

MARINE
NATIONAL FACILITY

2008

RV Southern Surveyor
program



CSIRO

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Reconstruction of paleo-oceanography and climate of SE Australia and the Southern Ocean from analysis of deep-sea corals

Itinerary

Departed Hobart 1815 hrs, Friday 11 January, 2008

Arrived Hobart 0800 hrs, Friday 1 February, 2008

Principal Investigator(s)

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Scientific Objectives

Circulation of the Southern Ocean, its water mass distributions and their rates of production are key elements in the global climate system. However, there is only sparse historical information on the oceanography of the region that could be used to constrain and test models of regional and global climate change and variability, limited to a small number of ship-based observations widely scattered in space and time. To overcome this problem, we have developed proxies for deep-ocean conditions, based on the composition of deep-water corals. These proxies allow us to reconstruct temperature, possibly salinity, and ventilation rates in the deep-ocean at decadal and millennial time scales. However, our ability to apply these proxies to temperate Australian waters and the Southern Ocean is severely limited by a lack of coral specimens from known depths and locations. This is the first voyage of a joint Australian-US, two-vessel program to obtain coral samples from seamounts and associated habitats off southeast Australia, that will be used to fill in gaps in the paleo-oceanographic record and allow us to test directly for long term changes in ocean ventilation rates. As part of the project, we will also document in detail biodiversity in the recently established South-east Commonwealth Marine Reserve network, by photographing and sampling at depths to about 5000 m, covering the 80% of the marine protected areas about which we have little or no biological information. Plankton samples will also be collected opportunistically while sailing out of and into the port of Hobart, to assess cross-shelf distributions of coastal invertebrate larvae.

