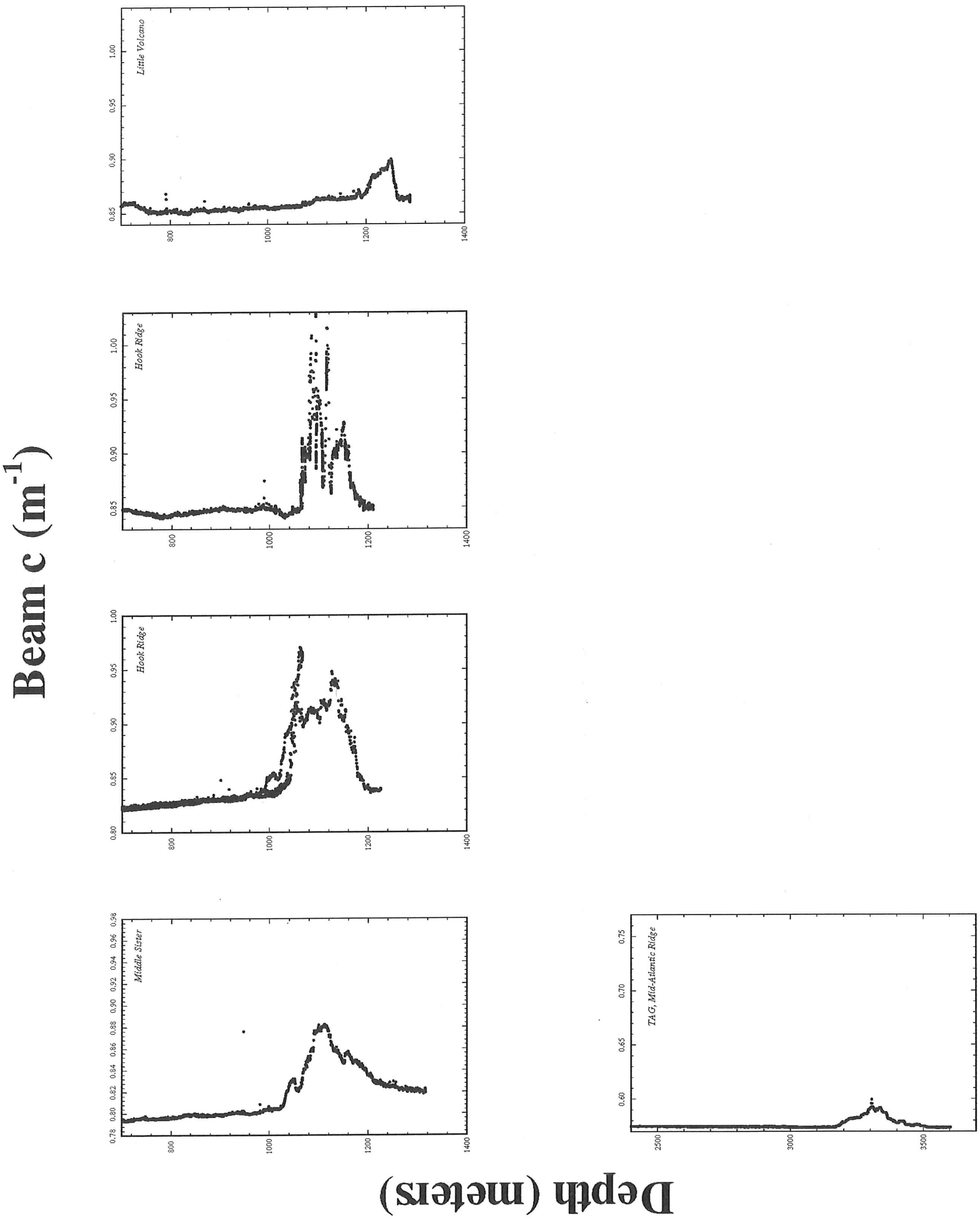
ZAPS Fig.2


Sled 13 - upcast
between North and Middle Sister
1060 m
Sled Tow 18 - T3
Middle Sister
970 m
Sled Tow 18 - upcast
Middle Sister
1000 m
Sled Tow 25
Middle Sister
1140-1180 m
1300 m
Sled Tow 26 - upcast
Middle Sister
950 m
1125 m
Potential Temperature, °C
-1.64
-1.66
-1.68
-1.70
-1.72
-1.74
Salinity, psu
34.56
34.565
34.57
34.575
34.58
34.585

ZAPS Fig.3

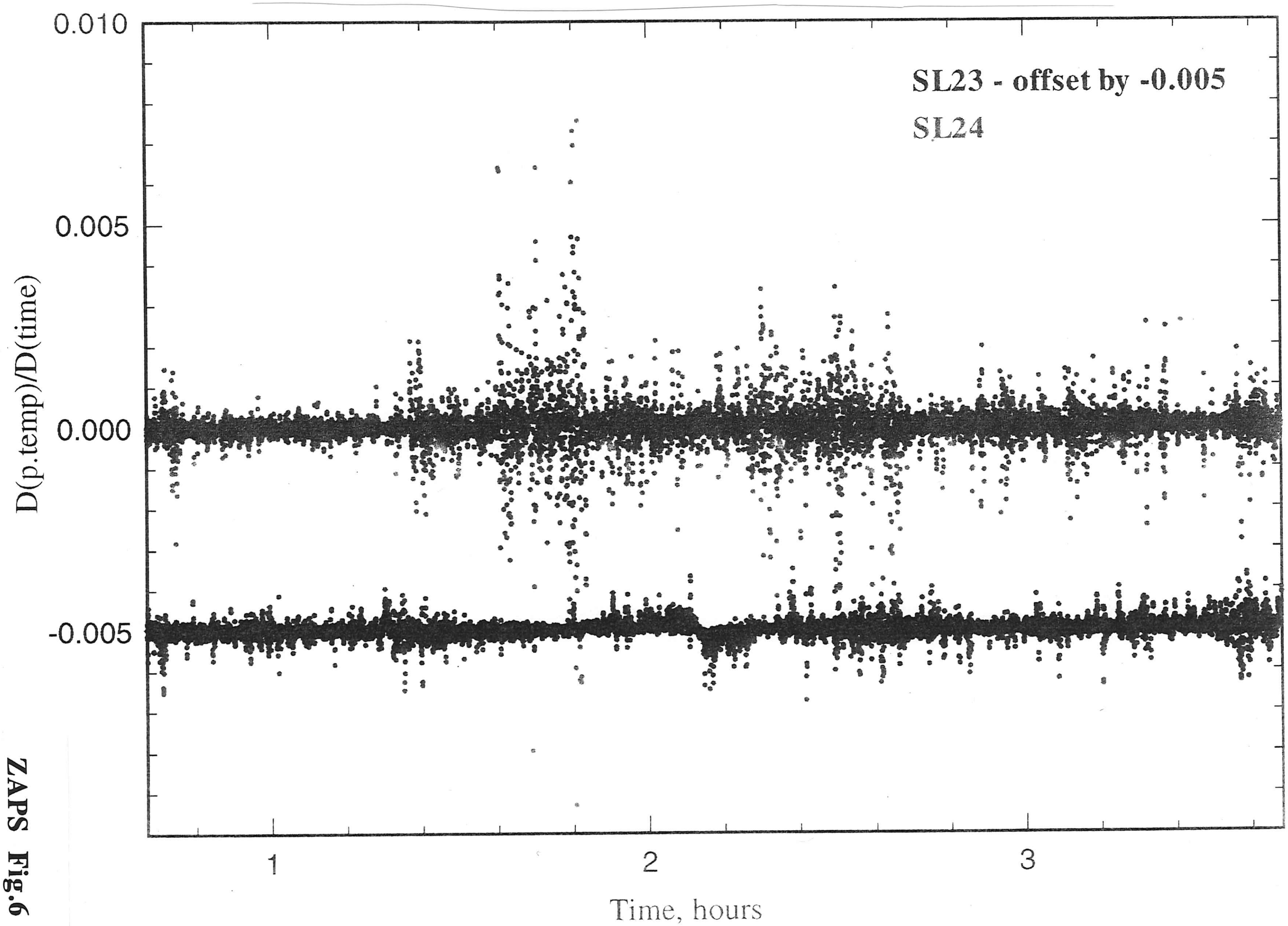

Turbidity (FTU)
Depth (meters)
Little Volcano
Hook Ridge
Hook Ridge
Middle Sister
TAG, Mid-Atlantic Ridge
0.00
0.05
0.10
0.15
800
1000
1200
1400
2500
3000
3500

ZAPS Fig.4

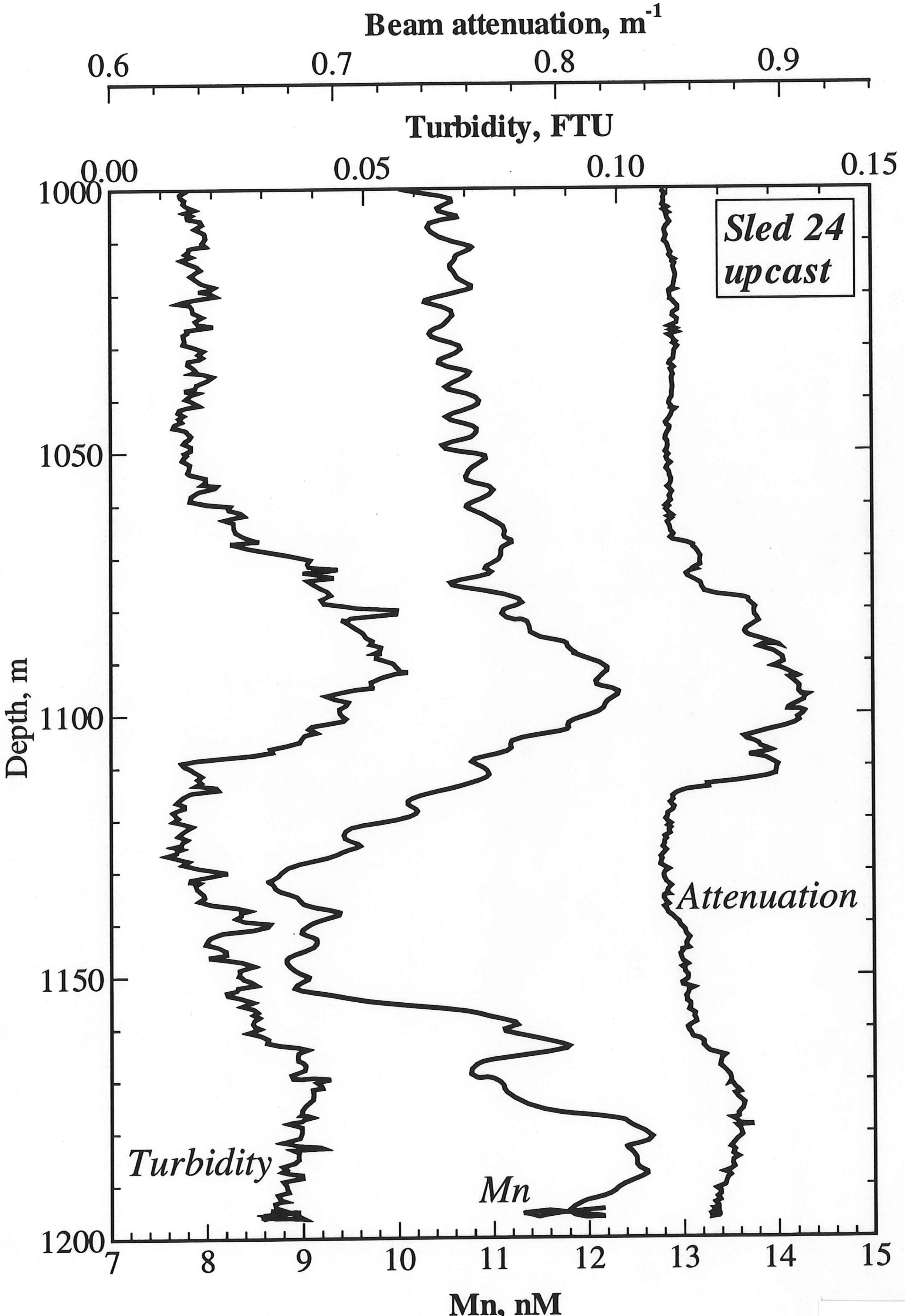

Beam c (m-1)
Depth (meters)
Little Volcano
Hook Ridge
Hook Ridge
Middle Sister
TAG, Mid-Atlantic Ridge

ZAPS Fig.5

$D(\theta)/D(t)$ plots from two bottom drifts on Hooked Ridge. The top time slice was near the hydrothermal site.

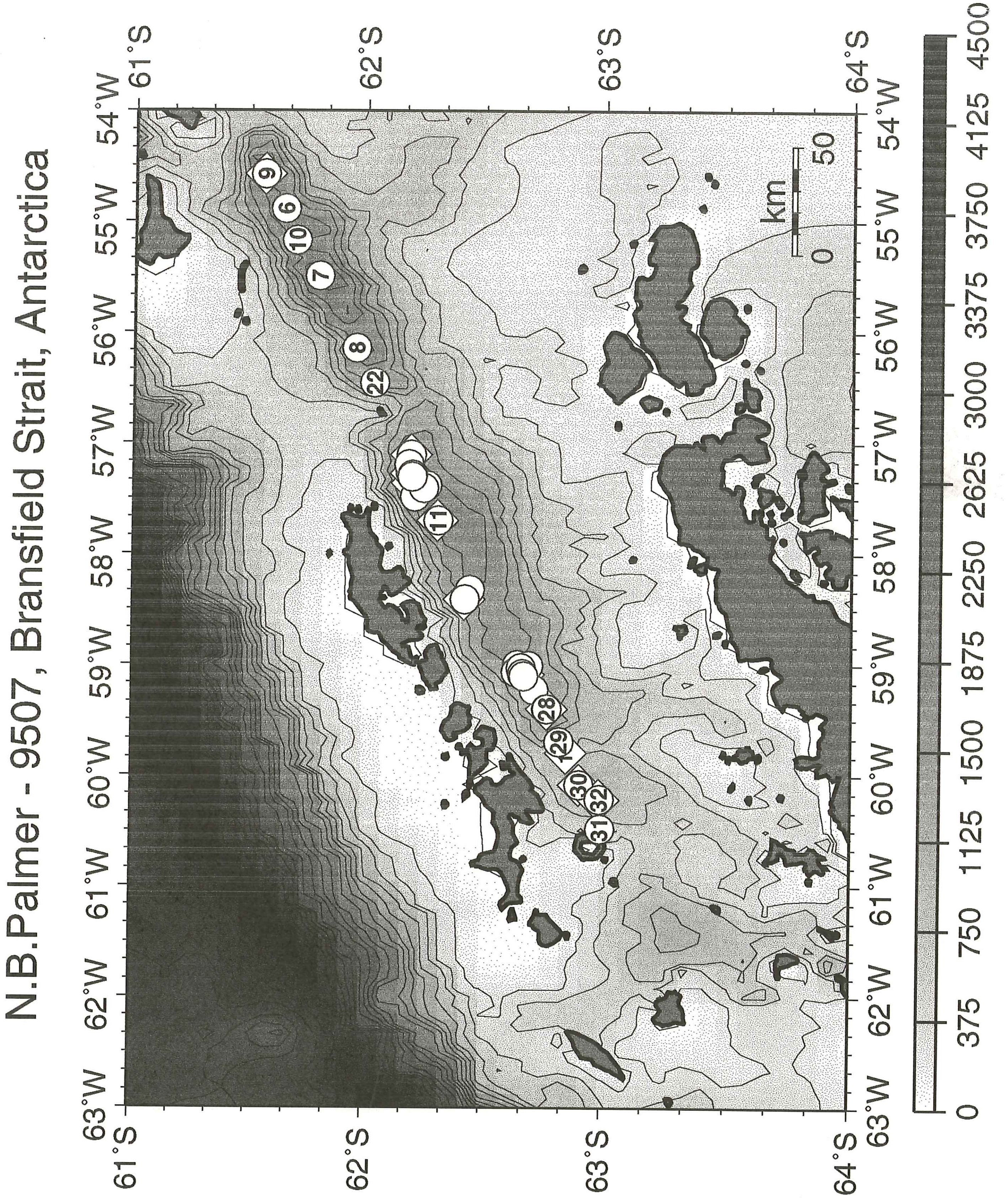


ZAPS Fig.6



Beam attenuation, m^{-1}
0.6
0.7
0.8
0.9
Turbidity, FTU
0.00
0.05
0.10
0.15
Sled 24
upcast
Depth, m
1000
1050
1100
1150
1200
Attenuation
Turbidity
Mn
7
8
9
10
11
12
13
14
15
Mn, nM

ZAPS Fig.7


N.B.Palmer - 9507, Bransfield Strait, Antarctica
63°W
62°W
61°W
60°W
59°W
58°W
57°W
56°W
55°W
54°W
61°S
62°S
63°S
64°S
km
0
50
9
6
10
7
8
22
11
28
29
30
32
31
0
375
750
1125
1500
1875
2250
2625
3000
3375
3750
4125
4500

ZAPS Fig.8

OSU APPENDIX

written by the Oregon State University Geochemistry Group:
K. Brooksforce
C. Chin
A. Flaveluke
G. Klinkhammer
M. Rudnicki
C. Schneller
J. Simpkins
P. Stoffregen
C. Wilson

In the course of NBP95-07, thirty-two deployments and recoveries of the Oregon State University instrument package (ZAPS sled) were conducted in a highly satisfactory manner from the NBP Baltic Room. Due to the well maintained telescoping boom and winch and skilled hands, quick recoveries were possible, preventing disastrous freezing of waterfilled small pump chambers and tubing on the sled. An additional 12 CTD rosette casts were made as well, swapping the cable connections and switching the custom made electrical box on the winch.

A few things may be done to improve operations even more, if the ship or ASA should choose. Firstly, an accurate log of the amount of wire on the winch is needed. Secondly installation of a deck skid from the big door all the way inboard to the safety rail at the winch would save back strain in moving the CTD rosette out of the way of an alternate "guest" package.

A third concern is the importance of grounding the shields of the coax wire from the baltic room winch to the instrument arrays, since these lines carry high DC voltage. The OSU system operates at 380V and the seabird uses 270V, either of which can be dangerous. The shields should be grounded directly to the ship's ground. During the setup of the OSU system, we found the coax shields floating and grounded them on both ends of the cables. When the ship's CTD system was set up days later, there were initial problems with fuses blowing as a result of a simple wiring error which connected the 'hot' line from the CTD to the coax shield. Had the shields not been grounded, the system may have operated correctly but the exposed shields on the BNC connectors would have been 'live' in the baltic room. The OSU system is usually deployed with a ground braid soldered from the sea cable shield in the termination to the sled's metal frame as an additional safety precaution. We recommend, at the very least, proper grounding of the shields of all the cables as an important safety measure that should not be overlooked, even when only a standard SeaBird CTD is used.

Lastly, the improved electrical splice, or termination, for .322" coax cable introduced on this cruise will save misery and time for all future users of the Baltic Room winch wire. At the beginning of the cruise the electrical splice on the Baltic Room winch wire was cast using the Scotch Cast technique, requiring drying time of 24 hours. Unfortunately, for reasons unknown, this splice failed on the first deployment, causing loss of data and time. The following is a description of the fast-drying potted splice introduced to us by Rick Pearce who manufactured ASA's Siesmic Streamer. He made the first one, then 15 deployments later when damaged wire required retermination, we duplicated his technique by memory. The OSU group intends to use this splice in the future because its a fast, no-fuss method that never failed.

What Rick taught us is a splice that is scotch-filled, heatshrunk, potted and heatshrunk again: double indemnity. Tools needed are 5/16" diameter clear heat shrink, 1" diameter clear heat shrink, heatgun, gray 3M Scotchfill ("monkey-snot"), potting compound (ask Rick Pearce), solder and solder gun, flux.

Here is the way to do the splice. After the mechanical termination is installed and pull tested, open the conducting cable exposing 3 conducting wires. The armor of the cable can be used as ground. Strip back the casing and clean all wire with ethanol so no casing is greasy at all. Put one 2"-3" long piece of 5/16" diameter clear heat shrink on each exposed conducting wire. Put a 1" diameter, 6" long clear heat shrink piece on the pigtail connector cable. Now solder the 3 conducting wires to the appropriate electrical termination pigtail conducting wires. Wrap these 3 solder joints in the gray scotch-fill then pull the 5/16" diameter heat shrink pieces over the scotch-fill and shrink them with the heatgun.