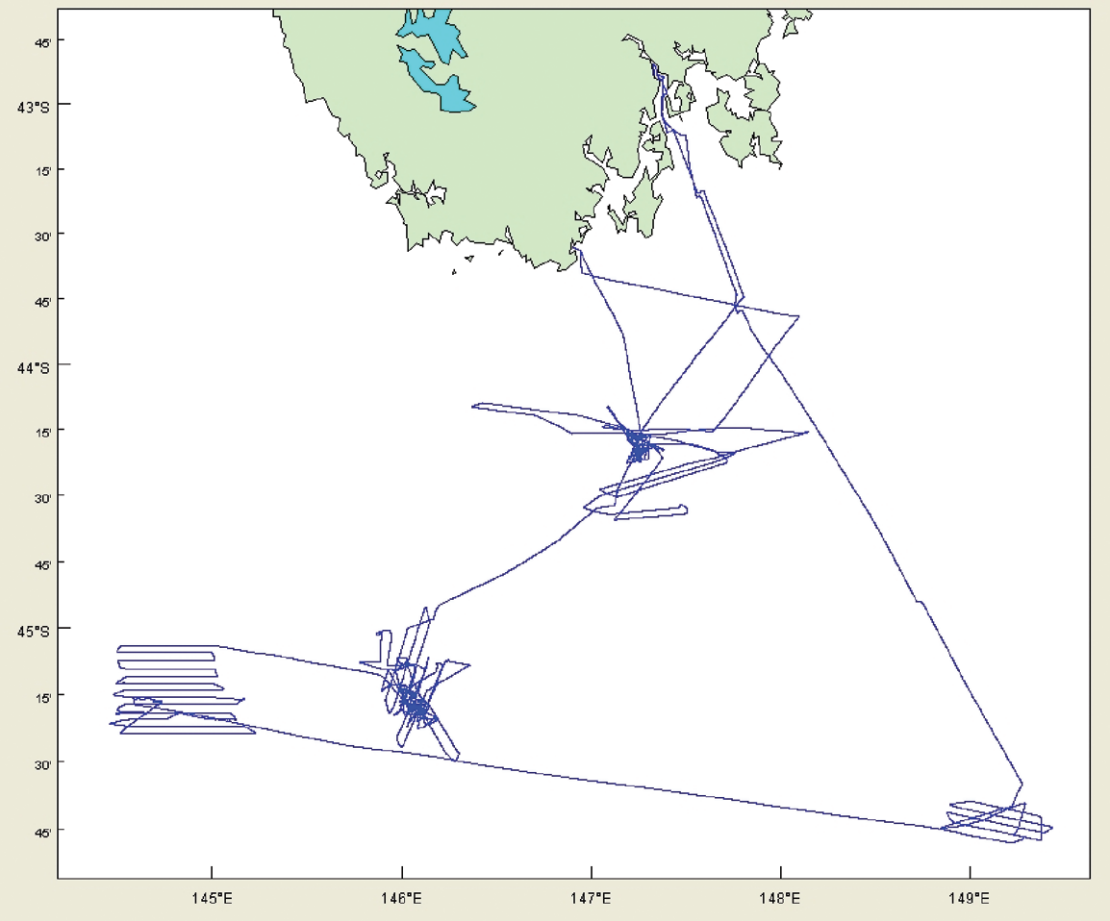
Voyage Objectives

The major objective of the voyage is to determine the location of beds of high quality live, sub-fossil and fossil corals off SE Tasmania, that can subsequently be sampled on the follow-up US vessel voyage. This objective will be met by deploying the Woods Hole Autonomous Benthic Explorer (ABE), a non-tethered instrument specifically designed for survey work to depths of about 4000 m. We will do a preliminary identification of probable areas of interest based on analysis of high resolution topographic maps of the survey sites (already in hand), from results of previous trawl samples of the areas, and from existing CSIRO video from tethered underwater vehicle surveys. Three broad areas of interest have been identified: The Southern Seamounts, the Tasman Fracture Zone, and the South Tasman Rise, which will be sampled in that order and in that order of priority. At each site, the ABE will be deployed for up to 4 days, to undertake a series of 6-7 hour dives examining the substrate for suitable coral samples, the GPS locations of which will be recorded for subsequent benthic sampling.

The second major objective of the voyage will be to document biodiversity of the deep parts of the South-east Commonwealth Marine Reserve Network. Little or nothing is known about biodiversity for the more than 80% of the marine reserves deeper than 1800 m, the current maximum depth for which there has been previous work. In part this objective will be achieved as an adjunct to the search for coral samples, as the video taken during that search will also be analysed for biodiversity. However, at least one day of ABE time will be allocated at each of the three primary sampling sites for surveys specifically to document biodiversity. Areas of particular interest will be located by their GPS coordinates, and sampled subsequently on the follow-up voyage. Depending on results, particular emphasis is likely to be placed on examining areas previously trawled scientifically or by fishers, to assess rates of reef growth and recovery, on assessing percent live coral cover in different locations and depths to assess reef health, and to comparing different video survey approaches (e.g., straight-line transects vs random point analyses, for example) to develop optimal strategies for future biodiversity surveys of the deep temperate reefs.

A third, and the lowest priority objective of the voyage is to collect surface plankton samples for invertebrate larvae while steaming across the shelf out of and back in to Hobart. No cross-shelf plankton sampling in the region has been done in over a decade, and the samples will be used to test hypotheses of the role of ocean currents on dispersal patterns of warmer water species moving spreading down the coast as an apparent response to global warming.

Voyage Track



Results

Objective 1: Identification of sites containing fossil coral, for subsequent sampling.

ABE (Autonomous Benthic Explorer) missions were carried out at the Sisters Pinnacle (Huon Marine Reserve) and a pair of un-named pinnacles in the Tasman Fracture Marine Reserve, at depths ranging from 850 to 2950 m. The performance of the vehicle was hindered by some minor mechanical problems (sheer pin failures) and unexpectedly strong currents around the seamounts. Nonetheless, over 6000 photographs of the bottom were taken, which have been examined closely for evidence of live and fossil corals. As well, 14 sled samples were taken, at depths ranging from 1050 to 1850 m, also looking for corals.

Fossil and sub-fossil corals (Desmophyllum, Caryophylla and isidids) were collected, sometimes in abundance, at most of the shallower sites sampled by sled. In total, over 2700 sub-fossil and fossil solitary corals were collected, and perhaps 100 isidids. In deeper water, ABE photographs show that isidids are common as deep as we could sample (2950 m) without reconfiguring the vehicle, whereas live solitary corals were unambiguously identified at 2250 m at a site in the Tasmanian Fracture Zone. Sub-fossil and fossil isidids are also obvious lying on the bottom in deep water. These depths are considerably greater than we had previously believed these corals would be found. Their abundance should make it relatively simple to obtain depth stratified samples using Jason, a process that will be made much easier due to the high resolution topographic maps we generated by swath mapping in each area. On the basis of this voyage, we anticipate a highly productive mission using Jason.

Three other coral related activities were carried out successfully. First, CTD casts were made over and around the seamounts, to identify the water masses modern corals would be exposed to. This information is critical to using coral chemistry to reconstruct paleo water mass distributions. The data suggest only a slight ridging of water masses over seamounts. Second, water samples were taken at two sites for subsequent determination of carbonate levels. These data will be used to help assess any climate-change associated changes in the depth of the carbonate saturation horizons on coral survival. And third, live corals were collected and put in aquaria on board Southern Surveyor, to determine which, if any, could survive to be used for experimental studies. Most turned out to be too delicate, or too badly damaged by the sled sampling, to survive. However, the deep-water species Caryophylla seems fairly robust, and several specimens were still alive at the end of the voyage.

Objective 2: Obtain data on deepwater biodiversity

Over 30,000 photographs were taken, showing in considerable detail the biodiversity in the southern regions at depths well below those previously sampled (1800 m). The deepest photographs are from 2950 m, and show that extensive communities of soft corals (gorgonians and gorgonshead corals) and stalked barnacles occur along ridges and on rocky ground nearly as deep as we could sample. Most species appear to be conspecific with those seen at shallower depths, but this will need to be confirmed when we obtain samples using Jason. This trip resulted in the deepest photographs of live organisms ever taken in Australian waters.

The ABE photographs will be examined in detail to quantitatively describe depth changes in biology, to depths not previously done in this part of the world. These data will be supplemented by further sampling to greater depths when Jason is used later in 2008.

Objective 3: Plankton sampling across the shelf

Samples were taken at four stations across the shelf while leaving Hobart, and four more while returning. Preliminary analysis indicates the species of interest (an invasive crab) was not present as larvae in the first sample set. The second has yet to be examined.

Problems that affected our voyage were harsh weather (not surprising in the Southern Ocean) and equipment. Equipment issues arose with the port trawl wire, CTD winch and Oracle operations logging system.

Voyage Narrative

11 January: Late departure from Selfs Point (1815) following bouts of strong NW winds (gusting to 60 knots) with the approach of a front. Sailed under the bridge at 1830, but remained in sheltered area off Sandy Bay while the ABE work was completed and an inshore bongo net plankton tow was done (2011-2021). Thereafter, three more plankton sets across the shelf, each of 10-minute duration, at Iron Pot (ca. 2230), 50 fathoms (ca. mid-night) and 100 fathoms (ca 0330) before turning SW towards Southern Hills region.

12 January/Saturday: Arrived at Sisters Pinnacles at 0830. Moderate swell and chop, winds at 15-20 knots, and meant to be easing over next 24 hours, prior to next front. Began organising to deploy the ABE transducers, in 4 transducer "net" that allows the ABE to navigate, along the western and SW portion of the Sisters and over a depth range of roughly 850 – 1500 m. Initial test suggested a problem with hearing the transducers, which resulted in a several hour delay in deploying them. All four transducers deployed and clearly audible by 2000, after which we did half circles around each to precisely determine its position using GPS. Rising seas and a synoptic chart that indicated strong winds on Sunday resulted in a decision not to deploy the ABE right away. The strong consensus of the captain, scientific and ships crew is that first deployment and retrieval should be under as close to best conditions as possible, given lack of familiarity with the equipment by some parties and possible problems retrieving the ABE if conditions blow up. Instead, a first short sled was undertaken, at "Little Sister," a small pinnacle coming up too about 1000 m and just north of the planned survey site. The target depth was 1200 m, and the intent to see if we could successfully collect and keep alive coral for observations and experimental studies of environmental effects on growth rates. About 0.5 tonnes of material was collected, which contained both live and fossil corals, the former placed in flow-through chilled aquaria and the latter sorted out for subsequent lab analyses.