Next, wrap gray scotch-fill around the jacket of the pigtail and slide the 1"diameter heat shrink over it and use the heatgun to seal that heat shrink down to it. This creates a sealed bottom to the large heatshrink tube that becomes your mould. Be sure the soldered wires in their heat shrink cases are centered the long way in this. It works fine if they are touching the inside of the larger heat shrink, don't worry. Find a way to keep the wire vertical for the potting process. We tied it up to the ceiling and down to the handle of a drawer. The potting compound is no thicker than maple syrup so it needs to sit tight and steady for the reaction time. Put on plastic gloves now. Using a newly installed self mixing tip, inject out some of the compound into the trash can, then simply fill your mold with no bubbles. Fill it right up to the top. Wait 10 minutes. While waiting, remove the used self mixing tip and discard it. Replace the sealing caps on potting compound injector.

After 10 minutes of reaction time, use the heatgun to shrink the top end of the mould, squeezing up a bit of the compound, perhaps, but I think it just makes it neater. Allow an additional 10 minutes set-up time and you are ready to tape it over neatly and plug it in. My splice didn't look as good as Rick's but it worked as well.

	OPERATION	Date	Time	dur.	Lat	Lat	Long	Long'	Depth	samp.	Comments
			GMT		°S	min.	°W	min.	m	type	
			STATION LOG								
Ship:	Nathaniel B. Palmer										
Area:	Bransfield Strait, Antartica										
Dates:	28 Oct - 8 Dec 1995										
Station ID format:		NBP-AAxx, AA=operation type, xx=operation number									
	Operations:	Water Sample Types:									
	SL=sled/ZAPS	R=Radon		F=Filtered water							
	R=rosette/CTD	H=Helium									
		S=Salinity									
		T=Trace metals									
ENTER DATE: COMMAND HYPHEN											
ENTER TIME: COMMAND SEMI-COLON											

	OPERATION	Date	Time	dur.	Lat	Lat	Long	Long'	Depth	samp.	Comments
			GMT		°S	min.	°W	min.	m	type	
Begin	NBP9507-SL01	29 Oct 95	13:08	0:00	55	11.040	65	10.190	912		Pressure Test - No electronics
End			14:00	0:52		10.700		9.310			on deck
Begin	NBP9507-R01	29 Oct 95	11:03	0:00	55	11.510	65	11.730	925	S	Bottle Test
End			12:42	1:39							
Begin	NBP9507-SL02	01 Nov 95	14:17	0:00	62	12.290	57	22.560	1667		In Bransfield Strait - in ice
End			15:05	0:48							OK on deck, fails if picked up
Begin	NBP9507-SL03	02 Nov 95	4:29	0:00	62	12.50	57	29.08	1902		sled powered up on deck
End			6:25	0:00	62	12.47	57	28.93			on deck

	OPERATION	Date	Time GMT	dur.	Lat °S	Lat min.	Long °W	Long' min.	Depth m	samp. type	Comments
Begin	NBP9507-R02	01 Nov 95	15:50		62	11.92	57	21.73		S R T	SE of King G. island near seamount
End											
Begin	NBP9507-SL04	02 Nov 95	15:19	0:00	62	15.710	57	23.060	1853	S T	south of East Seamount
End			17:22	2:03							on deck
Begin	NBP9507-SL05	02 Nov 95	18:41	0:00	62	11.600	57	6.460			east of large hook-shaped seamount
End			20:41	2:00	62	11.620	57	6.560	1691		on deck
Begin	NBP9507-R03	02 Nov 95	21:25	0:00	62	11.66	57	6.44	1691	R T	same spot as SL05
End			23:07	1:42							
Begin	NBP9507-SL06	03 Nov 95	17:58	0:00	61	38.970	54	53.310	2118	T	in eastern East Basin
End			20:22	2:24	61	38.78	54	53.73	2006		On deck- All bottles fired!!
Begin	NBP9507-SL07	03 Nov 95	23:08	0:00	61	47.80	55	29.73	2717		In Brnsfld deep, Eastern Basin
End		04 Nov 95	2:03	2:55	61	47.83	55	29.84	2757		on deck
Begin	NBP9507-SL08	04 Nov 95	5:18	0:00	61	57.46	56	8.57	1835		middle of Eastern Basin
End			7:58	2:40	61	57.55	56	7.78			on deck
Begin	NBP9507-R04	05 Nov 95	19:01	0:00	61	33.71	54	34.56	2205	R T H	Eastern East Basin
End			21:25	2:24							on deck
Begin	NBP9507-SL09	05 Nov 95	21:50	0:00	61	33.66	54	34.52	2230	T	same spot as R04
End		06 Nov 95	0:29	2:39	61	33.59	54	34.22			on deck
Begin	NBP9507-SL10	06 Nov 95	2:24	2:24	61	41.91	55	10.44	2188		in central part of East Basin
End			4:43	4:43	61	41.92	55	10.37	2180		on deck

	OPERATION	Date	Time	dur.	Lat	Lat	Long	Long'	Depth	samp.	Comments
			GMT		°S	min.	°W	min.	m	type	
Begin	NBP9507-SL11	07 Nov 95	14:10	0:00	62	18.56	57	41.96	1916?	S T	High heat flow site -Central Basin
End			17:09	2:59		18.42		42.40			on deck
Begin	NBP9507-R05	07 Nov 95	19:00	0:00	62	18.42	57	42.00	2000?	R T H	Eastern East Basin
End			20:53	1:53	62	18.48	57	42.00			
Begin	NBP9507-SL12	08 Nov 95	2:28	0:00	62	26.66	58	19.50	1500		east flank of Orca seamount-Central B.
End			4:48	2:20		26.49		19.44			on deck
Begin	NBP9507-SL13	08 Nov 95	12:21	0:00	62	39.63	59	5.00	1413	S T	The Sisters - western KG Basin
End			14:25	2:04							on deck, 8 -tap open, 12-DNC
Begin	NBP9507-SL14	08 Nov 95	16:55	0:00	62	38.68	58	59.98	1022		North Sister
End			18:55	2:00	62	38.09	58	59.70	1182		on deck
Begin	NBP9507-SL15	08 Nov 95	19:31	0:00	62	38.35	59	3.84	1068	T	summit of north ridge
End			21:30	1:59							on deck -pin went all the way around
Begin	NBP9507-SL16	08 Nov 95	22:19	0:00	62	41.43	59	0.54	1144	T	southern ridge
End		09 Nov 95	0:17	0:17	62	41.46	59	0.48	1144		on deck
Begin	NBP9507-SL17	09 Nov 95	1:11	1:11	62	39.51	59	1.83	1168	S T	flank of middle sister ridge
End			2:52	2:52		39.85		2.45			on deck
Begin	NBP9507-R06	09 Nov 95	3:38	0:00	62	40.4	59	5.1	1190	STHR	2 miles SW of SL17
End			4:47	1:09							at surface
Begin	NBP9507-SL18	09 Nov 95	16:11	0:00	62	42.81	59	13.48	1341	T	a tow above middle sister ridge
End			23:42	7:31	62	38.58	59	0.82			total distance=7.19 nm BIG plume!

	OPERATION	Date	Time	dur.	Lat	Lat	Long	Long'	Depth	samp.	Comments
			GMT		°S	min.	°W	min.	m	type	
Begin	NBP9507-SL19	09 Nov 95	12:53	0:00	62	25.38	58	24.58	1091	T S	in caldera of Orca semount/volcano
End			14:21	1:28		25.39		24.73	1110		on deck
Begin	NBP9507-R07	10 Nov 95	14:56	0:00	62	25.36	58	24.6	1136	T R H	same spot as SL19
End			15:58	1:02							on deck
Begin	NBP9507-SL20	10 Nov 95	20:25	0:00	62	14.85	57	24.34	~1650		tow along hook-shaped seamount
End		11 Nov 95	5:32	9:07		11.45		15.85			on surface, power off
Begin	NBP9507-SL21	11 Nov 95	6:32	0:00	62	11.05	57	11.67	1184	T	At hook of hook-shaped seamount
End			8:04	1:32	62	11.04	57	11.68			on deck
Begin	NBP9507-SL22	14 Nov 95	19:31	0:00	62	2.15	56	27.45	1830	T	eastern-most East Basin
End			21:29	1:58		2.22		24.9			out of water
Begin	NBP9507-SL23	15 Nov 95	1:47	0:00	62	11.94	57	17.37		T	bottom drift, hook-shaped seamount
End			6:05	4:18		11.50		16.57			on deck
Begin	NBP9507-R08	15 Nov 95	13:46	0:00	62	11.66	57	16.56	1123	T R H	at Hook
End			14:40	0:54							
Begin	NBP9507-SL24	16 Nov 95	1:26	0:00	62	11.89	57	18.29			bottom tow higher on ridge than SL23
End			5:55	4:29							
Begin	NBP9507-SL25	16 Nov 95	21:51	0:00	62	39.86	59	5.03		T S	tow-yo on middle ridge tres hermanas
End		17 Nov 95	1:13	3:22		39.01		4.11			
Begin	NBP9507-SL26	17 Nov 95	1:44	0:00	62	40.23	59	6.28		T S	same area as SL25 but more west
End		17 Nov 95	4:51	3:07							

	OPERATION	Date	Time	dur.	Lat	Lat	Long	Long'	Depth	samp.	Comments
			GMT		°S	min.	°W	min.	m	type	
Begin	NBP9507-SL27	17 Nov 95	22:17	0:00	62	43.67	59	16.07			Towing little volcano
End		18 Nov 95	7:33	9:16		45.97		24.05			
Begin	NBP9507-R09	18 Nov 95	8:25	0:00	62	46.22	59	24.05	1350	T R H	Little Volcano
End			9:36	1:11							Mark hit bottom!!
Begin	NBP9507-SL28	19 Nov 95	2:27	0:00	62	46.17	59	24.06	1360	T S	Caldera of Little Volcano
End			8:02	5:35		46.16		23.87			
Begin	NBP9507-R10	19 Nov 95	0:08	0:00	62	46.17	59	23.29	1350	T H	Caldera of Little Volcano- OSU CTD
End			2:00	1:52		46.21		24.01			
Begin	NBP9507-SL29	20 Nov 95	0:02	0:00	62	50.98	59	47.55			tow-yo labrys ridge
End			5:02	5:00		49.18		41.81			
Begin	NBP9507-SL30	20 Nov 95	6:39	0:00	62	54.27	60	4.89	1083		dip at S. Labrys Ridge
End			7:55	1:16		54.23		4.93			
Begin	NBP9507-R11	20 Nov 95	8:30	0:00	62	54.27	60	4.89	1072	R T H	dip at S. Labrys Ridge
End			9:38	1:08		54.23		4.93			
Begin	NBP9507-SL31	20 Nov 95	23:09	0:00	63	0.13	60	30.50			Deception Island, tow-yo
End		21 Nov 95	3:37	4:28	62	59.54	60	28.77			
Begin	NBP9507-SL32	21 Nov 95	4:37	0:00	62	59.32	60	12.90	976	S T	background sta. in middle of w. basin
End			5:47	1:10							
Begin	NBP9507-R12	21 Nov 95	6:08	0:00	62	59.27	60	12.97	976	T R H	same spot as SL32
THE			7:00	0:52							
END!!											

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
		SLED LOG								
Ship:	Nathaniel B. Palmer 9507									
Area:	Bransfield Strait, Antartica									
Dates:	28 Oct - 8 Dec 1995									
Station ID format:		NBP-AAxx, AA=operation type, xx=operation number								
	Operations:	Water Sample Types:								
	SL=sled/ZAPS	R=Radon								
	R=rosette/CTD	H=Helium		F=Filtered water						
		S=Salinity								
		T=Trace metals								
ENTER DATE: COMMAND HYPHEN										
ENTER TIME: COMMAND SEMI-COLON										
	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
Begin	NBP9507-SL01	29 Oct 95	13:08	0:00	55	11.04	65	10.19	912	Pressure Test - No electronics, just south
			13:28	0:20		10.91		9.89		off Cape Horn, in water
End	NBP9507-SL01	29 Oct 95	14:00	0:52		10.70		9.31		on deck
Begin	NBP9507-SL02	01 Nov 95	14:17	0:00	62	12.29	57	22.56	1667	In Bransfield Strait - in ice
			14:27	0:10		12.19		22.34		in H2O, SE of King G. island near seamount
										between D309 and D310 (polarstern)
			14:55	0:38		12.00		22.07	1667	taking out - modem not working - temp??
			15:00	0:43						on deck
			15:03	0:46						testing on deck - tension problem?
End	NBP9507-SL02	01 Nov 95	15:05	0:48						OK sitting on deck, fails when picked up

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
Begin	NBP9507-SL03	02 Nov 95	4:29	0:00	62	12.50	57	29.08	1902	sled powered up on deck, about to deploy
			4:34	0:05		12.49		29.08		in the water, holding at 10m wire out
			4:43	0:14		12.51		28.95	1893	starting down at 30m/min
										colder, clearer water layer at 290 m
										signals from neph, xmiss get noisy @ 510 m
			5:35	1:06		12.54		28.97		stopped at 1700 m
										altimeter reading 300m at 1700m out
			5:41	1:12		12.56		29.02		stopped at 1800m, going down 50 m more
										stopped at 1850 m, 64 m on altimeter
			5:46	1:17						rosette would not enable
			5:47	1:18		12.47		28.93		resetting plot buffer and going up at 30m/min
			5:59	1:30						error light on deck unit, Mark's program quit
										deck unit turned on/off -- dead
			6:02	1:33						bringing sled back up, leaving system off
										problem appears to be the termination
End	NBP9507-SL03	02 Nov 95	6:25	1:56		12.47		28.93		on deck
Begin	NBP9507-SL04	02 Nov 95			62	15.71	57	23.06	1858	Testing alex's termination - south of
										East Seamount
			15:19	0:00	62	15.71	57	23.06	1853	sled turned on-on deck
			15:21	0:02						logging data
			15:25	0:06		15.81		23.13	1855	in the water
			15:27	0:08		15.80		23.09	1855	holding at 10 m wire out
			15:32	0:13		15.77		23.02		down at 30m/min, heading for 1500 m
			15:44	0:25						everything's working so far
			15:54	0:35						forgot to do the backup logging, Paul started it
			16:18	0:59		15.81		23.18	1794	altimeter reading 300m at 1520m wire out
			16:22	1:03						wo=1663, going down another 100 m
			16:27	1:08		15.77		23.07		stopped at alt=50, depth 1801, wo=1797
			16:28	1:09					1850	firing first bottle (#2)
	NBP9507-SL04	02 Nov 95	16:28	1:09						coming up 200 m

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
	NBP9507-SL04	02 Nov 95	16:33	1:14		15.81		23.20		fired bottle 4, 1585m
			17:02	1:43		15.81		23.16		firing bottle #6, 665m
			17:09	1:50		15.80		23.40		firing bottle #8, 402m
			17:15	1:56		15.76		23.16		firing bottle #10, 198m
			17:21	2:02		15.82		23.22		5m -- fired last bottle (#12)
			17:22	2:03						system off
End	NBP9507-SL04	02 Nov 95	17:22	2:03						on deck
Begin	NBP9507-SL05	02 Nov 95								east of large hook-shaped seamount
			18:41	0:00	62	11.60	57	6.46	.	on station - power on
			18:45	0:04						lost modem again
			18:52	0:11		11.60		6.44	1690	in the water, down to 10m
			18:54	0:13						starting down at 30m/min
										modem quit at ~850m
			19:24	0:43		11.59		6.64	1689	modem reconnecting, connected for ~30sec
			19:33	0:52		11.60		6.54	1690	wo=1325
			19:35	0:54		11.57		6.54	1689	altimeter on scale @305m
			19:42	1:01		11.59		6.50	1690	alt=120, d=1597
			19:42	1:01					1690	alt=100, going down another 50 m
										depth = 1655 alt=58
			19:47	1:06		11.59		6.52	1690	alt=48, d=1664
			19:47	1:06						up at 30n/min, no modem - no bottles
			19:52	1:11						Gary decides it's the best day of his life!!
			19:53	1:12						
			19:54	1:13						modem trying, d=1430
			20:19	1:38						modem trying to reconnect, wo=593
										no modem-can't trip bottles
			20:25	1:44		11.67		6.50	1691	modem still trying to connect
			20:39	1:58					1691	at surface
			20:39	1:58		11.62		6.56	1691	out of water
End	NBP9507-SL05	02 Nov 95	20:41	2:00		11.62		6.56	1691	on deck

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
Begin	NBP9507-SL06	03 Nov 95	17:58	0:00	61	38.97	54	53.31	2118	eastern East Basin - on station, power on
			18:03	0:05		38.96		53.24	2342	in water - launched w/power on
			18:05	0:07						"Best data I've ever seen"- GPK
			18:08	0:10						going down at 30m/min to 1500m
			18:54	0:56		38.97		53.48	1822	at 1500m down to 1900
			19:14	1:16		38.87		53.59		lt & nephel signal at 1950
			19:15	1:17						bottle 2 at d=2104, alt=47
			19:16	1:18						down another 10 m
			19:18	1:20		38.87		53.59		bottle 4 at d= 2115, alt= 36
			19:18	1:20						starting up
			19:22	1:24		38.85		53.65		bottle 6 at d= 1994, alt = 160
			19:30	1:32		38.83		53.60		bottle 8 at d= 1713
										1950 signals absent on way up
			19:34	1:36						broad layer between 1600-1800 m
									2120	Larry says there is a neraby sill at 1700m
			20:19	2:21		38.79		53.70	2006	bottle 10 at d=40 m
			20:20	2:22		38.78		53.73		bottle 12 at d=6 m
			20:20	2:22						Power off
End	NBP9507-SL06	03 Nov 95	20:22	2:24	61	38.78	54	53.73	2006	On deck-Yippee! All bottles fired!!
Begin	NBP9507-SL07	03 Nov 95								In Bransfield deep in Eastern Basin
			23:08	0:00	61	47.80	55	29.73	2717	Powering up on deck... A-OK
			23:15	0:07		47.84		29.74		in water, going down to 10m
			23:17	0:09						going down to 1500m at 30m/min
			23:33	0:25		47.85		29.72	2718	modem just quit
			0:05	0:57		47.80		29.75	2771	stopped at 1500m, continuing to 2500m
			0:33	1:25		47.83		29.68	2720	continuing to 2600m
			0:34	1:26						altimeter working
			0:38	1:30		47.84		29.66		stopped at 2600m, going to 2700
			0:43	1:35		47.80		29.75		stopped at 2700, alt=70m, down 20m more
	NBP9507-SL07	03 Nov 95	0:45	1:37		47.81		29.73	2778	d=2729m, starting up, alt=49m

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
			1:59	2:51	61	47.83	55	29.82		wo=100m
			2:02	2:54		47.83		29.84	2757	surface
End	NBP9507-SL07	04 Nov 95	2:03	2:55		47.83		29.84	2757	on deck
Begin	NBP9507-SL08	04 Nov 95	5:18	0:00	61	57.46	56	8.57	1835	powering up on deck, losing the modem
			5:21	0:03		57.43		8.69		modem's back, in the water
			5:28	0:10		51.42		8.61		starting down at 30m/min
			6:29	1:11		57.44		8.41	2395	going down to 2300m
			6:38	1:20		57.43		8.37		alt=89m, going down 30m more, d=2306
			6:40	1:22		57.43		8.35	2400	firing bottle #2, alt=60, d=2343
			6:59	1:41		57.46		8.20		firing bottle #4, 1772m, alt=209
			7:00	1:42						firing didn't confirm -- questionable
										trying again to fire, no confirm
										trying again to fire, no confirm
			7:02	1:44						no response from rosette
										can't communicate with rosette
										tried 2 more firings
			7:50	2:32		57.58		7.89	2370	holding at 8.7m wire out
			7:52	2:34						testing at surface, power cycle
End	NBP9507-SL08	04 Nov 95	7:58	2:40	61	57.55	56	7.78		on deck
Begin	NBP9507-SL09	05 Nov 95	21:50	0:00	61	33.66	54	34.52	2230	same spot as R04, power on, on deck
			22:06	0:16		33.67		34.52		in water
			22:12	0:22		33.66		34.53		starting down from surface
			23:10	1:20		33.69		34.52	2330	wo=1891
			23:22	1:32		33.68		34.48		bottle #2 at d=2212 m alt=56
			23:23	1:33						start up at 30m/min
			23:30	1:40		33.65		34.39	2324	firing bottle #4, d=2000, alt=263
			23:45	1:55		33.67		34.54		firing bottle #6, d=1500
			23:59	2:09		33.61		34.40	2335	firing bottle #8, d=1001
	NBP9507-SL09	05 Nov 95	0:14	2:24		33.56		34.53	2328	firing bottle #10, d=442