13 January/ Sunday: Rough conditions, with winds gusting to >50 knots and seas averaging over 8 m, with some swells approaching 10. Conditions far too rough to work, so doing some swath mapping until things improve (possibly not until tomorrow). A significant fraction of the scientific crew felt poorly yesterday, and aren't visible today. The mess has been conspicuously empty during meal times.

14 January/Monday: 0700 - Conditions slowly improving, with winds down to 30-35 knots. Still too rough to deploy gear or finish configuring the ABE. Some staff are visible again, so things obviously improving. Depending on conditions, may do a hydrocast and sled this afternoon, and attempt ABE deployment this evening.

Conditions peaked at about noon, and have begun to deteriorate again. Winds holding at 25-35 knots, and seas not abating much. Completed a swath line westwards from Pedra, and then turned back with the intention of doing a sled shot possibly followed by an ABE deployment, if conditions permitted. They didn't. Did the sled at Mongrel Hill, at 1250 m. Pulled up about 3 tonnes of mixed rubble, which included huge numbers of fossil and sub-fossil solitary corals and smaller numbers of isidids. Excellent. Also a few live corals, ranging from *Primnoisis* and *Lepidisis* to solitaires and some gold corals. Transferred the living samples to cold-water aquaria, for transport back to Hobart. Heavy seas made sorting the sample difficult, with the aft deck awash at times. Took 3 hours to sort in the end, finishing at about 2200.

Heading in to Recherche Bay, to drop of 4 individuals, plus live corals, with intent to steam back out tomorrow in, we hope, improved conditions.

15 Jan/Tuesday: 0700 arrived at Recherche Bay. Beautiful and calm. It was obvious from the rocking of the boat when we came around the headland. Small boat launched and staff heading inshore just after 0830.

Headed out to station. Moderate seas, winds to 25 knots. Launched ABE at ca. 1700. Beautiful launch, smooth as glass as the vehicle motored away from the ship and slowly descended.

Once launched, started a series of CTD stations, starting ca. 10 km south of Sister, 6 stations ending on the pinnacle of S. sister, to see if there is any indication of topographic effects on the distribution of water masses. Seas rising, but thus far, not too badly.

16 January/Wednesday: 0800 ABE on surface. Choppy seas, with winds gusting to 35 knots. Far from ideal recovery conditions. ABE first located visually, bobbing at the surface with an albatross sitting on it. First attempts to swim the vehicle to the ship proved fruitless. The relatively weak motors of the ABE couldn't keep up with the ship's drift due to the winds, and attempts to hold the ship using the thrusters resulted in the currents pushing ABE off. Finally, the captain slipped the ship up to ABE the same way he would to a mooring, bringing it along the starboard side about 20 m from the ship and in the slight lee created by the ship. At this point, the ABE motored in closer, and was captured by a noose around its hanging point, which slipped the clip from the crane wire in. Prolonged struggle to get more guide lines onto the vehicle, with the intent of lifting it out of the water by crane, pulling it away from the ship, while the taut guide lines acted as the other two points of a triangle, holding the vehicle secure. Looked good initially, but strong winds and steep seas started the vehicle rocking widely once it was clear of the water, yanking ropes from the crew's hands and risking both the crew and the vehicle. Vehicle dropped back in, to stop the swing, more rope tied to it, and on the second attempt, it was lifted, swung inboard and dropped into its cradle. ABE crew reported that was about the wildest recovery they'd ever done.