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
			0:26	2:36		33.57		34.30		firing bottle #12, d=19m
			0:27	2:37						power off, surface
End	NBP9507-SL09	06 Nov 95	0:29	2:39	61	33.59	54	34.22		on deck - 6, 8 and 12 did not close
Begin	NBP9507-SL10	06 Nov 95	2:24	0:00	61	41.91	55	10.44	2188	in central part of East Basin
			2:24	0:00		41.91		10.43		power on, on deck
			2:31	0:07		41.95		10.39		in water, holding at surface
			2:34	0:10		41.90		10.38	2246	going down
			2:58	0:34		41.88		10.52	2270	bottle #2, d=899m
										modem quit for a while
			3:07	0:43		41.93		10.38		rosette should be ready for btl#4
			3:12	0:48						modem keeps disconnecting/reconnecting
			3:17	0:53		41.99		10.33	2270	continuing down to 2000
			3:32	1:08		41.92		10.39		2000m, going down another 100m
			3:35	1:11						2100m, down another 60m
			3:38	1:14		41.97		10.35	2178	2165m, alt=49, down another 10m
			3:40	1:16						2175, alt=41
			4:39	2:15		41.88		10.39	2180	coming up, wo=60
			4:42	2:18						at surface
End	NBP9507-SL10	06 Nov 95	4:43	2:19	61	41.92	55	10.37	2180	on deck 2&4 closed, in position 5
Begin	NBP9507-SL11	07 Nov 95	14:10	0:00	62	18.56	57	41.96	1916?	High heat flow site -kasten core -Central B.
			14:10	0:00						powered up on deck
			14:14	0:04						all systems ready! going in...
			14:19	0:09						waiting for *BIG* piece of ice to go by...
			14:24	0:14						system restarted
			14:25	0:15		18.52		42.28		system OK - trying again
			14:28	0:18		18.53		42.34		in water!! Going down to 10m
			14:30	0:20		18.51		42.43		bringing back to surface
			14:32	0:22		18.51		42.47		starting down again at 30m/min
	NBP9507-SL11	07 Nov 95	14:33	0:23						stbd roll is positive

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
	NBP9507-SL11	07 Nov 95	15:05	0:55		18.51		42.17		40 kt outside, have a 40 deg wire angle
			15:30	1:20		18.54		42.36	1935	d=1720, alt=215
			15:33	1:23						going down to 1900m
			15:34	1:24						no confirm. on empty position
			15:37	1:27		18.53		42.30	1943	btl#2, confirm, d=1904, alt=39m
			15:49	1:39		18.56		42.41		btl#4, confirm, d=1510
			16:03	1:53		18.61		42.55		btl#6, d=1014m
			16:17	2:07		18.51		42.60		btl#8, d=505m
			16:25	2:15		18.53		42.51		btl#10, d=249m
			16:32	2:22		18.58		42.60		btl#12, d=15m
			16:34	2:24						resetting plot param. to test pump
			16:36	2:26						starting down at 30m/min
			16:47	2:37		18.64		42.65		went down to - 340m going back up
			16:59	2:49						at 10 m - gonna hang out here -
			16:59	2:49						modem test-it reconnected but can't talk down
End	NBP9507-SL11	07 Nov 95	17:09	2:59		18.42		42.40		on deck - no H2O in btl 8,10, 12
Begin	NBP9507-SL12	08 Nov 95	2:28	0:00	62	26.66	58	19.50	1500	on east flank of Orca seamount-Central B.
			2:29	0:01						in water
			2:31	0:03		26.69		19.54	1583	holding at 10 m for 1/2 hour
			2:58	0:30		26.64		19.56	1487	up to surface to start down from surface
			2:59	0:31						modem crapped out
			3:04	0:36		26.57		19.56	1454	down at 30 m/min
			3:05	0:37						payout meter not working -winch stopped
			3:09	0:41		26.51		19.52	1471	going down at 30m/min from surface
			3:13	0:45						modem not working - no roll data
			3:51	1:23		26.46		19.47		d=1270, down another 200m
			3:58	1:30					~1510	down another 10m to 1460m
			4:00	1:32		26.46		19.50		at the bottom, d=1463, alt=50
			4:43	2:15		26.47		19.50		stopped at 13m, power cycle
	NBP9507-SL12	08 Nov 95								modem won't connect

	SLED NUMBER	Date	Time GMT	elapsed time	Lat °S	Lat min.	Long °W	Long min.	Depth meters	Comments
End	NBP9507-SL12	08 Nov 95	4:48	2:20		26.49		19.44		on deck
Begin	NBP9507-SL13	08 Nov 95	12:21	0:00	62	39.63	59	5.00	1413	between the Great Walls - western KG Basin
			12:21	0:00						turning system on
			12:30	0:09						in water, huge piece of ice heading toward sled
			12:32	0:11		39.58		5.01		at 10 m and holding
			12:56	0:35		39.57		5.06		up to the surface, then starting down @ 30
			13:31	1:10		39.61		5.12		d=1170, alt=200
			13:35	1:14						d=1280, going down another 50m
			13:37	1:16		39.58		5.11		d=1325, alt=50, bottle#2
	NBP9507-SL13	08 Nov 95	13:43	1:22						up 200m, stopped at 1180m, bottle#4
			13:45	1:24		39.57		5.15		alt=185, d=1187
			13:58	1:37		39.58		5.10		bottle#6, d=842, alt=345
			14:06	1:45		39.53		5.04		bottle#8, d=590
			14:15	1:54		39.49		5.05		bottle#10, d=280
			14:23	2:02		39.46		5.04		bottle#12, d=6m
End	NBP9507-SL13	08 Nov 95	14:25	2:04						on deck, 8 -tap open, 12-DNC
Begin	NBP9507-SL14	08 Nov 95	16:55	0:00	62	38.68	58	59.98	1022	on high on eastern end of middle long ridge
			16:55	0:00						power on - on deck
			17:01	0:06						No modem - turn system off then on again
			17:09	0:14		38.64		59.93		in water, down to 10m and hold
			17:14	0:19						modem quit
			17:16	0:21						power cycled the modem--back
			17:41	0:46		38.47		59.86		starting down at 30m/min
			17:44	0:49					1170	lost the modem
			18:10	1:15		38.38		59.78	1190	down 200 more, d=940
			18:17	1:22		38.36		59.82		stopped, d=1173, alt=26
			18:18	1:23					1182	plume at ~1050m
										rosette firing not working, starting up
	NBP9507-SL14	08 Nov 95								

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
			18:53	1:58		38.12		59.71		at surface, power off
End	NBP9507-SL14	08 Nov 95	18:55	2:00	62	38.09	59	59.70	1182	on deck
Begin	NBP9507-SL15	08 Nov 95	19:34	0:00	62	38.35	59	3.84	1068	summit of north ridge
			19:34	0:00		38.35		3.80	1068	power on - warming up pump on deck
			19:40	0:06						power cycling...
										modems picking up too much noise
			19:48	0:14		38.26		3.83		deploying - in the water, modems working
			19:49	0:15						modems quit again
										waiting for instruments to equilibrate
			20:17	0:43		38.23		3.62		going up to surface - then down @30
			20:48	1:14						d=980 - zilcho...
			20:54	1:20	62	38.26	59	3.35	1118	btl #2 d=1095, alt=62, up @ 30
			21:02	1:28		38.24		3.23		btl #4 d=862, alt=?
			21:11	1:37		38.20		3.16		btl#6, d=545
			21:19	1:45		38.19		3.12		btl#8, d=297
			21:23	1:49						btl#10. never got fire signal
			21:28	1:54		38.15		3.09		surface
End	NBP9507-SL15	08 Nov 95	21:30	1:56						on deck -pin went all the way around
Begin	NBP9507-SL16	08 Nov 95	22:19	0:00	62	41.43	59	0.54	1144	southern ridge
			22:19	0:00						powering up on deck
			22:19	0:00		41.49		0.44		modems not happy, power cycle
			22:26	0:07		41.48		0.49		in the water
			22:27	0:08						holding at 10m, modems off till it's in the h20
			22:39	0:20		41.49		0.49		power cycle
			22:43	0:24						modems up, entering ZAPS params manually
			22:47	0:28						all set, modems working!
										still holding at 10m
			23:03	0:44		41.47		0.40	1140	going down at 30
	NBP9507-SL16	08 Nov 95	23:32	1:13		41.49		0.51		d=900m, down another 100m, alt=245

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
	NBP9507-SL16	08 Nov 95	23:37	1:18						d=1000, alt=150, down another 50m
			23:42	1:23		41.46		0.67	1144	btl#2 @ d=1124, alt=32, up at 30
			23:46	1:27		41.44		0.52	1144	btl#4 @ d=1008, alt=150
			23:55	1:36		41.50		0.42	1142	btl#6 @ d=701
		09 Nov 95	0:01	1:42		41.49		0.47	1144	btl#8 @ d=497
			0:07	1:48		41.15		0.59		btl#10 @ d=297
			0:15	1:56						btl#12 @ d=10
			0:16	1:57		41.46		0.48		out of water - power off
End	NBP9507-SL16	09 Nov 95	0:17	1:58	62	41.46	59	0.48	1144	on deck - 2 DNC,
Begin	NBP9507-SL17	09 Nov 95	1:11	0:00	62	39.51	59	1.83	1168	on middle ridge between SL13 & SL 14
			1:11	0:00						all systems on & running
			1:11	0:00	62	39.51	59	1.83	1168	on middle ridge between SL13 & SL14
			1:19	0:08						modems not working, going to 10m
			1:22	0:11		39.51		1.86	1285	at 10m, modems working
			1:34	0:23		39.59		1.95	1285	up to surface then down @30
			2:12	1:01		39.72		1.98		btl#2, d=1165, alt=52
			2:14	1:03		39.71		2.01		btl#4, d=1175, alt=45
			2:14	1:03						starting up at 30
			2:18	1:07		39.72		2.13		btl#6, d=1043, alt=172
			2:36	1:25		39.85		2.29		btl#8, d=460
			2:44	1:33		39.84		2.40		btl#10, d=207
			2:50	1:39		39.82		2.43		btl#12, d=12, no confirm
End	NBP9507-SL17	09 Nov 95	2:52	1:41		39.85		2.45		on deck, btl 8 pin missing, on pos 2
Begin	NBP9507-SL18	09 Nov 95	16:11	0:00	62	42.81	59	13.48	1341	a tow above middle ridge
			16:11	0:00						system on-Paul says pump temp drift fixed
			16:15	0:04						she's getting wet now
			16:17	0:06						in water - down to 10m for a little siesta

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
	NBP9507-SL18	09 Nov 95	16:26	0:15		42.86		14.57		up to surface then down at 30m/min
			17:02	0:51		42.70		13.46		at 1100 m-bottom depth?? Alt not working
			17:02	0:51						stoppping
			17:03	0:52		42.69		13.44		maybe wandered off ridge and alt off-scale?
			17:05	0:54						d=1160, alt=260, down another 50
			17:06	0:55						appears alt is working -
			17:11	1:00						d=1350, alt=100, going for another 50 out
										d=1400 , alt=65 stopping
			17:17	1:06						new file, starting up slow, at .5 knot
			17:20	1:09						no capture file for downcast
			17:42	1:31		42.32		12.10		d=700m, down to 50 mab
			17:55	1:44						bridge was going 2.5 kt- slowing down
			18:05	1:54		42.04		11.37		alt says 88 off, up at 30, d=1290
			18:23	2:12		41.85		10.63		d=698, down at 30
			18:42	2:31		41.52		10.06	1319	d=1282, alt =37, seeing big signals again
			19:01	2:50		41.28		9.38		d=695, down at 30
			19:19	3:08		41.03		8.47		signal at 1175 m
			19:23	3:12						d=1350, alt=50, still paying out
			19:23	3:12		41.00		8.22	1388	d=1361, alt=27, going up, wo=1450 m
			19:44	3:33		40.83		7.29		d=700, wo=784, going down at 30
			20:00	3:49		40.53		6.52	1232	d=1196, alt=36, up =30
			20:07	3:56						going until we past sled 13 position
			20:18	4:07		40.35		6.00		d=703, wo =727
										TAG sized plume!
			20:38	4:27		40.01		5.43	1351	d=1315, alt=36, up at 30m/min
			20:56	4:45		39.71		4.79		d=703, wo=774, down =30
			21:14	5:03		39.53		3.99	1328	d=1285, alt= 43, up=30, po=1339
			21:34	5:23		39.40		3.24		d=679, wo=712, down=30
			21:51	5:40		39.33		2.75	1301	d=1262, wo=1279, alt=39
			22:09	5:58		39.29		2.41		d=702, wo=703
	NBP9507-SL18	09 Nov 95								depth readings from alt.

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
	NBP9507-SL18	09 Nov 95	22:21	6:10		39.23		2.01	1172	d=1121, alt=51, wo=1126
			22:23	6:12						Recover or continue? opted for cont.
			22:36	6:25		39.10		1.50		d=700,wo=705
			22:49	6:38		38.94		1.05	1112	d=1070, wo=1121, alt=42, recovering sled
			22:54	6:43		38.95		1.00	1146	winch stopped d=994, alt=152, wo=1021
			22:59	6:48		38.88		0.90		going down down to 60 mab for upcast
			23:01	6:50		38.87		0.90	1153	d=1100, alt=53, wo=1100
			23:05	6:54						changing files for upcast
			23:06	6:55		38.85		0.84	1132	btl#2, d=1075, alt=57
			23:10	6:59		38.81		0.82	1138	btl#4, d=965, alt=173
			23:17	7:06		38.77		0.96		btl#6, d=765
			23:21	7:10		38.74		0.90		btl#8, d=630
			23:33	7:22		38.67		0.99		btl#10, d=259, T max
			23:41	7:30		38.62		0.84		btl#12, d=10
			23:42	7:31						out of water
End	NBP9507-SL18	09 Nov 95	23:42	7:31	62	38.58	59	0.82		on deck. total distance= 7.19 nm
Begin	NBP9507-SL19	09 Nov 95	12:53	0:00	62	25.38	58	24.58	1091	in caldera of Orca semount/volcano
			12:53	0:00						power on, on deck
			12:56	0:03						modem not working, power cycle
			13:02	0:09						pump current and revs working
			13:04	0:11		25.40		24.70		in water, down to 10 and hold
			13:12	0:19		25.38		24.67	1093	up to surface then down
			13:13	0:20						sinking...
			13:19	0:26						modem gone - now back
			13:39	0:46		25.35		24.57	1110*	alt=270, d=840, *depth from alt
			13:45	0:52		25.37		24.49	1104	d=1014 , alt=90
			13:46	0:53		25.39		24.50	1104	d=1072, alt=32 - NADA
			13:48	0:55		25.39		24.47	1101	btl#2, d=1069, alt=32, up at 30
			13:53	1:00		25.42		24.54	1107	btl#4, d=927, alt=180
	NBP9507-SL19	09 Nov 95	14:03	1:10		25.38		24.66		btl#6, d=600

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
			14:11	1:18		25.41		24.59		btl#8, d=301
			14:17	1:24		25.43		24.73		btl#10, d=99
			14:20	1:27		25.39		24.75		stopped at surface, btl#12, d=2.4
End	NBP9507-SL19	09 Nov 95	14:21	1:28		25.39		24.73		on deck
Begin	NBP9507-SL20	10 Nov 95	20:25	0:00	62	14.85	57	24.34	~1650	tow along hook-shaped seamount
			20:25	0:00						powering up
			20:30	0:05		14.85		24.34		putting in water
			20:54	0:29		14.31		24.93		arrived on station - in water, holding at 10
			21:13	0:48		14.31		24.91		up to surface then down to 1000
			22:03	1:38					1690*	alt=60, d=1630, slowing to 20m/min
			22:04	1:39		14.26		24.83	1675*	d=1633, alt=52
			22:05	1:40						up at 30m/min
			22:06	1:41						starting new file at alt=89
			22:23	1:58		14.14		24.43	1594	d=1106m, heading back down
			22:38	2:13		13.99		24.05	1606*	d=1558, alt=48, starting up at 30
			22:51	2:26						wo=1229, d=1154
			23:06	2:41		13.77		23.32		wo=705, d=705, heading down at 30
			23:27	3:02		13.61		23.10	1454*	d=1406, alt=48, wo=1407, up @30
			23:49	3:24		13.53		22.92		stop at 690m, wo=690, down @30
			0:07	3:42		13.22		22.00	1391*	d=1345, alt=46, up at 30
			0:11	3:46						technical prob- winch stopped
			0:12	3:47						winch on - have not been getting lat&long
			0:22	3:57		13.10		21.75		
			0:31	4:06		13.01		21.59		
			0:34	4:09		12.58		21.35		down again, d=694m wo=362m!!
			0:36	4:11						lat and long back on
			0:46	4:21		12.87		21.35	1192*	d=1186, alt=46, heading back up
			1:02	4:37		12.76		21.06		down again, d=694, wo=357m
			1:15	4:50		12.69		20.75	1226*	up again, d=1183, alt=43, wo=844
	NBP9507-SL20	10 Nov 95	1:17	4:52						told bridge to speed up a little (from .5 kt)

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
	NBP9507-SL20	10 Nov 95	1:31	5:06		12.57		20.34		d=700,wo=394
			1:44	5:19		12.40		20.17	1209*	wo=833, d=1159, alt=50, up at 30
			1:56	5:31		12.28		19.89		wo=370, d=699, down
			2:10	5:45		12.17		19.49	1191*	wo=828, d=1143, alt=48
			2:24	5:59		12.11		19.50		d=710, wo=365
			2:39	6:14		12.13		18.55	1238*	d=1181, alt=57
						12.16		18.33	1258*	d=1028, turbidity anomaly, alt=230
			3:10	6:45		12.07		17.64	1278*	d=1230, alt=48, back up at 30
			3:30	7:05		11.98		17.12		d=695, changed optical, on the way down
			3:46	7:21		11.85		16.89	1270*	d=1225, alt=45, heading up
			4:03	7:38		11.75		16.83		d=698, down, wo=355
			4:14	7:49		11.66		16.70	1103*	d=1065, alt=38, wo=716
			4:27	8:02		11.57		16.61		d=669, going back down, wo=330
			4:37	8:12		11.51		16.48	1055*	d=1006, alt=49, wo=651
			4:47	8:22		11.45		16.30		d=700, wo=347
			4:58	8:33		11.37		16.60	1098*	alt=45, d=1053, wo=700
			5:04	8:39		11.34		16.07		recovering sled , upcast in T2 file
End	NBP9507-SL20	11 Nov 95	5:32	9:07		11.45		15.85		on surface, power off
Begin	NBP9507-SL21	11 Nov 95	6:32	0:00	62	11.05	57	11.67	1184	At hook of hook-shaped seamount
			6:32	0:00		11.02		11.62		power on, ect
			6:36	0:04		11.06		11.66		power cycling
			6:49	0:17		11.02		11.69		going in the drink
			6:51	0:19		11.00		11.65		She's all wet! => 10m and hold
			6:54	0:22		11.06		11.62		come up to surface -then down
			7:00	0:28					1140	
			7:31	0:59		11.02		11.68	1148*	d=1109, alt=39, btl#2
			7:32	1:00		11.01		11.67	1150*	btl#4, d=1092, alt=58
			7:38	1:06		11.06		11.72		btl#6, d=888
			7:46	1:14		11.05		11.69		btl#8, d=640
	NBP9507-SL21	11 Nov 95	7:55	1:23		11.02		11.72		btl#10, d=330

	SLED NUMBER	Date	Time	elapsed	Lat	Lat	Long	Long	Depth	Comments
			GMT	time	°S	min.	°W	min.	meters	
			8:04	1:32		11.03		11.67		btl#12, d=10
End	NBP9507-SL21	11 Nov 95	8:04	1:32	62	11.04	57	11.68		on deck
Begin	NBP9507-SL22	14 Nov 95			62		56			western East Basin-filling in coverage, lots of
										ice-drifting to position (56 5.9, 62 4.05)
			19:31	0:00		2.15		27.45		in H20, watch doesn't think we'll get there
			19:33	0:02		2.14		27.40		in water
			19:42	0:11		2.15		27.20	1835	up to surface, down at 30
			19:52	0:21		2.26		26.92	1835	still going down -lt low??
			20:01	0:30		2.33		26.78	1830	
			20:08	0:37		2.30		26.66	1830	
			20:13	0:42		2.26		26.64	1800	
			20:22	0:51		2.22		26.41	1830	
			20:26	0:55		2.19		26.19	1825	
			20:30	0:59		2.25		26.14	1831*	alt kicking in - a= 211m , d=1620
			20:34	1:03		2.28		26.12	1834*	d =1794, alt= 40, coming up @30
										analog channel out -no bottles
			20:56	1:25		2.25		25.59		d=1124, bottle 2, wo=1120
			21:06	1:35		2.28		25.46		d=798, wo=795, bottle4
			21:13	1:42		2.26		25.20		d=498m wo=501m bottle 6
			21:21	1:50		2.22		25.04		d=200, wo=200, bottle 8
			21:24	1:53	62	2.20	56	25.01		d=100, wo=100 bottle 10
			21:27	1:56		2.22		24.95		d=14m, bottle 12
End	NBP9507-SL22	14 Nov 95	21:29	1:58		2.22		24.90		out of water

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
				SLED LOG								
		Ship:	I B. Palmer 9507									
Area:	Bransfield Strait, Antartica											
Dates:	8 Oct - 8 Dec 1995											
Station ID format:		NBP-AAxx, AA=operation type, xx=operation number										
	Operations:	Water Sample Types:										
	SL=sled/ZAPS	R=Radon										
	R=rosette/CTD	H=Helium		F=Filtered water								
		S=Salinity										
		T=Trace metals										
ENTER DATE: COMMAND HYPHEN												
ENTER TIME: COMMAND SEMI-COLON												
	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
Begin	NBP9507-SL23	15 Nov 95	1:47	0:00	62	57				11.94	17.37	bottom drift at hook-shaped seamoun
			1:47	0:00								big signals of SL20
			1:47	0:00								power on
			1:57	0:10						11.95	17.13	in water
			2:07	0:20			290		307	11.86	16.94	d=290,wo=307
												neph=.07,xmiss=40
			2:16	0:29			640			11.86	17.02	
			2:24	0:37			857			11.94	17.04	
			2:31	0:44			1120	155	1140	11.97	17.08	
			2:36	0:49			1236	43		12.30	17.10	winch stopped
			2:40	0:53			1250	36	36	12.00	17.16	starting down

ROSETTE LOG

Ship: Nathaniel B. Palmer 9507
Area: Bransfield Strait, Antartica
Dates: 28 Oct - 8 Dec 1995

Station ID format: NBP-AAxx, AA=operation type, xx=operation number

Operations:	**Water Sample Types:**		
SL=sled/ZAPS	R=Radon	F=Filtered water	
R=rosette/CTD	H=Helium		No bottle in position #4 - altimeter
	S=Salinity		DNF-Did Not Fire
	T=Trace metals:1 liter and 500 ml (1IT, .5IT)		

ENTER DATE: COMMAND HYPHEN
ENTER TIME: COMMAND SEMI-COLON

	ROSETTE NUMBER	Date	Time GMT	elapsed time	Lat °S	Lat min.	Long °W	Long min.	Depth meters	Comments
Begin	NBP9507-R01	29 Oct 95	11:03	0:00	55	11.51	65	11.73	925	Bottle Test-ships seasave program
End			12:42	1:39						didn't work until upcast
										21 bottles @ 500 m, 1 @ 250, 1 @ surface

Type	Sample ID NBP9507-R01	Rosette Number	Depth meters	Approx. MAB	Comments
S	2046	1	500	425	leaky
S	2052	2	500	425	
S	2020	3	500	425	
S	2048	5	500	425	
S	2056	6	500	425	
S	2028	7	500	425	
S	2042	8	500	425	

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R01	Number	meters	MAB						
S	2054	9	500	425						
S	2150	10	500	425		leaky				
S	2024	11	500	425						
S	2060	12	500	425						
S	2116	13	500	425						
S	2026	14	500	425		leaky				
S	2211	15	500	425		leaky				
S	2016	16	500	425						
S	2022	17	500	425						
S	2030	18	500	425						
S	2044	19	500	425						
S	2038	20	500	425		leaky				
S	2014	21	250	675						
S	2040	22	0	925		leaky				
Begin	NBP9507-R02	01 Nov 95	15:20	0:00	62	11.93	57	21.79	1667	In Bransfield Strait - in ice
										in water, SE of King G. island near seamoun
										between D309 and D310 (polarstern)
			15:48	0:28	62	11.96	57	21.77	1672	in the water, at the surface
			15:50	0:30		11.92		21.73		starting down, going to 1500 m
										at 350m stopped seasave to change param
			16:09	0:49		11.83		21.39	1632	
										xmiss spike at 630 m
			16:18	0:58		11.79		21.22	1581	
			16:28	1:08		11.80		20.68	1484	p=1106
			16:34	1:14		11.72		20.70	1502	p=1270
			16:39	1:19		11.68		20.71	1517	p=1407, stopped, down another 25 m
										p=1434, stopped fired 3 bottles
			16:42	1:22		11.70		20.60		positions 1-4 tripped, p=1452
										position 5 shows up on software as tripped

	NBP9507-R02	01 Nov 95	16:51	1:31	62	11.68	57	20.53	1492	positions 6, 7, 8 at p=1302
			16:55	1:35		11.63		20.45		positions 9, 10, 11 at p=1200
			16:59	1:39		11.60		20.42		positions 12, 13, 14 at p=1100
			17:03	1:43		11.57		20.41		positions 15, 16, 17 at p=1002
			17:06	1:46		11.54		20.36		positions 18, 19, 20 at p=900
			17:13	1:53		11.52		20.24		position 21 at p=752
			17:17	1:57		11.50		20.27		position 22 at p=641
			17:23	2:03		11.44		20.26		position 23 at p=500
			17:33	2:13		11.41		20.20		position 24 at p=250
End	NBP9507-R02	01 Nov 95	17:43	2:23						done
Type	**Sample ID**	**Rosette**	**Depth**	**Approx.**	**Comments**					
	NBP9507-R02	**Number**	**meters**	**MAB**						
RS	S9-bl	1	1425	67						
	DNF	2	1425	67						
RS	S11-yr	3	1425	67						
RST	S6-r; 1l TM	5	1415	77						
RS	S7	6	1290	202						
RT	1l TM	7	1290	202						
	DNF	8	1290	202						
RS	S11-bl	9	1189	303						
RS	S17	10	1189	303						
RST	S3-y; 1l TM	11	1189	303						
	DNF	12	1090	402						
RS	S15	13	1090	402						
RST	S21-ry; 1l TM	14	1090	402						
RS	S9-yr	15	993	499						
RS	S23	16	993	499						
RST	S6-bl; 1l TM	17	993	499						
RS	S21-bl	18	894	598						
RS	S19-bl	19	894	598						
ST	S19-rg; 1l TM	20	894	598						
ST	S17-rg; 1l TM	21	747	745						

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R02	Number	meters	MAB						
ST	S23-rg; 1l TM	22	636	856						
ST	S15-rg; 1l TM	23	496	996						
	DNF	24	250	1242						
Begin	NBP9507-R03	02 Nov 95	21:25	0:00	62		57			At site of SL05, in water
			22:15	0:50		11.59		6.44		fired bottles 1-3, p=1661 db
			22:21	0:56		11.63		6.49		fired bottles 5, p=1500 db
			22:24	0:59		11.60		6.49		fired bottles 6-8, p=1398 db
			22:28	1:03		11.58		6.49		fired bottles 9, p=1298 db
			22:31	1:06		11.58		6.44		fired bottles 10-12, p=1198 db
			22:34	1:09		11.54		6.44		fired bottles 13, p=1099 db
			22:37	1:12		11.57		6.44		fired bottles 14-16, p=1000 db
			22:40	1:15		11.57		6.36		fired bottles 17, p=896 db
			22:43	1:18		11.52		6.31		fired bottles 18-20, p=800 db
			22:49	1:24		11.55		6.41		fired bottles 21, p=599 db
			22:55	1:30		11.57		6.47		fired bottles 22-24, p=397 db
End	NBP9507-R03	02 Nov 95	23:10	1:45						done
										23 bottles fied - #2 & #24 didn't fire
Type	**Sample ID**	**Rosette**	**Pres**	**Approx.**	**Comments**					got all bottles fired error at #24
	NBP9507-R03	**Number**	**Dbars**	**MAB**						Seasoft software DID NOT SAVE file!
R		1	1661							
	DNF	2	1661							
RT	.5lT	3	1661							
T	.5lT	5	1500							
R		6	1398							
R		7	1398							
R		8	1398							
T	.5lT	9	1298							
R		10	1198							
R		11	1198							

Type	Sample ID	Rosette	Pres	Approx.	Comments					
	NBP9507-R03	Number	Dbars	MAB						
R		12	1198							
T	.5IT	13	1099							
R		14	1000							
R		15	1000							
R		16	1000							
T	.5IT	17	896							
R		18	799							
R		19	799							
R		20	799							
T	.5IT	21	599							
R		22	397							
R		23	397							
	DNF	24	397							
Begin	NBP9507-R04	05 Nov 95	19:01	0:00	61	33.71	54	34.56	2205	Eastern East Basin
			19:04	0:03		33.72		34.44	2205	in the water
			19:13	0:12						tape restarted d=250 m
			19:57	0:56						tape changed direction d=1809
			20:00	0:59						at bottom - new file
			20:12	1:11		33.72		34.53		btl 1-3, d=2183
			20:16	1:15		33.80		34.46		btl. 5, d=2080
			20:22	1:21		33.73		34.49		btl. 6-8, d=1900
			20:26	1:25		33.72		34.50		btl. 9, d=1800m
			20:30	1:29		33.73		34.51		btl. 10-12, d=1701m
			20:34	1:33		33.74		34.51		btl. 13, d=1600m
			20:38	1:37		33.71		34.52		btl. 14-16, d=1500m
			20:41	1:40						tape changed
			20:47	1:46		33.71		34.54		btl. 17, d=1201m
			20:54	1:53		33.76		34.46		btl. 18-20, d=1000m
			21:03	2:02		33.68		34.38		btl. 21, d=750m
			21:11	2:10		33.68		34.48		btl. 22-24, d=501m

End	NBP9507-R04	05 Nov 95	21:25	2:24						on deck
										bottles 14 and 22 leaking
Type	**Sample ID**	**Rosette**	**Pres**	**Approx.**	**Comments**					
	NBP9507-R04	**Number**	**Dbars**	**MAB**						
RH		1	2182	23						
	DNF	2	2182	23						
RT	1IT	3	2182	23						
TH	.5IT	5	2080	125	value slightly leaking?					
RH		6	1900	305						
R		7	1900	305						
RT	1IT	8	1900	305						
TH	.5IT	9	1800	405						
RH		10	1701	504						
R		11	1701	504						
RT	1IT	12	1701	504						
TH	.5IT	13	1600	605						
RH		14	1500	705	leaking					
R		15	1500	705						
RT	1IT	16	1500	705						
TH	.5IT	17	1201	1004						
RH		18	1000	1205						
R		19	1000	1205						
R		20	1000	1205						
TH	.5IT	21	750	1455						
RH		22	500	1705	leaking					
R		23	500	1705						
RT	1IT	24	500	1705						
Begin	NBP9507-R05	07 Nov 95	19:00	0:00	62	18.42	57	42.00	2000?	Eastern East Basin
			19:00							power on, at surface
			19:02							tape recording
			19:03							winch stopped to reset - didn't work
			19:04							going back to surface - no wo readings

	NBP9507-R05	07 Nov 95	19:05	0:05						at surface, going down again @ 45m/min
			19:07	0:07						salinity sensor still covered - recovering CTD
			19:12	0:12						on deck
			19:14	0:14						let's try again, down at 45 m/min
			19:17	0:17						winch stopped, d=105, ship drifting from wire
										- tugged back in w/ grapples. wire damaged?
			19:19	0:19						continuing down
			20:00	1:00		18.48		42.00		btl. 1-4, d=1900m
			20:04	1:04		18.42		41.94		btl. 5, d=1800m
			20:06	1:06		18.48		41.94		btl. 6-8, d=1700m
			20:09	1:09		18.42		41.88		btl. 9, d=1600m
			20:12	1:12		18.18		41.88		btl. 10-12, d=1520m
			20:16	1:16		18.42		41.82		btl. 13, d=1350m
			20:20	1:20		18.48		41.94		btl. 14-16, d=1200m
			20:25	1:25		18.48		41.94		btl. 17, d=1000m
			20:30	1:30		18.53		41.93		btl. 18-20, d=800m
			20:39	1:39		18.55		41.97		btl. 21, d=450m
			20:41	1:41		18.56		42.01		btl. 22-24, d=380m
			20:48	1:48						winch stopped at 110 m to check wire
			20:48	1:48						tape had stoppped - put in new one
			20:50	1:50						coming back in
End	NBP9507-R05	07 Nov 95	20:53	1:53	62	18.48	57	42.00	2000	on deck-FILE EMPTY - recovered w checkdsk

Type	**Sample ID**	**Rosette**	**Depth**	**Approx.**	**Comments**
	NBP9507-R05	**Number**	**meters**	**MAB**	
RH		1	1900	100	
R		2	1900	100	leaking during sampling
RT	1IT	3	1900	100	
TH	.5IT	5	1800	200	
RH		6	1700	300	
R		7	1700	300	
RT	1IT	8	1700	300	
TH	.5IT	9	1600	400	

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R05	Number	meters	MAB						
RH		10	1520	480						
R		11	1520	480						
RT	1IT	12	1520	480						
TH	.5IT	13	1350	650						
RH		14	1200	800						
R		15	1200	800						
RT	1IT	16	1200	800						
TH	.5IT	17	1000	1000						
RH		18	800	1200						
R		19	800	1200						
RT	1IT	20	800	1200						
TH	.5IT	21	450	1550						
RH		22	380	1620						
R		23	380	1620						
RT	1IT	24	380	1620						
Begin	NBP9507-R06	07 Nov 95			62	40.40	59	5.10	1190	2 miles SW of SL17
			4:15			40.39		5.16		btl. 1-3, d=1105
										btl. 5, d=1070
										btl. 6-8, d=1060
			4:20			40.37		5.12		btl. 9, d=1010
			4:21			40.37		5.17		btl. 10-12, d=980
			4:23			40.39		5.15		btl. 13, d=950
			4:24			40.40		5.11		btl. 14-16, d=920
			4:25			40.40		5.06		btl. 17, d=890
			4:27			40.40		5.06		btl. 18-20, d=850
			4:28			40.39		5.07		btl. 21, d=825
			4:29			40.39		5.07		btl. 22-24, d=800

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R06	Number	meters	MAB						
RH		1	1105	75	b slushy click					
R		2	1105	75						
RT	1IT	3	1105	75						
TH	.5IT	5	1070	110						
RH		6	1060	120						
R		7	1060	120						
RT	1IT	8	1060	120						
TH	.5IT	9	1010	170	a slushy, b lost					
RH		10	980	200						
R		11	980	200						
RT	1IT	12	980	200						
TH	.5IT	13	950	230						
RH		14	920	260						
R		15	920	260						
RT	1IT	16	920	260						
TH	.5IT	17	890	290						
RH		18	850	330	b slushy click					
R		19	850	330						
RT	1IT	20	850	330						
TH	.5IT	21	825	355	leaking before valve opened					
RH		22	800	380						
R		23	800	380						
RT	1IT	24	800	380						
Begin	NBP9507-R07	10 Nov 95	14:56	0:00	62		58		1091	same spot as SL19
			15:20	0:24		25.36		24.50		btl. 1-3, d=1050
			15:22	0:26		25.36		24.53		btl. 5, d=1002
			15:25	0:29		25.36		25.55		btl. 6-8, d=953
			15:27	0:31		25.34		25.58		btl. 9, d=903
			15:29	0:33		25.34		25.59		btl. 10-12, d=853
			15:32	0:36		25.36		25.56		btl. 13, d=803

	NBP9507-R07	10 Nov 95	15:34	0:38		25.36		25.59		btl. 14-16, d=763
			15:36	0:40		25.37		25.59		btl. 17, d=727
			15:38	0:42		25.37		25.60		btl. 18-20, d=690
			15:39	0:43		25.36		25.60		btl. 21, d=650
			15:41	0:45		25.34		25.67		btl. 22-24, d=600
End	NBP9507-R07	10 Nov 95	15:58	1:02						on deck
Type	**Sample ID**	**Rosette**	**Depth**	**Approx.**	**Comments**					
	NBP9507-R07	**Number**	**meters**	**MAB**						
RH		1	1050	50	b slushy click					
R		2	1050	50						
RT	1IT	3	1050	50						
	no water	5	1002	98	DNC					
RH		6	953	147						
R		7	953	147						
RT	1IT	8	953	147						
TH	.5IT	9	903	197	a no click					
RH		10	853	247	a slushy click, b no click					
R		11	853	247						
RT	1IT	12	853	247						
	no water	13	803	297	DNC					
RH		14	763	337						
R		15	763	337						
RT	1IT	16	763	337						
TH	.5IT	17	727	373						
RH		18	690	410						
	no water	19	690	410	NDC					
RT	1IT	20	690	410						
TH	.5IT	21	650	450						
RH		22	600	500	b no click					
R		23	600	500						
RT	1IT	24	600	500						

Begin	NBP9507-R08	15 Nov 95	14:56	0:00	62		58		1091	same spot as SL23, camera, dredge etc.
			15:20	0:24		11.61		16.60		btl. 1-3, d=1015
			15:22	0:26		11.60		16.57		btl. 5, d=998
			15:25	0:29		11.61		16.52		btl. 6-8, d=979
			15:27	0:31		11.61		16.48		btl. 9, d=956
			15:29	0:33		11.57		16.49		btl. 10-12, d=938
			15:32	0:36		11.55		16.52		btl. 13, d=919
			15:34	0:38		11.58		16.51		btl. 14-16, d=899
			15:36	0:40		11.64		16.46		btl. 17, d=879
			15:38	0:42		11.64		16.46		btl. 18-20, d=859
			15:39	0:43		11.62		16.49		btl. 21, d=839
			15:41	0:45		11.59		16.51		btl. 22-24, d=799
End	NBP9507-R08	15 Nov 95	15:58	1:02						on deck
Type	**Sample ID**	**Rosette**	**Depth**	**Approx.**	**Comments**					
	NBP9507-R08	**Number**	**meters**	**MAB**						
RH		1	1015	76						
R		2	1015	76						
RT	1IT	3	1015	76						
TH	.5IT	5	998	93						
RH		6	979	112						
R		7	979	112						
RT	1IT	8	979	112						
TH	.5IT	9	956	135						
RH		10	938	153						
R		11	938	153						
RT	1IT	12	938	153						
TH	.5IT	13	919	172						
RH		14	899	192						
R		15	899	192						
RT	1IT	16	899	192						
TH	.5IT	17	879	212						
RH		18	859	232						

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R08	Number	meters	MAB						
R		19	859	232						
RT	1IT	20	859	232						
TH	.5IT	21	839	252						
RH		22	799	292						
R		23	799	292						
RT	1IT	24	799	292						
Begin	NBP9507-R09	18 Nov 95	8:25	0:00	62	46.22	59	24.05	1350	Little Volcano
			8:56	0:31		46.21		24.01		btl. 1-3, d=1353, Mark hit bottom!!
										btl. 5, d=1301
						46.17		24.02		btl. 6-8, d=1280
			9:02	0:37		46.19		23.96		btl. 9, d=1261
			9:03	0:38		46.18		23.95		btl. 10-12, d=1256
			9:04	0:39		46.16		23.94		btl. 13, d=1252
			9:05	0:40		46.15		23.98		btl. 14-16, d=1241
			9:06	0:41		46.15		24.04		btl. 17, d=1225
			9:08	0:43		46.16		24.04		btl. 18-20, d=1210
			9:09	0:44		46.18		24.01		btl. 21, d=1202
			9:12	0:47		46.18		24.01		btl. 22-24, d=1100
End	NBP9507-R09	18 Nov 95	9:36	1:11						on deck
Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R09	Number	meters	MAB						
RH		1	1353	0						
R		2	1353	0						
RT	1IT	3	1353	0						
TH	.5IT	5	1301	52						
RH		6	1280	73						
R		7	1280	73						
RT	1IT	8	1280	73						
TH	.5IT	9	1261	92						

Type	Sample ID	Rosette	Depth	Approx.	Comments
	NBP9507-R09	Number	meters	MAB	
RH		10	1256	97	
R		11	1256	97	
RT	1IT	12	1256	97	
TH	.5IT	13	1252	101	
RH		14	1241	112	
R		15	1241	112	
RT	1IT	16	1241	112	
TH	.5IT	17	1225	128	
RH		18	1210	143	
R		19	1210	143	
RT	1IT	20	1210	143	
TH	.5IT	21	1202	151	
RH		22	1100	253	
R		23	1100	253	
RT	1IT	24	1100	253	