The ABE sustained minor structural damage, due to the rough seas it had to swim in, and appears to have had problems with its positioning system, so that the acoustic data for the first dive was less valuable than hoped. On the other hand the on-board camera system, tested on this dive, worked well.

ABE put on to recharge, while the rest of the 6-station CTD series was completed.

1200, seas rising, with winds gusting over 40 knots and seas rising to >5 m. Conditions continuing to deteriorate, despite forecast that suggested likely improvement. Sled sample planned for PM cancelled due to rough seas as, shortly after, was the planned second CTD series (more or less at right angles to first). Back to swath mapping, in deeper water looking for good samples sites, until the seas abate, hopefully tomorrow.

17 January/Thursday: Sea conditions improved marginally overnight, but then began to worsen again starting about 0400. By 0700, winds averaging about 26 knots, and gusting to about 32, with rain. Completed a set of swath maps on some deep (ca. 2200 m) features south of the Sisters, which we hoped might prove suitable for some deep coral sampling, weather permitting. Heading back to Sisters, with the intent of, in order of preference and reverse order of likelihood, putting ABE in the water, dredging a coral sample from the top of South Sisters, and starting the second CTD line. Positioning problem on the ABE sorted out, so we should begin to start generating useful data once the machine gets back in the water.

While waiting for the ABE to be prepped, we attempted two sled shots on the top of South Sister, depth 900 m. First sled came up empty, which we variously decided possibly meant it hadn't hit the bottom despite 1200 m of wire. Tried again, this time shooting out 1350 m. Winch drum tension clearly indicated bottom contact, but still came up empty.

Sea state improving, with winds dropping to about 20 knots. After much futzing around, including replacing a damaged panel on the side of ABE, it was put back in the water at 1700, to do a photo and acoustic survey of the upper slopes of the Sisters.

Survey looked good until about 1900, when stressed report by ABE operators that the vehicle appeared to be stuck. After beginning its transit of the ridge, when it got to the first valley between peaks, it basically stopped moving. Initial concerns were that it might have gotten fouled in lost fishing gear, which we know is on this hill. If so, recovering ABE would be a job for Jason, a year hence. The vehicles programming directed it to try different options (turn left, turn right) with the final option being drop all ballast and attempt to surface. After the turn left command, suddenly the vehicle seemed to be moving again, confirmed about 20 minutes later when it came out of an acoustic shadow zone and its position could be accurately recorded again. No idea why the vehicle stopped, though the favored hypotheses are strong head currents coupled with a steeply falling bottom, a very irregular and possibly spongy bottom (which would confuse its orientation) and an amorous giant squid. Photos taken during the stopped period should be informative.

Planned CTDs scrapped, in favor of staying close to the vehicle in case the problem happens again.

18 January/Friday: It's been a long week.

Sea conditions great this morning, long swell and little wind or chop. ABE due to surface around noon, so we did a CTD while waiting. ABE crew still anxious about the vehicle, so we're basically loitering near it until it comes up. Sea state forecast to pick up throughout the day. Hoping to dredge a deeper pinnacle (ca 1050 m) this afternoon, once ABE is on board.

ABE surfaced at 1130, and was retrieved without incident. Examination of the vehicle indicates the lack of speed when down was probably due to a failed sheer pin in one of the motors, which resulted in a lack of overall power. The problem in the "zone of death" became evident when we examined photos from the area. Strong currents in the valley between the peaks – strong enough to flatten the cnidarians that pepper the bottom there – appear to have buffeted the vehicle, and it lacked the power to push against it. On swinging back through the "zone" on its return trip, the currents pushed ABE to the shadowed part of the pinnacles, causing it to lose its bearings and, basically, wander lost for 10 hours, until the surface time arrived. We got photos of the first part of the run, showing a few orange roughy, said cnidarians and not much else, and no acoustic data. Although not a complete mission, the dive did show us that the rumoured large amounts of healthy coral in the valleys between the peaks on Sisters do not exist; the areas are mostly bare rock, like the rest of the pinnacles.