Begin	NBP9507-R10	19 Nov 95	0:08	0:00	62	46.17	59	23.29	1350	Caldera of Little Volcano- OSU CTD
			0:47	0:39		46.19		24.02		btl. 1, d=1300
			0:50	0:42		46.19		24.02		btl. 2, d=1287
			0:52	0:44		46.14		24.01		btl. 3, d=1237
						46.16		23.99		btl. 5, d=1177
						46.19		23.98		btl. 6, d=1166
			0:59	0:51		46.19		23.94		btl. 7, d=1152
			1:01	0:53		46.20		23.97		btl. 8, d=1126
			1:03	0:55		46.21		23.98		btl. 9, d=1097
			1:05	0:57		46.17		24.00		btl. 10, d=1085
			1:06	0:58		46.17		23.99		btl. 11, d=1070
			1:08	1:00		46.16		23.98		btl. 12, d=1053
			1:09	1:01		46.18		23.96		btl. 13, d=1037
			1:10	1:02		46.20		23.93		btl. 14, d=1022
			1:12	1:04		46.23		23.97		btl. 15, d=1001
			1:14	1:06		46.22		24.06		btl. 16, d=968
			1:16	1:08		46.16		24.01		btl. 17, d=921
			1:20	1:12		46.14		24.02		btl. 18, d=847
			1:29	1:21		46.15		24.00		btl. 19, d=642
			1:35	1:27		46.21		24.01		btl. 20, d=467
			1:38	1:30		46.16		24.03		btl. 22, d=399
			1:43	1:35		46.21		23.92		btl. 23, d=219
			1:46	1:38		46.18		24.05		btl. 24, d=14
End	NBP9507-R10	19 Nov 95	1:54	1:46		46.21		24.01		on deck
Type	**Sample ID**	**Rosette**	**Depth**	**Approx.**	**Comments**					
	NBP9507-R10	**Number**	**meters**	**MAB**						
RH		1	1300	53						
R		2	1287	66						
RT	1IT	3	1237	116						
TH	.5IT	5	1177	176						
RH		6	1160	193						
R		7	1152	201						

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R10	Number	meters	MAB						
RT	1IT	8	1126	227						
TH	.5IT	9	1097	256						
RH		10	1085	268						
R		11	1070	283						
RT	1IT	12	1053	300						
TH	.5IT	13	1037	316						
RH		14	1022	331						
R		15	1001	352						
RT	1IT	16	968	385						
TH	.5IT	17	921	432						
RH		18	847	506						
R		19	642	711						
RT	1IT	20	467	886						
TH	.5IT	21	399	954						
RH		22	296	1057						
R		23	219	1134						
RT	1IT	24	14	1339						
Begin	NBP9507-R11	20 Nov 95	8:30	0:00	62	54.27	60	4.89	1072	dip at S. Labrys Ridge
			8:57	0:27		54.23		4.94		btl. 1-3, d=1002
			9:01	0:31		54.23		4.95		btl. 5, d=905
			9:06	0:36		54.20		4.87		btl. 6-8, d=800
			9:11	0:41		54.20		4.88		btl. 9, d=702
			9:15	0:45		54.23		4.84		btl. 10-12, d=600
			9:18	0:48		54.28		4.79		btl. 13, d=500
			9:21	0:51		54.25		4.76		btl. 14-16, d=437
			9:26	0:56		54.20		4.79		btl. 17, d=289
			9:30	1:00		54.23		4.82		btl. 18-20, d=166
			9:33	1:03		54.24		4.71		btl. 21, d=100
			9:34	1:04		54.24		4.72		btl. 22-24, d=50
End			9:38	1:08		54.23		4.93		on deck

Type	Sample ID	Rosette	Depth	Approx.	Comments					
	NBP9507-R11	Number	meters	MAB						
RH		1	1002	70						
R		2	1002	70						
RT	1IT	3	1002	70						
TH	.5IT	5	905	167						
RH		6	800	272						
R		7	800	272						
RT	1IT	8	800	272						
TH	.5IT	9	702	370						
RH		10	600	472	b didn't click					
R		11	600	472						
RT	1IT	12	600	472						
TH	.5IT	13	500	572						
RH		14	437	635						
R		15	437	635						
RT	1IT	16	437	635						
TH	.5IT	17	289	783						
RH		18	166	906						
R		19	166	906						
RT	1IT	20	166	906						
TH	.5IT	21	100	972						
RH		22	50	1022						
R		23	50	1022						
RT	1IT	24	50	1022						
Begin	NBP9507-R12	21 Nov 95	6:08	0:00	62	59.27	60	12.97	976	
			6:30	0:22		59.27		12.97		btl. 1-3, d=952
			6:32	0:24		59.26		12.96		btl. 5, d=900
			6:34	0:26		59.27		12.94		btl. 6-8, d=850
			6:36	0:28		59.27		12.92		btl. 9, d=801
			6:38	0:30		59.27		12.94		btl. 10-12, d=700

	NBP9507-R12	21 Nov 95	6:41	0:33		59.26		12.93		btl. 13, d=604
			6:44	0:36		59.26		12.97		btl. 14-16, d=500
			6:56	0:48		59.25		12.98		btl. 17, d=405
			6:49	0:41		59.21		12.97		btl. 18-20, d=303
			6:52	0:44		59.21		13.04		btl. 21, d=200
			6:55	0:47		59.20		13.05		btl. 22-24, d=100
End	NBP9507-R12	21 Nov 95	7:00	0:52						on deck
Type	**Sample ID**	**Rosette**	**Depth**	**Approx.**	**Comments**					
	NBP9507-R12	**Number**	**meters**	**MAB**						
RH		1	952	24						
R		2	952	24						
RT	1IT	3	952	24						
TH	.5IT	5	900	76						
RH		6	850	126						
R		7	850	126						
RT	1IT	8	850	126						
TH	.5IT	9	801	175						
RH		10	700	276						
R		11	700	276						
RT	1IT	12	700	276						
TH	.5IT	13	604	372						
RH		14	500	476						
R		15	500	476						
RT	1IT	16	500	476						
TH	.5IT	17	405	571						
RH		18	303	673						
R		19	303	673						
RT	1IT	20	303	673						
TH	.5IT	21	200	776						
RH		22	100	876						
R		23	100	876						
RT	1IT	24	100	876						

Scientific Watchstanding on NBP9507
by R. Von Herzen

The scientific watches on cruise NBP9507 were organized at the beginning of the cruise to accomplish several purposes:

1) Provide a nearly real time hard copy of samples uniformly spaced in time of the underway data being logged by computer, and a written summary record throughout the cruise of the related scientific activity.

2) Monitor continuously the standard underway scientific instrumentation being used for data acquisition.

3) Provide a focal point for information important to the scientific objectives of the cruise.

The watches were organized into 3 shifts of 8 hours each: 00-08 hrs, 08-16 hrs, and 16-24 hrs (local time). Two persons were nominally assigned to each watch to provide continuous coverage for the above objectives. The cruise watches were initially assigned by Larry Lawver as follows:

00-08 hrs: Jim Lundy, Marta Ghidella
08-16 hrs: Ben Sloan, Amelia Shevenell
16-24 hrs: Dick Von Herzen, Steve Stevenoski

About midway through the cruise, Lundy and Stevenoski exchanged watch times to satisfy personal preferences. The watches were continued for both underway and station activities. When 1 person was sufficient to cover the watch activities, each watch organized themselves to provide such coverage, with the other person being available during the watch period as needed.

The instrumentation and data streams normally being monitored on watches consisted of the following:

Ship position (latitude and longitude, from GPS)
Water depth (Bathy 2000, ODECO, Inc.)
Gravity (Lacoste-Romberg)
Total magnetic field (proton precession)
Ship speed and heading direction
Multibeam (SeaBeam, Inc.) echo sounding contour plotter
Seismic reflection records (paper copies only)

Except for the latter two instrument systems, the above variables were normally hand written on log sheets (Underway Geophysical Watch Log) as copied from the monitor screens each 5 minutes while underway, and each 15 minutes on station, unless other sampling frequencies were requested. The watchstanding station in the main lab included 5 computer consoles and 5 video monitors to show various views of the ship useful for monitoring station activity and deployment of instrumentation. The ship's bridge watch was requested to provide notice of any changes in speed and direction, or other events that might affect the acquisition of scientific data during the cruise (e.g., iceberg avoidance and low visibility conditions). These events were also logged on the sheets when information was made available to the scientific watch. More than 500 log sheets of such information were filled in by the watches during the cruise.

Approximately once each hour the watch stored the depth display from the ODECO Bathy 2000 instrumentation in files on a magneto-optical disk provided with this instrumentation. This procedure prevented loss of large sections of this data when the data logging for this sensor crashed, which occurred several times daily on average for this cruise. The magnetic field data logging commenced only during the transit from Bransfield Strait to New Zealand. Initially the normal magnetometer (gradiometer) was inoperative and a portable backup unit was deployed instead; later both were deployed when the total field was being measured by the gradiometer. The magnetometer data were also recorded in analog form on a strip chart, which was annotated for time by the watch approximately once each hour. The watches changed paper and set up the large format grids for the multibeam echo sounding plotter, and monitored the performance of the plotting in nearly real time. More than 100 multibeam contour plot sheets were generated on this cruise. (A separate SeaBeam watch was being maintained by engineers responsible for this instrumentation on this cruise; plotter malfunctions were reported either to them or to the ASA personnel). The multichannel seismic data monitored on EPC recorders was annotated for time and other information during the short (few hours - 1 day) periods over which this instrumentation was deployed.

Although the manual data logging was redundant with, and not as complete as, the normal automatic data logging systems to hard disk, it served the useful function of backup against loss of any automatically logged data. Perhaps more importantly, it usually provided rapid notification when any sensor system failed, or the logging system itself crashed. These occurred many times during the cruise, and they were usually detected within 5-10 minutes as a result of the watch system set up for logging. The watch was also able to detect deficiencies of certain instrument systems such as the magnetometer from the hand logged data, even though the instrumentation had not failed. The scatter of successive values showed that a peculiar noise was present when initially deployed, probably caused by a defective component in the control unit. Subsequent plotting of some data showed that the noise was tolerable for the primary purposes of the data logging (detection of seafloor magnetic polarity reversals).

The watchstanders also participated, along with others, in the post-acquisition editing of multibeam data acquired up through the Bransfield Strait surveys. This was a major activity for the watchstanders, usually carried out during the watch and during additional free time. In this author's experience, this data editing required as much or more person-time than was required to collect the data. This editing is probably still not perfect and is also non-uniform, since it was carried out by individuals using somewhat subjective editing criteria. Hopefully this type of data correction can be automated in the future, to reduce the effort required on major multibeam data collection cruises and provide more consistent treatment of data.

ZAPS Sled Lowerings

Sled	Julian	START				END				
No.	Day	Time (z)	Latitude	Longitude	Depth (m)	Time (z)	Latitude	Longitude	Depth (m)	Notes
1	302	13:27	55°10.91'S	65°09.91'W	1071.30	13:58	55°10.71'S	65°09.34'W	1117.00	
2	305	14:17	62°12.21'S	57°22.36'W	1713.50	15:05	62°12.00'S	57°22.00'W	1667.00	
3	306	04:30	62°12.50'S	57°29.10'W	1902.00	06:25	62°12.50'S	57°28.90'W	1902.00	
4	306	15:19	62°15.81'S	57°23.13'W	1909.00	17:22	62°15.84'S	57°23.20'W	1939.00	
5	306	18:41	62°11.57'S	57°06.49'W	1760.90	20:38	62°11.40'S	57°06.30'W	1691.00	
6	307	18:02	61°38.93'S	54°53.28'W	2118.00	20:20	61°38.77'S	54°53.72'W	2006.00	
7	307-308	23:15	61°47.49'S	55°29.43'W	2717.00	02:01	61°47.83'S	55°29.81'W	2825.30	
8	308	05:21	61°57.40'S	56°08.70'W	2548.90	08:00	61°57.40'S	56°08.60'W	2461.00	
9	309-310	22:11	61°33.67'S	54°34.54'W	2326.00	00:30	61°33.58'S	54°34.21'W	2338.10	
10	310	02:30	61°41.95'S	55°10.40'W	2284.60	04:45	61°41.10'S	55°10.00'W	2276.40	
11	311	14:27	62°18.51'S	57°42.43'W	1940.00	17:07	62°18.53'S	57°42.48'W	1916.00	
12	312	02:30	62°26.68'S	58°19.54'W	1572.70	04:45	62°26.50'S	58°19. 50'W	1504.90	
13	312	12:45	62°39.59'S	59°05.07'W	1414.20	14:25	62°39.48'S	59°05.07'W	1413.00	
14	312	17:08	62°38.60'S	58°59.08'W	1019.10	18:55	62°38.10'S	58°59.71'W	1303.30	
15	312	19:45	62°38.27'S	59°03.83'W	1073.80	21:30	62°38.15'S	59°03.08'W	1092.00	
16	312-313	22:25	62°41.49'S	59°00.50'W	1194.10	00:15	62°41.46'S	59°00.49'W	1194.20	
17	313	01:30	62°39.17'S	59°01.94'W	1225.70	02:53	62°39.94'S	59°02.46'W	1291.60	
18	313	16:25	62°42.89'S	59°13.49'W	1424.20	23:40	62°38.70'S	59°00.99'W	1217.20	Drift
19	314	13:03	62°25.40'S	58°24.68'W	1091.00	13:50	62°25.40'S	58°24.67'W	1110.00	
20	314-315	20:53	62°14.22'S	57°24.80'W	1694.20	05:35	62°11.50'S	57°15.80'W	1289.60	
21	315	07:00	62°11.00'S	57°11.70'W	1387.70	08:07	62°11.00'S	57°11.70'W	1170.60	
22	318	19:35	62°02.15'S	56°27.19'W	1877.50	21:25	62°02.19'S	57°24.77'W	1903.80	
23	319	01:56	62°11.96'S	57°17.13'W	1333.70	06:15	62°11.40'S	57°16.80'W	1027.10	Bottom Drift
24	320	01:30	62°11.88'S	57°18.29'W	1237.60	06:00	62°11.80'S	57°17.10'W	1083.70	Bottom Drift
25	320-321	21:53	62°39.84'S	59°04.97'W	1059.60	01:15	62°39.01'S	59°03.98'W	1306.80	Tow Yo
26	321	01:50	62°40.34'S	59°06.16'W	1362.10	04:55	62°40.20'S	59°04.70'W	1208.10	
27	321-322	22:27	62°43.71'S	59°15.97'W	1418.90	07:50	62°46.10'S	59°24.00'W	1316.50	Drift
28	323	02:40	62°46.08'S	59°23.97'W	1349.40	08:01	62°46.10'S	59°23.90'W	1334.20	
29	324	00:09	62°50.98'S	59°47.50'W	827.60	05:00	62°49.01'S	59°41.90'W	909.40	Tow Yo
30	324	06:50	62°54.20'S	60°04.90'W	1074.60	07:56	62°54.20'S	60°04.90'W	1072.30	Dip
31	324-325	23:12	63°00.14'S	60°30.50'W	91.90	03:40	62°59.50'S	60°28.80'W	214.90	Tow Yo
32	325	04:45	62°59.30'S	60°13.10'W	1007.50	05:50	62°59.30'S	60°13.00'W	1005.00	

Dredge Lowerings

	Julian	START				END				
No.	Day	Time (z)	Latitude	Longitude	Depth (m)	Time (z)	Latitude	Longitude	Depth (m)	Location
1	319	07:30	62°11.90'S	57°16.00'W	1354.70	09:21	62°11.70'S	57°17.60'W	1142.70	Fish Ridge
2	320	06:15	62°11.70'S	57°11.90'W	1089.30	07:30	62°11.90'S	57°18.00'W	1144.80	Fish Ridge
3	323	08:29	62°46.00'S	59°24.40'W	1348.20	10:13	62°46.70'S	59°23.10' W	1430.10	Little Volcano

Recovery No.	Contents
1	150-200 lbs. vesicular Basalt, 10 lbs erratics, 10 lbs plagioclase, fish and other biota
2	2 rocks- 25 lbs., Basalt with some plagioclase, biota
3	100 g of rocks, 1 erratic, cinders, mud, biota

Camera Lowerings

	Julian	START				END				
No.	Day	Time (z)	Latitude	Longitude	Depth (m)	Time (z)	Latitude	Longitude	Depth (m)	Notes
0	319	06:30	62°11.30'S	57°16.80'W	1024.50	07:05	62°11.30'S	57°16.50'W	1029.30	Pressure Test
1	319	09:48	62°11.70'S	57°16.40'W	1122.30	13:24	62°11.69'S	57°16.43'W	1126.00	Bounce 30x
2	320	07:39	62°11.90'S	57°17.60'W	1118.40	10:19	62°11.90'S	57°17.70'W	1135.80	Bounce30x

Kasten Core Lowerings

	Julian	START				END			
No.	Day	Time (z)	Latitude	Longitude	Depth (m)	Time (z)	Latitude	Longitude	Depth (m)
1-A	311	12:31	62°18.40'S	57°41.80' W	1997.70	13:59	62°18.70'S	57°42.20'W	1994.70
1-B	311	17:17	62°18.59'S	57°42.22' W	1995.00	18:40	62°18.45'S	57°42.22'W	1997.00
1-C	311	21:06	62°18.57'S	57°41.82' W	1998.20	22:11	62°18.37'S	57°41.74'W	1997.00
2	319	19:25	62°12.45'S	57°29.63' W	1973.00	20:37	62°12.87'S	57°29.45'W	1980.00
3	321	05:17	62°39.63'S	59°05.96' W	1422.10	06:14	62°39.80'S	59°06.30'W	1422.10
4	324	09:40	62°54.24'S	60°04.70' W	1070.80	10:39	62°54.20'S	60°04.90'W	1070.00
5	325	07:30	62°59.20'S	60°13.10' W	1012.00	08:02	62°59.40'S	60°13.20'W	1013.00

Recovery No.	Description
1-A	None
1-B	None- Wash Out
1-C	300 cm core, no sediment/water interface
2	300 cm core, no sediment/ water interface
3	280 cm core, sediment /water interface intact
4	45 cm core, sediment/water interface intact
5	35 cm core, sediment/water interface intact

XBT Launches

No.	Day	Time (z)	Latitude	Longitude	Depth (M)	Area
1	302	08:25	55°10.10'S	65°12.01'W	1035.30	Scotia Sea
2	303	11:50	57°08.16'S	67°12.36'W	1680.00	Scotia Sea
3	304	07:40	58°42.70'S	61°08.80'W	2725.30	Scotia Sea
4	305	10:20	62°11.50'S	56°46.50'W	954.90	Bransfield Strait
5	306	12:30	62°23.10'S	58°04.40'W	1978.00	Bransfield Strait
6	307	13:00	61°46.36'S	55°10.71'W	2120.80	Bransfield Strait
7	308	18:10	60°50.60'S	54°04.33'W	942.20	Bransfield Strait
8	310	11:35	62°04.90'S	56°19.70'W	2188.20	Bransfield Strait
9	310	12:00	62°06.58'S	56°23.76'W	1719.10	Bransfield Strait
10	318	22:12	59°57.26'S	56°15.79'W	1524.70	Scotia Sea
11	326	14:00	64°47.43'S	69°37.00'W	2867.00	South Pacific
12	327	12:35	66°47.43'S	78°50.36'W	4123.60	South Pacific
13	328	13:40	66°31.16'S	90°32.73'W	4495.60	South Pacific
14	329	14:05	66°41.69'S	101°08.66'W	4773.30	South Pacific

Tidal Data Buoy Deployments

No.	Day	Time (z)	Latitude	Longitude	Depth (m)
1	302	08:21	55°10.50'S	65°12.10'W	1004.70
2	308	18:02	60°50.30'S	54°04.23'W	903.00

Seismic Data Aquisition

	Julian	START				END					
No.	Day	Time (z)	Latitude	Longitude	Depth (m)	Time (z)	Latitude	Longitude	Depth (m)	Equipment	Notes
1	308-309	20:00	60°50.51'S	54°06.30'W	944.30	05:40	60°36.30'S	54°35.70'W	2826.30	LS, 5B	Balancing
2	310-311	21:45	61°50.00'S	56°41.70'W	498.20	03:30	61°59.50'S	56°08.90'W	2424.90	LS, 5B , 6G	Some data
3	317-318	16:05	60°16.38'S	56°41.70'W	3765.90	10:05	60°42.70'S	56°34.10'W	3284.10	-S, 5B, 6G, S	Data
4	323	12:50	62°37.3'S	59°26.47'W	1407.40	18:10	62°32.70'S	59°14.90'W	1124.80	SS,2SG	Data

LS= Long 48 channel streamer
SS= Short single channel streamer
G= 250 cu in. Gun
SG= 50 cu. in. gun
B= Bird
S= Sono buoy

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL23	15 Nov 95	2:40	0:53			1257	27	1254	12.01	17.18	stopped
			2:43	0:56			1258	27	1254	12.03	17.23	change direction, going NE
			2:47	1:00			1258	31	1256	12.01	17.11	going down 5m
			2:50	1:03			1257	39	1260	12.02	17.02	going down 15m
			2:53	1:06			1269	35	1274	12.03	16.96	going down 10m
			2:56	1:09			1276	33	1286	12.02	16.88	going down 5m
							1278	37	1289	12.02	16.84	going down 8m
			3:00	1:13			1284	35	1383	12.00	16.73	going down 20
			3:01	1:14			1298	25	1313	11.99	16.73	stop
			3:03	1:16			1293	34	1313	11.98	16.68	going down 5m
			3:07	1:20			1293	33	1318	11.90	16.63	going down 5m
			3:09	1:22			1299	21	1322	11.87	16.62	down 5
			3:09	1:22			1292	20	1316	11.86	16.62	down 5 more
			3:10	1:23			1285	17	1305	11.87	16.61	up 5 slowly
			3:11	1:24			1257	33	1278	11.83	16.61	stop
			3:12	1:25			1258	27	1278	11.81	16.62	up slow
							1253	27	1271	11.80	16.62	up at 2m/min
							1236	36	1253	11.79	16.62	stop
							1238	27	1253	11.79	16.61	up at 20m/min *spike in data
			3:16	1:29			1215	47	1224	11.80	16.59	stop
			3:17	1:30			1219	44	1225	11.81	16.59	down 15m
			3:17	1:30			1232	26	1234	?	16.56	stop
			3:21	1:34			1235	33	1235	11.92	16.49	down 5m
			3:22	1:35			1234	34	1240	11.93	16.49	down 5 again
			3:22	1:35			1239	33	1247	11.94	16.48	down 5 more
			3:23	1:36			1243	33	1251	11.95	16.47	down 5 more
			3:24	1:37			1253	34	1256	11.96	16.45	down 5 more
			3:25	1:38			1254	35	1260	11.96	16.44	down 8
			3:26	1:39			1264	34	1268	11.97	16.43	down 5
			3:28	1:41			1270	36	1273	11.98	16.42	down 10
	NBP9507-SL23	15 Nov 95	3:29	1:42			1279	36	1284	11.98	16.43	down 10

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL23	15 Nov 95	3:31	1:44			1289	36	1293	11.97	16.41	down 10
			3:32	1:45			1298	34	1303	11.98	16.39	down 5
			3:33	1:46			1303	37	108	11.98	16.38	down 10
			3:34	1:47			1312	36	1318	11.99	16.36	down 8
			3:35	1:48			1318	38	1327	12.00	16.31	down 10
			3:36	1:49			1327	36	1336	12.00	16.26	down 10
			3:38	1:51			1336	36	1346	12.00	16.25	down 8
			3:39	1:52			1343	37	1354	12.00	16.23	down 10
			3:41	1:54			1350	40	1365	11.98	16.15	down 20
			3:42	1:55			1369	28	1384	11.98	16.11	stop
			3:44	1:57			1368	41	1203	12.03	16.06	up at 20m/min
			3:55	2:08			1151	258	1151	11.91	16.23	
			4:01	2:14			1033	?	1033	11.85	16.34	
			4:05	2:18			950	?	961	11.86	16.45	stop, down at 30m/min
			4:13	2:26			1232	38		11.74	16.45	down 20
			4:13	2:26			1244			12.44	16.45	
			4:14	2:27			1243	22		11.72	16.46	up 5
			4:15	2:28			1238	22	1236	11.71	16.46	up 5
			4:16	2:29			1231	19	1232	11.70	16.45	up 5
			4:18	2:31			1200	29		11.67	16.43	stopped
			4:18	2:31			1200	25	1186	11.67	16.45	up slow
			4:20	2:33			1159	47		11.70	16.48	stop winch
												start down slow *mark this sp
			4:22	2:35						11.72	16.48	mark this spot!!
			4:22	2:35			1176	21	1171	11.72	16.48	stop winch, up slow
			4:23	2:36			1164	27	1159	11.72	16.47	stop **
			4:26	2:39			1164	24	1159	11.72	16.50	try to keep ship here-mark this spot
							1164	25	1159	11.72	16.52	down 8 ** nephl=0.09 -pinger=15m
			4:31	2:44			1171	22	1172	11.73	16.56	
			4:31	2:44			1171	22	1172	11.73	16.56	down 5m
	NBP9507-SL23	15 Nov 95	4:35	2:48			1177	22	1172	11.76	16.55	temperature and trans off

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL23	15 Nov 95	4:38	2:51			1175			11.80	16.57	temperature varies
			4:38	2:51			1175	28	1172	11.81	16.58	down 8
			4:39	2:52			1179	30	1182	11.82	16.66	down 10
			4:42	2:55			1192	21	1185	11.78	16.62	try to move westward, up 5m also
			4:44	2:57			1188	30	1186	11.76	16.57	down 10
			4:46	2:59			1199	29	1195	11.75	16.54	down 10
			4:48	3:01			1206	30	1205	11.73	16.46	down 10
			4:51	3:04			1207	30	1215	11.78	16.36	down 10
			4:55	3:08			1224	20	1225	11.76	16.31	up 5
			4:57	3:10			1224	17	1220	11.75	16.34	up 5
			4:58	3:11			1219	17	1224	11.74	16.40	up 10
			5:00	3:13			1208	34	1205	11.76	16.43	down 5
			5:02	3:15			1212	35	1210	11.80	16.43	down 10
			5:03	3:16			1221	30	1220	11.80	16.50	down 10
			5:06	3:19			1229	17	1230	11.78	16.58	up 10
			5:08	3:21			1218	17	1220	11.80	16.59	up 10
			5:12	3:25			1210	19	1210	11.79	16.68	up 10?
			5:13	3:26			1200	19	1199	11.78	16.69	up 10
			5:15	3:28			1192	19	1189	11.79	16.74	up 10
			5:17	3:30			1184	15	1179	11.78	16.73	up 10
			5:18	3:31			1173	18	1165	11.78	16.71	up 10
			5:19	3:32			1163	18	1160	11.77	16.72	up 10 *seeing signals
			5:20	3:33			1153	13	1150	11.77	16.75	up 10 *big signal
			5:22	3:35			1136	24	1133	11.77	16.77	up in a hurry, stop now
			5:22	3:35			1135	16	1131	11.76	16.78	up 10 more
			5:23	3:36			1124	18	1120	11.75	16.80	up 10
			5:23	3:36			1115	21	1113	11.75	16.80	stop winch, **big signal
			5:24	3:37			1115	16	1110	11.74	16.82	up 10, fast **still large signal
			5:26	3:39			1106	??	1102	11.71	16.87	up 10
			5:28	3:41			1088	16	1084	11.69	16.84	up 10, nephl=.19
	NBP9507-SL23	15 Nov 95	5:29	3:42			1081	16	1082	11.68	16.80	up 10

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
			5:30	3:43			1071	16	1073	11.66	16.79	up 10
			5:32	3:45			1066	16	1063	11.67	16.79	up 10
							1056	18	1052	11.67	16.80	up 10 more *signals at backgrnd now
			5:33	3:46			1046	15	1044	11.64	16.84	up 15 - pinger=5m *background
			5:35	3:48			1030	16	1029	11.60	16.89	up 10
			5:36	3:49			1021	20	1017	11.58	16.90	up 10 - alt off for a while
			5:37	3:50			1012	18	1009	11.57	16.87	bring back to surface
End	NBP9507-SL23	15 Nov 95	6:05	4:18						11.50	16.57	on deck
Begin	NBP9507-SL24	16 Nov 95										bottom tow higher on ridge than SL 2
			1:26	0:00								power on
			1:32	0:06						11.89	18.29	power on, zaps set up, pump data ok
			1:33	0:07						11.84	18.23	in h2o @ 15m for 5 min, => surface
			1:38	0:12			2		1	11.85	18.26	going down 30m/min
			1:46	0:20			310		324	11.90	18.06	
			1:55	0:29			606		613	11.92	17.93	
			2:04	0:38			922	279	937	11.95	18.11	
			2:11	0:45			1154	53	1170	12.01	18.21	stop, down 10 more
			2:12	0:46			1183	24	1190	12.02	18.23	stop winch
			2:14	0:48			1180	17	1190	12.01	18.28	up 10
							1169	30	1180	12.07	18.33	down 10
			2:18	0:52			1181	21	1190	12.07	18.35	winch stoped
			2:19	0:53			1183	26	1190	12.06	18.37	down 5
			2:22	0:56			1186	26	1195	12.14	18.34	down 5
			2:23	0:57			1190	26	1204	12.12	18.37	down 5
			2:26	1:00			1205	29	1206	12.08	18.42	down 5
			2:28	1:02			1210	38	1209	12.07	18.43	down 10
			2:30	1:04			1220	41	1220	12.10	18.37	down 10
			2:33	1:07			1227	38	1230	12.06	18.47	down 10
			2:35	1:09			1234	35	1240	12.04	18.54	down 10
	NBP9507-SL24	16 Nov 95	2:37	1:11			1251	18	1250	12.06	18.44	up 5

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL24	16 Nov 95	2:40	1:14			1240	?	1243	12.06	18.34	up 5
			2:42	1:16			1224	39	1239	12.01	18.29	down 5
			2:43	1:17			1221	43	1245	11.98	18.30	down 10
			2:44	1:18			1221	41	1256	11.94	18.33	down 10
			2:47	1:21			1229	17	1265	11.88	18.37	up 5
			2:48	1:22			1229	17	1250	11.88	18.27	up 10
							1212	18	1248	11.87	18.22	up 5
			2:51	1:25			1203	15	1241	11.88	18.12	up 10
			2:51	1:25			1199	16	1235	11.90	18.11	up 10
			2:53	1:27			1195	13	1224	11.91	18.10	up 10
			2:53	1:27			1188	15	1214	11.92	18.08	up 10
							1184	16	1204	11.92	18.06	up 10
			2:55	1:29			1181	18	1195	11.92	18.05	up 10
			2:57	1:31			1172	32	1184	11.90	18.01	down 5
			3:00	1:34			1175	30	1192	11.93	17.94	down 5
			3:03	1:37			1179	30	1197	11.91	17.94	down 5
			3:04	1:38			1180	32	1200	11.90	17.86	down 5
			3:05	1:39			1179	32	1207	11.87	17.78	down 8
							1180	27	1213	11.91	17.65	mark this spot - temp off scale
			3:10	1:44			1180	?		11.92	17.64	temp high, just came back
			3:11	1:45			1176	?	1208	11.92	17.63	up 10 - pinger 15 or 20
			3:13	1:47			1171	25	1283	11.92	17.61	attempting btl#2, still in it
			3:13	1:47			1166	21	1193	11.91	17.58	big temp spike
			3:14	1:48			1163	18	1191	11.91	17.57	up 10
			3:15	1:49			1153	22	1173	11.90	17.56	up 10
			3:16	1:50			1143	21	1172	11.88	17.52	fire bottle #4 attempt, no confirm
			3:17	1:51			1143	20	1170	11.87	17.50	up 10
			3:19	1:53			1137	18	1162	11.83	17.47	still in plume, temp still high
			3:20	1:54			1137	14	1160	11.82	17.46	up 20
			3:21	1:55			1122	25	1144	11.82	17.45	fire bottle #6, no confirm
	NBP9507-SL24	16 Nov 95	3:22	1:56			1115	20	1142	11.80	17.42	up 10 - still in it

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL24	16 Nov 95	3:24	1:58			1088	37	1133	11.76	17.37	down 10, temp still high
			3:26	2:00			1101	17	1143	11.75	17.29	up 10
			3:26	2:00			1103	14	1132	11.77	17.30	up 20
			3:28	2:02			1094	?	1112	11.77	17.33	stop winch-pinger=25, still in it
			3:31	2:05			1106	15	1111	11.78	17.27	up 10
			3:38	2:12			1092	26	1102	11.79	17.13	still trans, nephl, temp
			3:45	2:19			1044	?	1102	11.64	16.94	still trans, nephl, temp, pinger=35
			3:47	2:21			1030	?	1102	11.57		signal stoped, down 10
			3:50	2:24			1022	35	1077	11.53	16.90	signal started again
			3:52	2:26			1000	46	1040	11.52	16.92	winch stop, signal stopped a moment ago
			3:53	2:27			1015	?	1040	11.53	16.92	up 10
			3:54	2:28			1015	18	1030	11.55	16.91	up 10
			3:55	2:29			1012	19	1019	11.56	16.90	up 10
			3:57	2:31			1009	18	1008	11.54	16.91	up 10
			3:59	2:33			1004	17	1000	11.53	16.94	up 10
			4:07	2:41			988	36	992	11.57	17.14	down 10
			4:09	2:43			1001	32	1000	11.57	17.19	down 10
			4:12	2:46			1008	37	1012	11.52	17.23	down 10
			4:13	2:47			1020	30	1021	11.52	17.22	down 10
			4:15	2:49			1030	29	1031	11.58	17.26	down 10
			4:20	2:54			1038	31	1041	11.61	17.40	down 10, nephl and trans, no temp
			4:22	2:56			1049	28	1054	11.60	17.41	down 10
			4:24	2:58			1053	29	1060	11.58	17.45	down 10
			4:32	3:06			1068	32	1070	11.69	17.53	down 10
			4:35	3:09			1077	27	1031	11.66	17.67	down 5
			4:39	3:13			1082	31	1086	11.67	17.70	down 10
			4:42	3:16			1094	32	1096	11.71	17.74	down 10
			4:45	3:19			1101	30	1105	11.70	17.80	down 10
			4:48	3:22			1114	23	1123	11.73	17.86	down 8
			4:51	3:25			1120	30	1123	11.76	17.80	down 10
	NBP9507-SL24	16 Nov 95	4:54	3:28			1125	18	1143	11.74	17.74	up 10

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL24	16 Nov 95	4:57	3:31			1098	40	1133	11.83	17.63	down 15
			5:00	3:34			1102	29	1150	11.87	17.55	down 10
			5:04	3:38			1118	17	1158	11.95	17.38	up 10
			5:06	3:40			1100	19	1147	11.94	17.38	up 10
			5:07	3:41			1096	17	1137	11.93	17.41	up 10
			5:08	3:42			1103	17	1127	11.94	17.41	up 10
			5:10	3:44			1103	30	1119	11.96	17.41	down 10
			5:11	3:45			1114	35	1128	11.97	17.42	stop ship, let wire settle
							1141	61	1150	12.00	17.40	down 40
			5:18	3:52			1195	20	1193	11.97	17.43	stop winch
			5:19	3:53			1192	26	1188	11.95	17.44	up to surface, 30m/min
End	NBP9507-SL24	16 Nov 95	5:55	4:29						11.76	17.17	on deck-bottles DNC
Begin	NBP9507-SL25	16 Nov 95			62	59						tow-yo on middle ridge tres hermanas
			21:51	0:00						39.86	5.03	power on,
			21:56	0:05					10	39.84	4.97	in water,holding at 10m
			22:00	0:09			ll		10	39.86	5.10	up to surface,then down 30m/min
			22:02	0:11			9		11.9	39.84	5,08	back to surface, then down 30m/min
			22:31	0:40			1008		1009	39.87	4.87	
			22:40	0:49			1301	29	1297	39.89	4.94	stop winch
			22:46	0:55			1293	38	1297	39.84	4.78	up at 30m/min
			22:51	1:00						39.90	4.72	dead as shit
			22:55	1:04			1019			39.88	4,73	down at 30m/min
			23:04	1:13			1269	31	1299	39.92	4.39	down 20 and stop.
			23:05	1:14			1268	24	1301	39.91	4.35	up at 30
			23:12	1:21			1034	210	1111	39.90	3.98	down at 30
							1167	18	1271	39.97	3.72	stopped, up 5
			23:19	1:28			1133	33	1261	40.00	3.62	down 10
			23:20	1:29			1139	46	1262	40.01	3.58	up at 30
			23:23	1:32			1007	188	1154	40.02	3.38	down at 30
	NBP9507-SL25	16 Nov 95					1155	40	1320	40.02	3.15	stop winch

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL25	16 Nov 95	23:33	1:42			1147	48	1322	39.97	2.94	down 20
			23:34	1:43			1176	12	1340	39.97	2.91	up 10, keep coming up
			23:36	1:45			1153	31	1276	39.97	2.93	stop winch
			23:37	1:46			1164	16	1176	39.96	2.93	up 20
			23:38	1:47			1159	20	1154	39.91	2.94	up 10
			23:40	1:49			1156	39	1245	39.87	2.97	starting to head north
			23:43	1:52			1187	32	1238	39.79	3.09	up 10
			23:46	1:55			1167	49	1234	39.74	3.18	down 10
			23:48	1:57			1160	53	1250	39.68	3.24	down 15
			23:49	1:58			1164	50	1260	39.66	3.26	down 20
			23:50	1:59			1171	42	1280	39.62	3.32	down 10
			23:51	2:00			1167	45	1290	39.60	3.35	down 15
			23:53	2:02			1158	53	1304	39.54	3.38	down 15
			23:55	2:04			1141	29	1319	39.46	3.44	up at 30
		17 Nov 95	0:00	2:09			940	220	1170	39.33	3.61	down at 30
			0:07	2:16			1086	190	1386	39.14	3.78	up at 30
			0:13	2:22			1009	250	1200	39.07	3.78	stop winch
			0:16	2:25			1131	168	1199	39.15	3.80	wire angle improving...
			0:32	2:41			1190	75	1199	39.13	4.10	down 50
			0:33	2:42			1245	15	1249	39.13	4.12	up 10
			0:35	2:44			1234	38	1243	39.12	4.18	down 10
			0:37	2:46			1243	50	1250	39.09	4.17	fire bottle #2
			0:37	2:46			1243	55	1249	39.08	4.18	up at 30m/min to surface
			0:45	2:54			997	?	906	39.06	4.18	fire bottle #4
			0:49	2:58			858		851	39.13	4.17	fire bottle #6
			1:01	3:10			455	?	454	39.10	3.99	fire bottle #8
			1:12	3:21			47			39.03	4.13	fire bottle #10
			1:13	3:22			8			39.01	4.11	fire bottle #12
End	NBP9507-SL25	17 Nov 95	1:13	3:22								out of the water

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
Begin	NBP9507-SL26	17 Nov 95	1:44	0:00						40.23	6.28	same area as SL25 but more west
			1:45	0:01								power on
			1:52	0:08					10	40.32	6.24	in water at 10m,holding
			1:55	0:11					1.6	40.33	6.42	up to surface, then down at 30m/min
			2:04	0:20					223	40.39	6.21	
			2:15	0:31			585		610	40.24	6.13	
			2:26	0:42			887		978	40.31	5.60	
			2:35	0:51			1133	151	1251	40.39	5.21	stopped
			2:41	0:57			1246	26	1250	40.35	5.43	up 10
			2:42	0:58			1238	23	1236	40.35	5.45	up 10
			2:44	1:00			1223	38	1221	40.37	5.53	down 10
			2:46	1:02			1230	45	1230	40.32	5.36	down 5
			2:52	1:08			1234	52	1245	40.40	5.69	down 20
			2:55	1:11			1221	55	1273	40.36	5.95	down 20
			2:57	1:13			1230	14	1275	40.26	5.94	up 10
							1218	33	1265	40.23	5.94	up 10
			3:00	1:16			1216	30	1275	40.21	5.94	up 10
			3:01	1:17			1256	25	1273	40.23	5.89	up 10
			3:03	1:19			1261	36	1264	40.26	5.86	up at 30
			3:16	1:32			897	?	901	40.43	5.86	down at 30
			3:25	1:41			1193	30	1189	40.46	5.97	stop winch
			3:36	1:52			1174	49	1189	40.33	5.84	down 20
			3:40	1:56			1179	56	1210	40.33	5.67	down 20
			3:46	2:02			1150	89	1230	40.41	5.30	down 30
			3:52	2:08			1231	?	1259	40.42	5.25	up 10
			3:54	2:10			1228	?	1250	40.39	5.24	up 10
			3:55	2:11			1221	22	1239	40.38	5.24	up 20
			3:57	2:13			1212	23	1219	40.37	5.28	up 10
			3:57	2:13			1210	18	1210	40.36	5.34	up 20
			3:59	2:15			1194	24	1189	40.34	5.36	up 10, this is absolutely zero
	NBP9507-SL26	17 Nov 95	4:05	2:21			1168	67	1183	40.25	5.34	down