After the dive, we dredged Hill B1, bouncing the sled off the top of the peak at 1050 m. A small catch (about 0.5 tonnes), as planned, but like the sleds at other depths, full of fossil solitary corals, as well as *Solenosmillia* and, for the first time, large amount of *Gonocorella*. A few small isidids and gold corals, as well.

ABE re-launched at 2320. First night launch. Sea conditions still good, so we're taking advantage of it. Targeting a deeper pinnacle, over a depth range of 1820 m (at start of dive) to 1250, at its end.

19 January/ Saturday: Sea conditions still good. Winds generally <15 knots from NNE, though forecast to pick up later. ABE running smoothly, aside from the occasional hesitancy on the bottom, for reasons not obvious.

Did two dredges on Z44, about 1.25 km SE of ABE survey site. Pinnacle at 1450. Clearly hit pinnacle on both shots, but first came up completely empty and second came up with a small number of stalked barnacle shells (a common benthic detritus deeper) and some manganese pavement fragments, indicating the sled made contact. Conclude there is not much coral on the pinnacle.

ABE surfaced at 2330, resulting in our first night recovery. No problems. Vehicle easily visible on surface because of its flashing strobe lights. Initial plans to immediately recover the transponders postponed until morning, as it would be difficult to see them on surface at night (no lights). Completed second CTD line while waiting.

20 January/Sunday: Seas picking up, now from SW, though winds still generally <20 knots. Small white caps and moderate swell, with the ship rocking around a bit.

Picked up transponders by noon, the ABE guys being able to trigger release when the ship is close to the transponders, which take about 20 minutes to surface.

Moving towards the fracture zone, site 2, in about 1650+ depths, while swath mapping "Jess's Ridge" on the way. Plan is to do the 6-8 hour transit, then swath map the likely target area for ca.12 hours before deciding where to put the net.

Looked at images from last night's ABE dive. Nice stuff. Lots of great photos, followed by an acoustic run. Dive went from 1850 – 1250 m, working more or less uphill. Extensive Solenosmilia fields shallower than about 1400 m, though much of it appears to be dead, as per Koslow's observations. Extensive barren rock from ca 1450 –1700, but then indications of live and fossil solitaries at 1800-1850. Solitaries appear to go deeper than Solenosmilia. Photos also show stalked crinoids, sea stars, heaps of urchins and a few fish. A goldmine of biodiversity data. Numerous near vertical cliff faces, especially deep. Hesitancy in the ABE run appears to have been caused by the vehicle running into the cliff faces, at times causing a shower of debris being shaved off. ABE covered with scrape marks on recovery.

21 January/Monday: Seas still rough. Continued swath mapping.

22 January/ Tuesday: Seas workable, with W/SW winds varying during the day from ca. 15 to 30 knots. Swath map completed about 2400, and target area selected – a pinnacle and ridge system just east of the Tasman Fracture, at water depths ranging from 1400-3600 m. Transponder net set, and ABE launched at 0600, under good conditions, to a depth of 2950, ranging up to 2000 m. Initial readings indicate the vehicle is on track.

Attempted a CTD while ABE was down, but failure of the altimeter indicated a leak in the system, requiring several hours repair. Instead, we did a sled shot to the top of the pinnacle, ca. 1450 m. The first attempt came up virtually empty, with only a few barnacle plates and one dead Desmophyllum. A second attempt, at 1590 m, brought up one nice, live isidid, more barnacle plates and a very large iron rock jammed into the mouth of the sled. A few small coral fragments, some small live Stylaster and a chiton were found on the rock. The rock itself had a deposited Manganese coating, and was relatively light and porous, with large crystal and a penetrating web of what looked like bacterial mass inside it, possibly living on the reducing minerals. Samples taken (by sledge hammer) and frozen.