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL26	17 Nov 95	4:06	2:22			1210	31	1213	40.26	5.25	winch stop
			4:09	2:25			1172	76	1172	40.29	5.27	down
			4:10	2:26			1234	21	1228	40.32	5.20	stop, and back up
			4:11	2:27			1197	47	1207	40.32	5.14	fire bottle #2
			4:15	2:31			1045	186	1091	40.41	5.02	fire bottle #4
			4:26	2:42			747		758	40.32	5.00	fire bottle #6
			4:42	2:58			203		192	40.18	5.00	fire bottle #8
			4:47	3:03			63		151	40.21	4.94	fire bottle #10
End	NBP9507-SL26	17 Nov 95	4:51	3:07			3		?	40.10	4.88	fire bottle #12
Begin	NBP9507-SL27	17 Nov 95										Towing baby sister and liitle volcano
			22:17	0:00	62	59				43.67	16.03	power on
			22:25	0:08	62	59	14					time off: Prog=22:24:30 GMT=22:23:11
			22:26	0:09	62	59	14			43.72	16.01	using new optical disk for this tow
			22:32	0:15	62	59	14		10	43.67	16.06	in water 10m,holding
			22:35	0:18	62	59	14		10	43.67	16.01	to surface and start down
			22:39	0:22	62	59	100		96.2	43.67	15.97	coming back up to surface
			22:44	0:27	62	59	20?		13.8	43.72	16.03	going back down
			22:58	0:41			467		465	43.69	15.95	
			23:22	1:05			1337	35	1329	43.72	16.09	stop winch
			23:28	1:11			1336	37	1329	43.68	16.15	start moving ship
			23:31	1:14			1137	37	1329	43.69	16.12	down 10
			23:37	1:20			1329	45	1339	43.76	16.33	up at 30m/min
			23:56	1:39			717	43	745	43.91	16.99	stopped
			23:57	1:40			719		761	43.91	17.04	down at 30m/min
		18 Nov 95	0:14	1:57			1307	30	1340	44.02	17.50	winch stop
			0:18	2:01			1302	47	1340	44.06	17.59	down 10
			0:28	2:11			1312	23	1346	44.11	17.87	up 10
			0:29	2:12			1302	9	1337	44.12	17.90	up 20
			0:30	2:13			1283	12	1312	44.13	17.91	keep coming up
	NBP9507-SL27	18 Nov 95	0:31	2:14			1252	31	1287	44.14	17.95	stop winch

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL27	18 Nov 95	0:36	2:19			1253	41	1287	44.12	18.12	down 10
			0:38	2:21			1266	19	1297	44.13	18.17	up 10
			0:41	2:24			1254	18	1287	44.16	18.20	up 10
			0:43	2:26			1239	17	1276	44.18	18.21	up 10
			0:49	2:32			1227	25	1266	44.20	18.43	up at 30 m/min
			1:05	2:48								down at 30m/min
			1:10	2:53			849		884	44.37	19.00	opps, delayed response....
			1:17	3:00			1124	36	1165	44.44	19.16	stop winch
			1:25	3:08			1119	24	1165	44.50	19.35	up 10
			1:31	3:14			1119	18	1155	44.55	19.45	up 10
			1:32	3:15			1120	22	1144	44.55	19.44	up 10
			1:37	3:20			1106	23	1133	44.60	19.50	up 10
			1:39	3:22			1119	19	1120	44.62	19.54	up 10
			1:39	3:22			1094	18	1112	44.62	19.57	up 10
			1:40	3:23			1090	18	1104	44.61	19.57	up 10
			1:40	3:23			1086	19	1095	44.60	19.57	up 10
			1:41	3:24			1079	16	1082	44.60	19.57	up 10
			1:41	3:24			1070	15	1074	44.60	19.55	up 20
			1:44	3:27			1056	19	1059	44.58	19.52	up 10
			1:45	3:28			1049	17	1044	44.58	19.55	up 10
			1:48	3:31			1037	36	1031	44.58	19.61	down 10
			1:49	3:32			1027	51	1026	44.59	19.62	down 15
			1:53	3:36			1037	41	1043	44.65	19.64	down 10
			1:56	3:39			1033	37	1049	44.73	19.58	up at 30m/min
			2:04	3:47			762		797	44.84	19.58	down at 30m/min
			2:16	3:59			1144	48	1189	44.99	19.60	stop winch
			2:17	4:00			1159	32	1200	45.01	19.58	winch actually stopped
			2:19	4:02			1160	19	1199	45.03	19.60	up 10
			2:19	4:02			1153	20	1189	45.03	19.60	up 10
			2:23	4:06			1141	40	1179	45.10	19.58	down 10
	NBP9507-SL27	18 Nov 95	2:27	4:10			1140	42	1189	45.16	19.57	up at 30m/min

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL27	18 Nov 95	2:35	4:18			780			45.17	19.51	down again
			2:49	4:32			1172	28	1142	45.19	19.53	winch stop
			2:53	4:36			1169	19	1142	45.23	19.64	up 10
			2:54	4:37			1160	20	1142	45.21	19.64	up 10
			2:56	4:39			1151	16	1142	45.22	19.62	up 20
			2:58	4:41			1133	20	out	45.19	19.64	up 10
			3:00	4:43			1123	32				wo=1115, they're working on wo display
			3:09	4:52			1102	30	1115	45.21	19.90	up at 30m/min
			3:19	5:02			799		805	45.26	20.06	down again 30m/min
			3:31	5:14			1222	26	1230	45.26	20.36	stop winch
			3:33	5:16			1224	19	1230	45.25	20.41	up 10
			3:34	5:17			1215	16	1219	45.26	20.43	up 10
			3:38	5:21			1200	21	1209	45.28	20.53	up 10
			3:40	5:23			1190	29	1197	45.25	20.54	up at 30
			3:51	5:34			843		840	45.29	20.59	down at 30
			4:01	5:44			1155	29	1160	45.31	20.78	winch stop
			4:12	5:55			1136	36	1164	45.36	21.18	down 10
			4:17	6:00			1131	33	1169	45.37	21.31	up at 30
			4:31	6:14			708		717	45.40	21.53	down at 30
			4:44	6:27			1151	36	1160	45.43	21.79	winch stop
			4:49	6:32			1130	61	1168	45.47	21.95	down 20
			4:52	6:35			1148	42	1181	45.53	21.97	down 10
			4:54	6:37			1176	18	1190	45.51	22.02	up 10
			4:56	6:39			1175	19	1178	45.48	22.04	up 10
			5:00	6:43			1153	37	1175	45.48	22.16	down 10
			5:06	6:49			1166	23	1179	45.51	22.26	up 10
			5:12	6:55			1158	35	1171	45.38	22.37	down 10
			5:13	6:56			1173	19	1180	45.40	22.37	up 15
			5:16	6:59			1151	42	1165	45.44	22.48	down 10
			5:28	7:11			1150	28	1174	45.60	22.58	up 10
	NBP9507-SL27	18 Nov 95	5:30	7:13			1140	20	1164	45.63	22.61	up 10 and keep going up: pinger=0

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL27	18 Nov 95	5:31	7:14			1117	14	1164	45.63	22.64	coming up at 30m/min (to 700)
			5:42	7:25			747		out	45.56	22.90	down at 30
			5:54	7:37			1148	30	1165	45.69	23.13	stop winch
			5:56	7:39			1162	39	1165	45.70	23.07	down 10
			5:58	7:41			1167	44	1175	45.72	23.10	down 10
			5:59	7:42			1169	50	1185	45.73	23.16	down 10
			6:00	7:43			1175	47	1195	45.73	23.20	down 15
			6:04	7:47			1194	36	1212	45.76	23.32	down 10
			6:07	7:50			1202	39	1220	45.81	23.33	down 10
			6:07	7:50			1213	33	1230	45.83	23.32	up at 30
			6:13	7:56			1038	212	1053	45.83	23.37	stop and back down at 30m/min
			6:19	8:02			1220	60	1237	45.88	23.45	stop and back up 20
												finally seeing some signal
			6:21	8:04			1178	98	1192	45.90	23.44	down at 30
			6:24	8:07			1243	51	1260	45.90	23.50	stop winch
			6:24	8:07			1242	54	1260	45.91	23.52	down 20
			6:26	8:09			1260	42	1280	45.93	23.57	up 60
			6:33	8:16			1191	33	1219	46.03	23.69	down 20
			6:39	8:22			1203	98	1230	46.04	23.75	down 10
			6:40	8:23			1220	80	1240	46.05	23.81	down 50
			6:45	8:28			1270	20	1290	46.11	23.87	up 10
			6:54	8:37			1273	14	1280	46.13	23.94	up 10
			6:56	8:39			1273	19	1270	46.12	23.90	up 10
			7:04	8:47			1268	43	1259	46.11	23.90	down 20
			7:06	8:49								rosette won't enable
			7:06	8:49								attempt fire #1(empty)
			7:07	8:50			1288	19	1280	46.14	23.89	up 30m/min to surface
			7:09	8:52			1235	78	1222	46.13	23.94	attempt fire #2
			7:11	8:54			1174		1165	46.10	23.98	attempt fire #4
			7:22	9:05			810		802	46.04	23.93	attempt fire #6
End	NBP9507-SL27	18 Nov 95	7:33	9:16			421		415	45.97	24.05	attempt fire #8

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
Begin	NBP9507-SL28	19 Nov 95	2:27	0:00						46.17	24.06	power-No ZAPS (or nephls) this tow -OC
			2:40	0:13					1	46.08	23.98	in water
												stop at 200m
							200		200	46.19	23.95	down at 30m/min
			3:17	0:50			1093		1088	46.18	23.94	slow to 20m/min, alt=110
			3:28	1:01			1319	32	1315	46.22	23.92	winch stopped
			3:29	1:02			1321	29	1315	46.22	23.91	up 300m
			3:40	1:13			965	?	963	46.17	23.92	down at 30m/min
			3:50	1:23			1306	34	1300	46.18	23.92	stop winch
			3:51	1:24								real GMT time is 3:50
			3:53	1:26			1306	42	1300	46.21	23.94	down 10
			3:57	1:30			1317	36	1310	46.20	23.85	ddown 5
			4:02	1:35			1322	32	1316	46.19	23.89	down 5
			4:06	1:39			1327	27	1322	46.19	23.88	down 5
			4:10	1:43			1328	25	1325	46.16	23.95	down 5
			4:14	1:47			1334	11	1330	46.11	23.96	up 5
			4:14	1:47			1328	14	1325	46.11	23.96	up 5
			4:16	1:49			1326	11	1320	46.12	23.96	up 5
			4:17	1:50			1319	12	1314	46.13	23.95	up 20
			4:20	1:53			1295	18	1289	46.12	23.87	up 10
			4:22	1:55			1285	20	1279	46.12	23.89	up 10
			4:24	1:57			1275	28	1270	46.14	23.94	down 5
			4:32	2:05			1281	30	1275	46.12	23.98	down 5
			4:35	2:08			1287	26	1280	46.12	23.97	down 5
			4:38	2:11			1290	19	1285	46.11	23.97	temp spike, .006
			4:41	2:14			1290	26	1285	46.20	23.89	down 5
			4:43	2:16			1293	31	1289	46.20	23.92	down 5
			4:45	2:18			1298	32	1295	46.18	23.91	down 5
			4:46	2:19			1304	32	1302	46.20	23.90	down 5
	NBP9507-SL28	19 Nov 95	4:47	2:20			1309	33	1305	46.18	23.92	down 5

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL28	19 Nov 95	4:48	2:21			1314	31	1310	46.16	23.95	down 5
			4:51	2:24			1317	35	1317	46.17	23.95	down 10
			4:53	2:26			1323	30	1325	46.25	23.93	down 10
			5:00	2:33			1326	24	1335	46.28	24.10	down 5
			5:01	2:34			1332	19	1340	46.27	24.12	up 5
			5:04	2:37			1335	17	1135	46.29	24.13	up 5
			5:06	2:39			1134	17	1329	46.29	24.12	up 10
			5:08	2:41			1326	19	1318	46.25	24.09	up 5
			5:13	2:46			1320	28	1315	46.25	24.08	down 5
			5:16	2:49			1325	19	1320	46.24	24.15	up 5
			5:17	2:50			1321	18	1315	46.24	24.13	up 10
			5:22	2:55			1309	?	1304	46.21	24.04	down 5
			5:24	2:57			1316	33	1304	46.18	24.07	dow 5
			5:25	2:58			1321	29	1304	46.18	24.09	down 5, waking up Bruce to fix wo
			5:30	3:03			1325	17	?	46.22	24.15	up 5
			5:31	3:04			1321	19	?	46.20	24.16	up 5
			5:36	3:09			1317	33	1311	46.24	24.12	down 5
			5:37	3:10			1322	30	1315	46.22	24.11	down 5
			5:39	3:12			1328	25	1321	46.21	24.11	down 5
			5:43	3:16			1330	20	1325	46.18	24.15	up 5
			5:46	3:19			1325	17	1320	46.16	24.17	up 10
			5:48	3:21			1314	18	1309	46.13	24.11	up 10
							1305	17	1301	46.10	24.17	up 5
			5:59	3:32			1301	16	1295	46.10	24.14	up 5
			6:01	3:34			1295	18	1289	46.08	24.07	up 5
			6:06	3:39			1290	25	1285	46.14	24.03	down 5
			6:14	3:47						46.12	24.05	small temperature blip
							1301	26	1296	46.12	24.02	d 5
			6:19	3:52			1306	20	1300	46.14	23.96	up 5
			6:33	4:06			1288	19	1295	46.08	23.76	up 5
	NBP9507-SL28	19 Nov 95	6:38	4:11			1278	15	1290	46.03	23.64	up 5

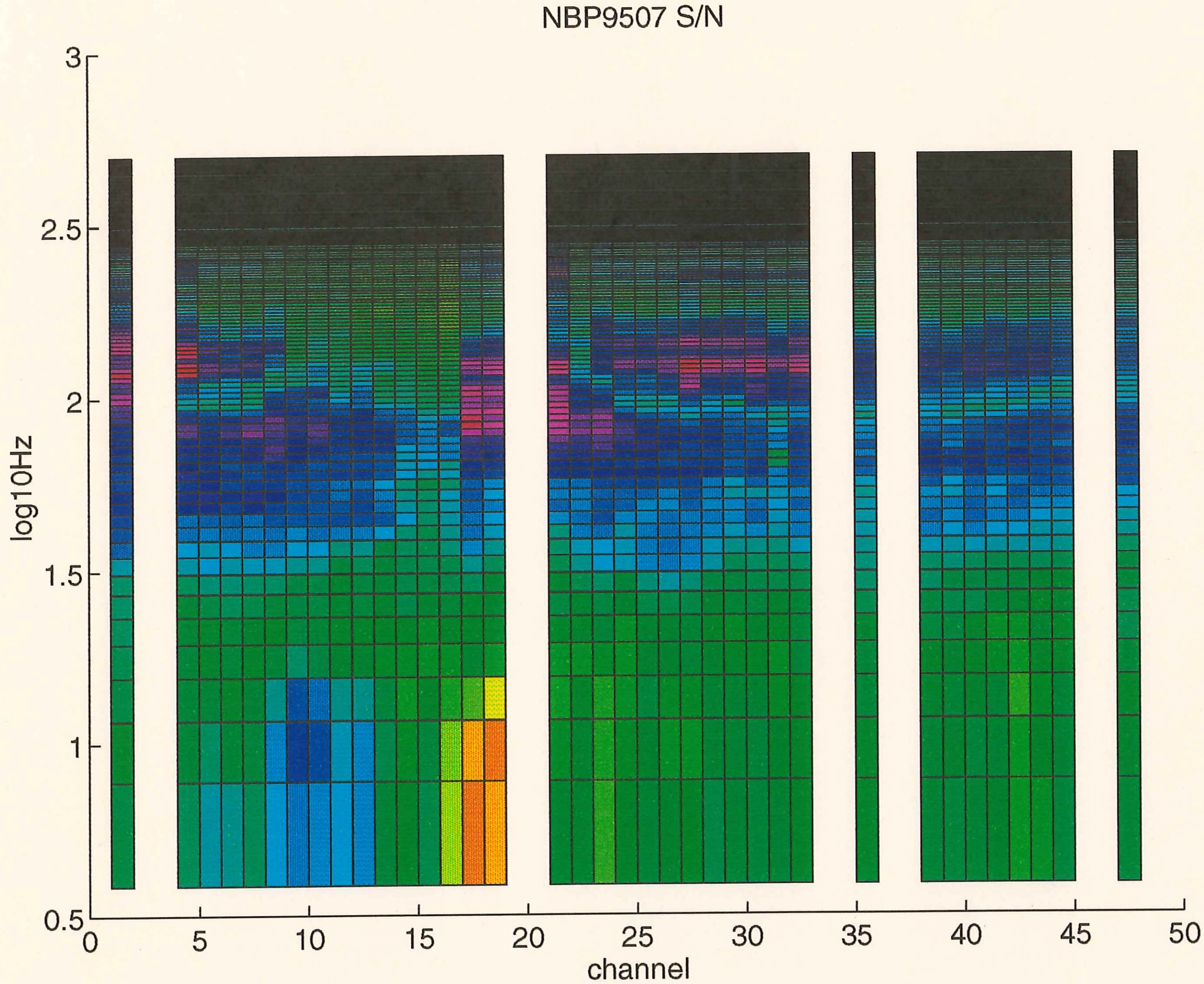
	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL28	19 Nov 95					1277	13	1285			up 5
			6:40	4:13			1277	10	1280	46.03	23.68	up 10
			6:41	4:14			1272	14	1269	46.05	23.69	up 10
			6:42	4:15			1265	17	1260	46.06	23.69	up 5
			6:58	4:31			1255	31	1259	46.17	23.77	down 5
			7:00	4:33			1262	29	1260	46.18	23.80	down 5
			7:03	4:36			1272	29	1268	46.16	23.77	down 8
			7:06	4:39			1277	31	1273	46.11	23.79	down 5
			7:12	4:45			1284	18	1278	46.12	23.76	up 5
			7:19	4:52			1271	?	1273	46.14	23.86	up at 30m/min to surface
			7:22	4:55			1167			46.17	23.90	btl #2
			7:24	4:57			1114			46.20	23.79	btl #4 - ? no confirm
			7:32	5:05			856			46.18	23.87	btl #6
			7:38	5:11			680			46.19	23.95	btl#8
			7:53	5:26			200			46.21	23.95	btl#10
			8:00	5:33			18					btl #12
End	NBP9507-SL28	19 Nov 95	8:02	5:35						46.16	23.87	out of water
Begin	NBP9507-SL29	20 Nov 95			62	59						tow-yo labrys ridge
			0:02	0:00						50.98	47.55	power on
			0:08	0:06								in water.holding 10m
			0:17	0:15					10	50.99	47.54	up to surface, down at 30m/min
			0:30	0:28			432		423	51.01	47.48	
			0:42	0:40			763	33	760	50.99	47.47	winch stop
			1:12	1:10			743	39	760	50.63	47.57	up 10
			1:15	1:13			731	35	750	50.59	47.56	up 10
			1:17	1:15			718	37	740	50.55	47.57	up 20
			1:21	1:19			692	31	720	50.47	47.57	up 20
			1:32	1:30			685	44	700	50.32	47.58	up 20
			1:35	1:33			622	35	680	50.29	47.69	up 20
	NBP9507-SL29	20 Nov 95	1:36	1:34			638	32	660	50.28	47.64	up 30

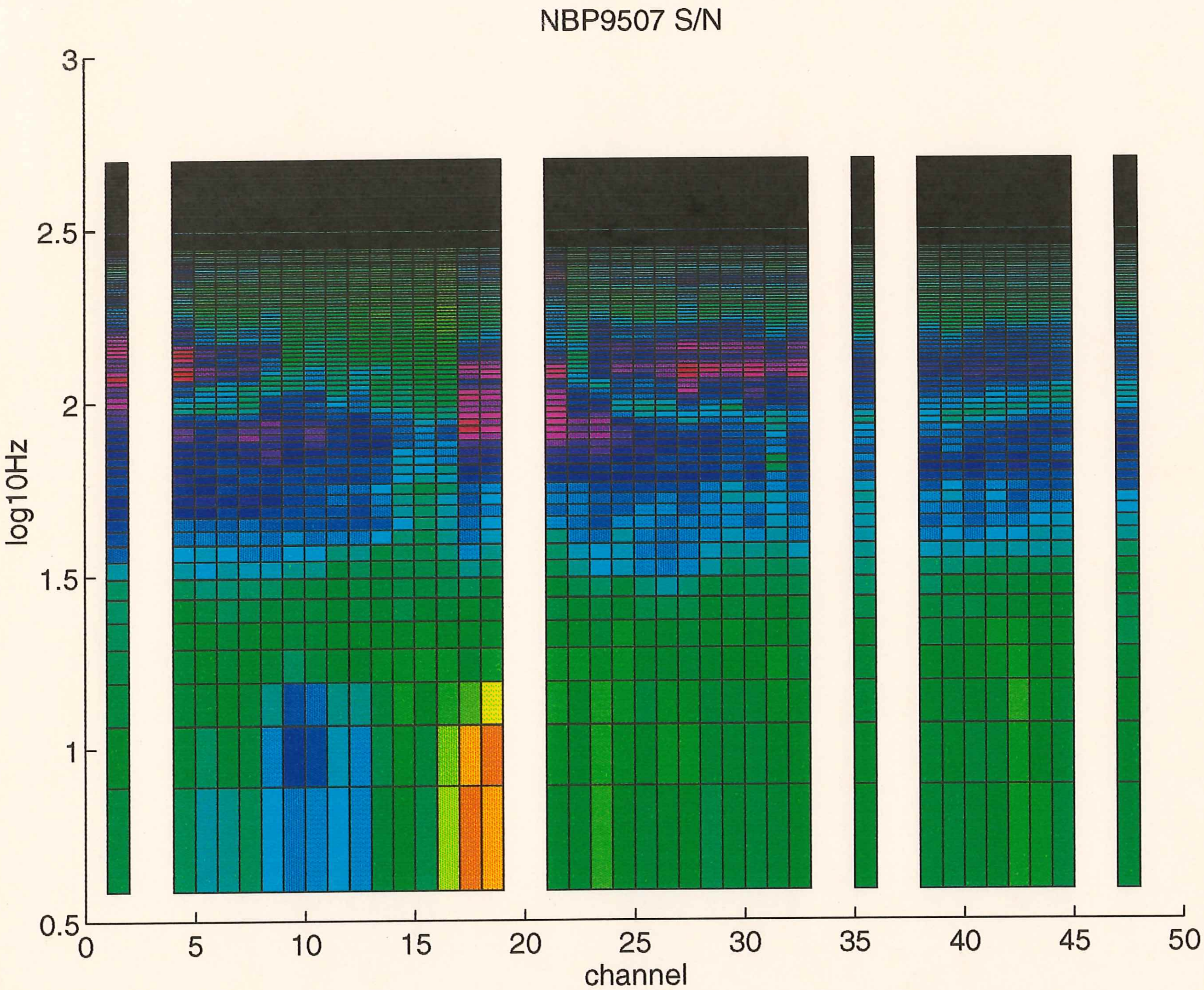
	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL29	20 Nov 95	1:38	1:36			607	38	629	50.27	47.63	up 30
			1:40	1:38			600	17	596	50.25	47.62	up 30 - fast - keep coming up
			1:49	1:47			296	250	293	50.19	47.68	stop winch
			1:51	1:49			296	249	293	50.22	47.67	down at 30m/min
			1:58	1:56			512	40	508	50.19	47.65	stpo winch
			1:59	1:57			511	42	508	50.19	47.68	fire command #1 on rosette
			2:06	2:04			508	67	509	50.13	47.75	down 20
			2:08	2:06			526	61	528	50.10	47.79	down 20
			2:12	2:10			535	74	548	50.03	47.61	down 20
			2:14	2:12			553	71	569	50.00	47.54	down 30
			2:21	2:19			593	44	600	49.98	47.31	down 10
			2:23	2:21			607	24	610	49.96	47.26	up 10
			2:26	2:24			595	19	599	49.94	47.11	up 20
			2:42	2:40			297	315	300	49.87	46.58	down again
			2:49	2:47			542	52	548	49.81	46.31	down another 10 and stop
			2:52	2:50			549	45	560	49.79	46.14	down 10
			2:58	2:56			563	42	570	49.78	45.93	down 10
			3:01	2:59			574	56	580	49.74	45.86	down 20
			3:06	3:04			590	45	600	49.71	45.59	down 10
			3:08	3:06			598	68	610	49.69	45.48	down 20
			3:12	3:10			621	56	634	49.67	45.43	down 10
			3:15	3:13			636	34	643	49.66	45.35	down 10
			3:18	3:16			647	22	645	49.65	45.20	up 10
			3:20	3:18			643	42	658	49.64	45.13	down 10
			3:23	3:21			654	19	655	49.64	45.03	up 10
			3:26	3:24			644	45	645	49.63	44.99	down 10
			3:30	3:28			651	68	655	49.59	44.85	down 20
			3:31	3:29			670	61	674	49.57	44.80	up to 300m
			3:43	3:41			296	317?	300	49.47	44.34	down again 30m/min
			3:59	3:57			806	36	826	49.45	43.77	up again
	NBP9507-SL29	20 Nov 95	4:15	4:13			298	335?	306	49.32	43.16	down again

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
			4:36	4:34			960	29	997	49.24	42.16	up again to surface
End	NBP9507-SL29	20 Nov 95	5:02	5:00						49.18	41.81	surface
Begin	NBP9507-SL30	20 Nov 95	6:39	0:00	62	60				54.27	4.89	dip@ southern Labyrs Ridge; power on
			6:46							54.23	4.89	in water,surface
			6:48						10	54.26	4.93	10m,holding
			6:53						37	54.25	4.90	going down 30m/min
			7:07				515		513	54.22	4.99	
			7:16				789		785	54.24	4.89	
			7:21				955		955	54.22	4.92	
			7:23				1004	35	1002	54.21	4.98	stop winch
			7:26				1026	14	1026	54.23	4.98	up 30m/min to surface
End	NBP9507-SL30	20 Nov 95	7:55							54.23	4.93	at surface, recovering
Begin	NBP9507-SL31	20 Nov 95	23:09	0:00	63	60				0.13	30.50	Deception Island; power on
			23:12	0:03	63	60	2		-0.4	0.15	30.50	in water
			23:16	0:07			12	100	10.2	0.16	30.48	waiting at 10m
			23:21	0:12			18	62	10	0.10	30.48	down 20m/min
			23:26	0:17			117	10	116	0.23	30.61	up
			23:31	0:22			7	135	5	0.36	30.83	down
			23:39	0:30			153	12	152	0.46	31.10	up
			23:46	0:37			7	128	4.8	0.57	31.34	down
			23:52	0:43			140	13	136	0.64	31.65	up
			23:58	0:49			7	149	5.2	0.73	31.68	down
		21 Nov 95	0:02	0:53			103	11	101	0.70	31.99	up 5
			0:08	0:59			8	61	5.1	0.73	32.21	down
			0:10	1:01			54	17	51.1	0.71	32.21	up
			0:13	1:04			8	58	5	0.71	32.25	down
			0:15	1:06			50	13	47.5	0.72	32.27	up
			0:18	1:09			7	49	5.9	0.72	32.29	down
	NBP9507-SL31	21 Nov 95	0:20	1:11			49	14	46	0.75	32.30	up

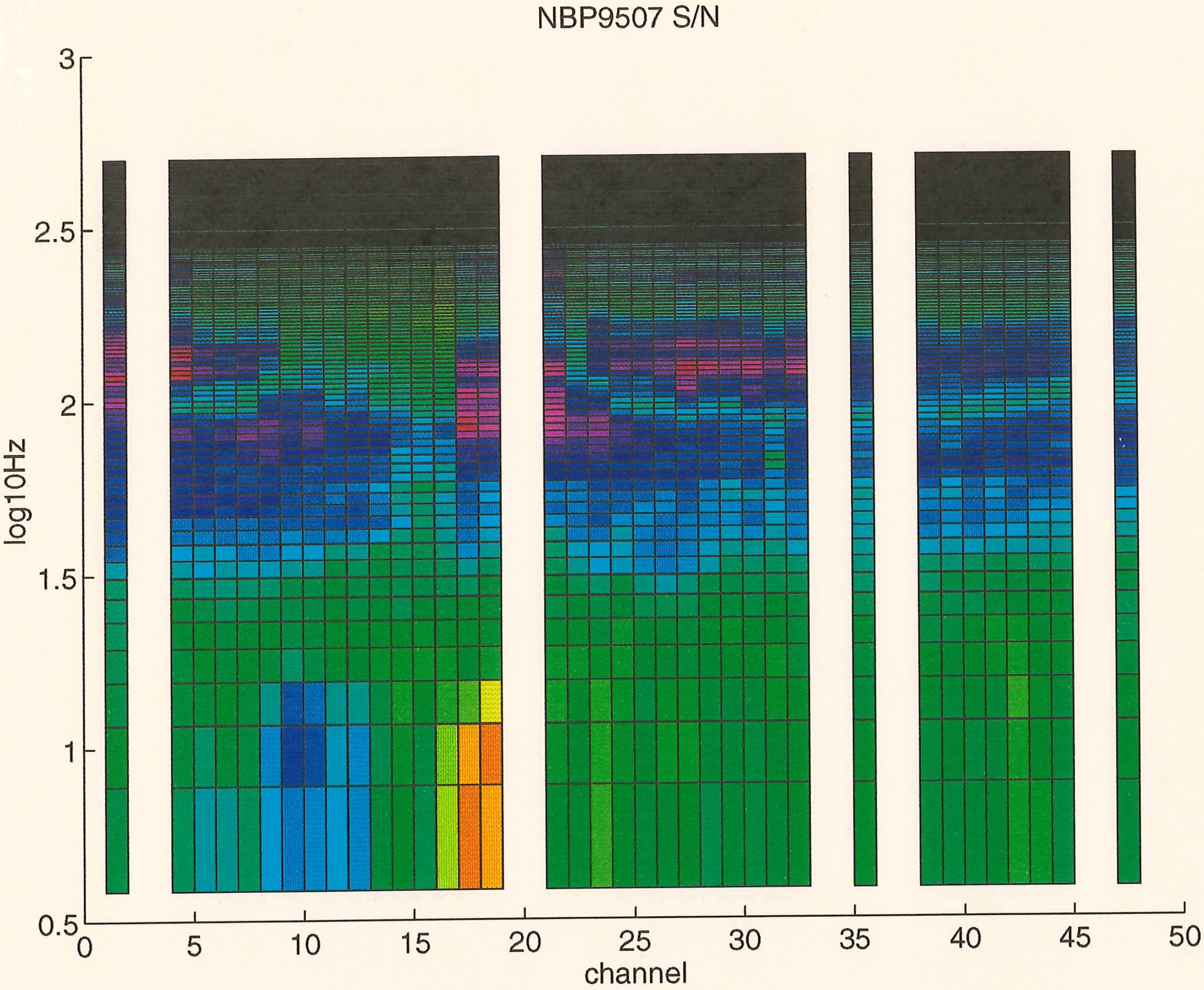
	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
	NBP9507-SL31	21 Nov 95	0:23	1:14			7	59	5.3	0.77	32.31	down
			0:25	1:16			59	13	56.9	0.76	32.31	up
			0:28	1:19			7	81	4.5	0.76	32.22	down
			0:32	1:23			104	19	103	0.79	32.03	up
			0:38	1:29			8	160	5.5	0.81	31.76	down
			0:49	1:40			220	12	221	0.89	31.27	up
			1:01	1:52			7	251	9.2	0.84	30.73	down
			1:11	2:02			263	13	265	0.82	30.41	up
			1:25	2:16			8	244	7.2	0.80	29.87	down
			1:39	2:30			298	14	305	0.64	29.26	up
			1:52	2:43			8	?	7.8	0.40	28.66	down
			2:03	2:54			248	13	261	0.15	28.33	up
			2:15	3:06	62		8	?	5.1	59.94	27.77	down
			2:31	3:22			350	23	357	59.66	27.17	up
			2:47	3:38			8	185?	12.3	59.60	27.82	down
			2:58	3:49			262	13	269	59.54	28.40	up
			3:07	3:58			8	?	6.9	59.54	28.63	down
			3:11	4:02			165	35		59.56	28.86	doing alt. calibration - ship stopped
			3:21	4:12			175	44		59.58	28.81	down 20 m
			3:24	4:15			195	14	191	59.54	28.79	up to a=50
			3:33	4:24			96	116		59.56	28.80	recovering sled
End	NBP9507-SL31	21 Nov 95	3:37	4:28						59.54	28.77	on deck
Begin												background sta in middle of western basin
			4:37	0:00	62	60				59.32	12.90	power on
			4:43	0:06								in water, 10m holding
			4:44	0:07						59.25	13.08	up to surface, down 30m/min
			4:54	0:17			290		289	59.26	13.02	
			5:14	0:37			963	13	970	59.34	13.16	stopped at the bottom
			5:15	0:38								starting up at 30m/min, bottle 2
	NBP9705-SL32	21 Nov 95	5:17	0:40			921	54	920	59.30	13.14	bottle 4

	SLED NUMBER	Date	Time	elapsed	Lat	Long	depth	alt	wire	Lat	Long	Comments
			GMT	time	°S	°W			out	min.	min.	
			5:26	0:49			626	225		59.37	13.01	bottle 6
							200		200			bottle 8
							97					bottle 10
THE			5:45	1:08			6					bottle 12
END	NBP9705-SL32	21 Nov 95	5:47	1:10								surface


NBP9507 S/N
log10Hz
channel
3
2.5
2
1.5
1
0.5
0
5
10
15
20
25
30
35
40
45
50

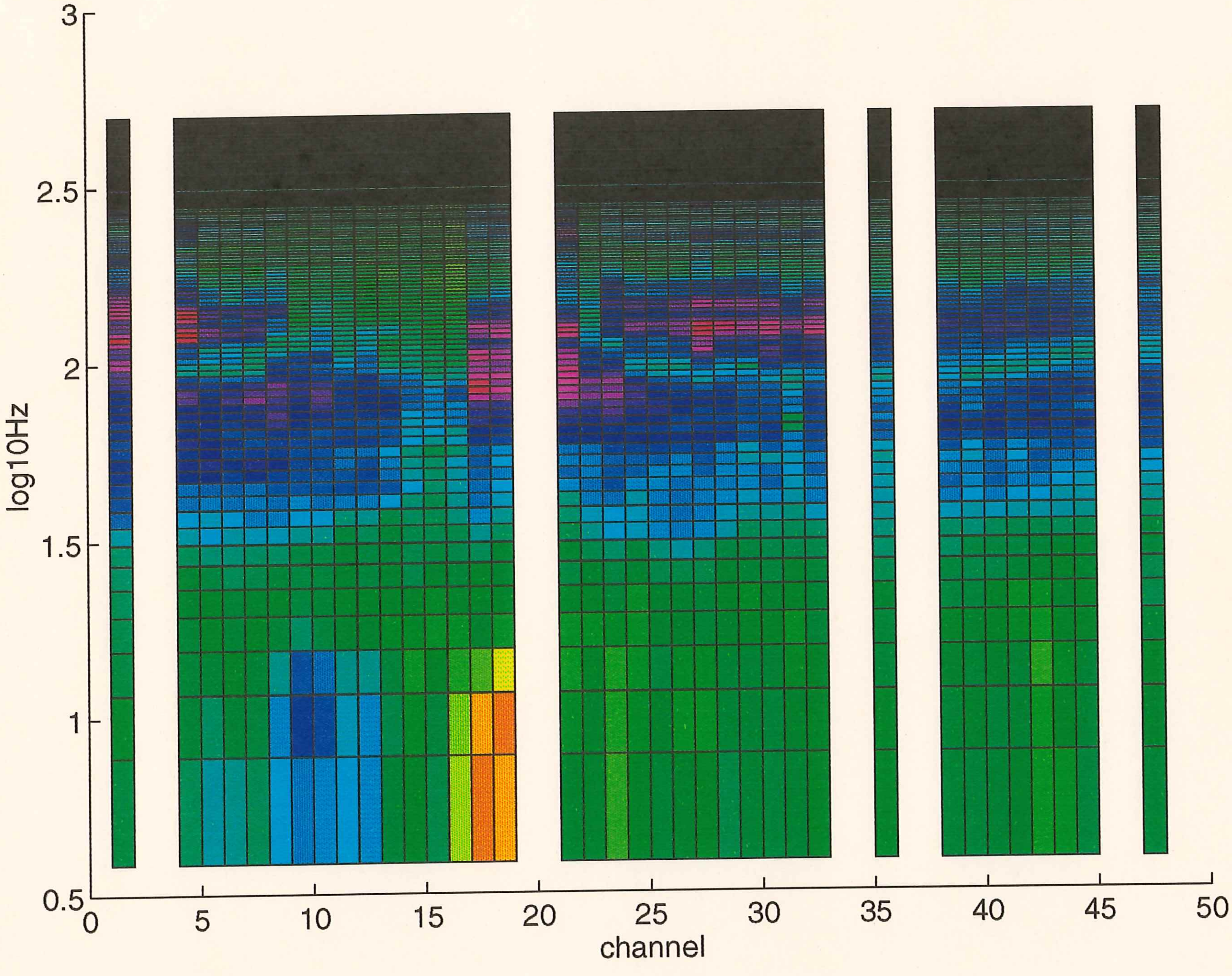


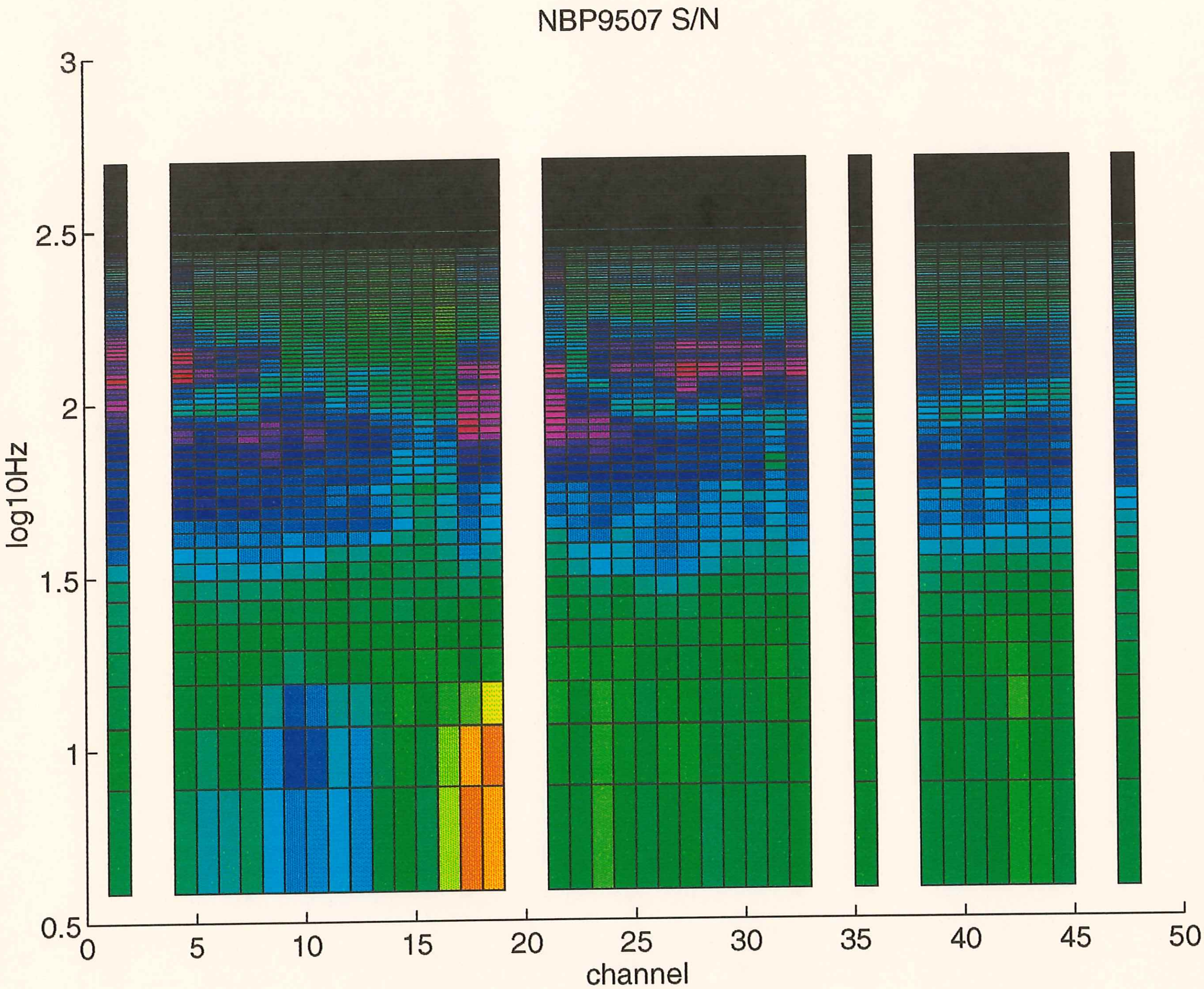
NBP9507 S/N
log10Hz
3
2.5
2
1.5
1
0.5
0
5
10
15
20
25
30
35
40
45
50
channel



NBP9507 S/N
log10Hz
3
2.5
2
1.5
1
0.5
0
5
10
15
20
25
30
35
40
45
50
channel

NBP9507 S/N





NBP9507 S/N
log10Hz
3
2.5
2
1.5
1
0.5
0
5
10
15
20
25
30
35
40
45
50
channel

Mount Palmer, Bransfield Strait

RV Nathaniel B. Palmer

November 1995

SEABEAM 2112 Image