23 January/Wednesday: Seas still workable, and look reasonable for the next few days. ABE recovered at 1300, after which some swath mapping done. Problems with the vertical thrusters (both broke their shear pins) limited the mission to 8 hours (all photo) and a depth range of 2500-2950 m. Still, the photos are terrific. Large numbers of isidids (Karen thinks Isidella) below 2800 m, with one photo showing both large live specimens and dead skeletons littering the bottom. Crinoids and naked corals also present, along with numerous barnacle plates littering the bottom. No sign of solitary corals. Bottom mainly large dark coloured boulders interspersed amongst clay or rubble bottom.

CTD not operational. Re-spooled main warp wire to correct bad spooling at around 2000 m. Re-spooled and out to about 3300 m.

ABE re-charging and being worked on. Dropped fourth transponder, and planning to drop ABE in after dinner.

ABE launched at 2130.

24 January/Thursday: Miserable night for the ABE. After reaching bottom, the vehicle struggled to follow its programmed path. After several hours, the decision was made to abort the mission and bring it up. Seas picked up shortly before the ABE surfaced, which caused problems and resulted in the ABE banging against the ship's hull, cracking a fibreglass cowling on the centre thruster. Finally in its cradle by 0530.

Immediate feedback from the ABE crew is that the physical damage is fixable, but that it will be a while sorting out why the ABE wasn't moving. First indications are that one of the thrusters may not have been working, and also that the vehicle may have been trying to move against a current. As of 1800, still no prognosis on when the vehicle will be functional again.

Support staff continue work on CTD.

Launched the sled at 1000, targeting a flattish plain at 1650 m. Several severe yanks on the wire after we hit bottom suggested the plain wasn't that flat after all, and then it appears the sled hung up on the bottom. Wire strain up to 14 tonnes before we got the sled free. The two sacrificial links on the bridle had broken, allowing us to pull the sled backwards out of the hang-up, exactly as they are designed to do. A small amount of material retained in the bag, nonetheless, which contained a live isidid, numerous sub-fossil isidids, a handful of fossil and sub-fossil solitary corals and fragments of *Solenosmilia*, and probably 0.25 tonnes of barnacle plates. It appears we can get coral material to at least this depth, but age ??? It appears that there was a reef here in the past, now extinct.

Assessment of ABE performance indicated a couple of the thrusters not working at full capacity, and also evidence of stronger than anticipated currents at depth. ABE translocation as it ascended suggest a horizontal current of about 0.5 m/sec a few hundred m above the bottom, which could well have resulted in turbulence enough to interfere with ABE navigation. We should be able to launch again tomorrow.

Photos from last night's brief run indicate abundant invertebrate fauna at 2000 m. Numerous gorgonshead corals, gorgonians. What appear to be solitary stalked barnacles on underside of overhang on vertical ridge. No sign of aragonitic corals.

CTD also again functional. Switched to second cable, which, along with fixing some of the leads in the unit, appears to have fixed the problem. First cast indicates AAIW core at about 800 m, and relatively uniform water mass from about 2100 m to bottom (3300 m).

25 January/Friday: Winds still moderate, with long swell. Two more CTDs overnight, both close to “the Knob,” and both indicating an odd high salinity water intrusion at 400-1000 m and quite low salinity water below it. Could be a CTD calibration problem. Drew and Hiski checking.

ABE repaired overnight, and back in water at 0815, targeting the “finger,” a long slender plateau (top 2000 m) SE of “the Knob,” with steep flanks. ABE running along the northern crest of it, from 2500 – 2000 m.

26 January/Saturday: ABE surfaced just after midnight, and was picked up at 0600. Retrieval went very well. First look at photos continues to show large stands of gorgonians and gorgonshead corals at depth. Some indications of scattered, possibly dead solitary corals at ca. 2100 m.

Discussed science options for the rest of the trip, in light of the forecast deteriorating weather over the next two days. Decided to complete one more deep CTD cast here, then pull up the transponders and move west, to explore areas closer to the fracture itself. In particular, an east west valley at about 2500 m looks interesting, as possibly a strong current area, which might encourage coral growth. Plan is to swath map it, do a sled or two if weather and time permit, and then head back to Hobart with a brief stop at the Southern Hills area to do another sled or two.

Transponder pick-up completed at 1900, and heading west. Seas still smooth, with light winds directly out of the north. Front expected to approach during the night, and be on us early tomorrow.

27 January/Sunday: Seas steadily out of the west, with winds running at 20-25 knots and seas slowly building during the day. Spent the day swath mapping a feature near the edge of the fracture. Some interesting looking cliffs at about 2500 m.

Forecast is for more of the same tomorrow, with gale force winds tomorrow night, after which conditions might ease enough for us to work.

28 January/Monday: Sea conditions marginal for working, although we have been swath mapping all night. The captain felt that a CTD might be possible, so we cut off the swathing to do a deep CTD (4200 m) in the fracture, with the intent of doing a second for comparison on top of one of the nearly 2000 m features. Conditions worsened during the first cast, however, and the second was called off, in deference to more swathing. By 1800, conditions had deteriorated to the point where even swath mapping was abandoned, with the ship just holding a heading into the oncoming sea. Swell in excess of 6 m, and winds gusting to more than 30 knots, and expected to reach 40 knots overnight.

29 January/Tuesday: Swell running > 6 m in morning, with winds 25-30 knots at 260°. Conditions nonetheless improved over last night, and are forecast to continue improving. Did CTD cast on top of 1850 m feature about 10 km east of the fracture, and then attempted to sled top of feature to see if there was any coral present. Dredged from e-w (into wind), and attempted to set sled down on slight down slope on w side of pinnacle, in order to avoid dredging up hill. No sign of bottom contact at 2000 m of wire, so after clearing pinnacle, approx 0.75 km past the pinnacle started playing out more wire at 80/ min. No sign of bottom contact by 2500 m; stopped wire out, and then began retrieve.

Trace still widely variable until after about 5 min haul, a sharp spike to ca 10 tonnes, followed by a sudden release of tension. Sled missing when wire reached surface. The hammerlock between the sacrificial wire and the main wire had given way, presumably during the 10 tonne yank (tho' this is well below the rated breaking point for the system).

Message sent to Al Williams, advising him of the gear loss, so he can try to get a replacement made in time for his voyage.

CTD wire jumped spooling guides while being retrieved at 1830. Operational at 2340.

Considered options due to lack of time to use ABE and loss of sled, about most valuable thing we can do with the time remaining. Decided to swath map and possibly rock sled a small seamount due east of here, north of the STR (which is too far away to get to in the time remaining) and south of Cascade Plateau. Rough charts indicate <2000 m pinnacle depth, with >4000 m water nearby. Exploring as possible Jason site.

30 January/Wednesday: Steaming at ca. 12 knots to SE seamount. Seas relatively calm and following, making for a quick and relatively smooth transit. Scheduled arrival 1600. Commenced swath mapping at 1630. Seamount about 20 km long, plateau, with a top depth of about 2500 m and a small escarpment around the edge, before dropping to ca. 4000 m. A few hill like features on the plateau, shoaling up to 1780 m.

31 January/Thursday: Did a rock sled on a small hill on the otherwise pretty flat seamount, targeting the shallowest point, at about 1800 m. Sled brought up several pieces of manganese pavement, which had on it a few solitary gorgonians and the base of a fossil coral, ID? Completed swath map, and then heading to Hobart. Winds westerly, at 25-30 knots. Moderate swell.

Surface plankton tows carried out at 100 and 50 fathom contours and in Storm Bay, en route into Hobart.

1 February/Friday: Docked at 0800.

Summary

Rough conditions and equipment failure (including the ABE) limited the number of dives we could make with the ABE, but nonetheless those we did, along with a larger than planned number of sled samples, abundantly documented the distribution of corals in the study areas. This information, along with the swath maps we made and the CTD casts to identify water mass distributions, abundantly satisfied our scientific objectives and will allow detailed planning of the sampling program with Jason later in the year. We also provided outstanding information on the biodiversity of the southern reefs to depths much greater than previously sampled, identifying previously unknown communities at depths below those that could previously be sampled. We judge the voyage a major success. We would note that it also generated good national publicity for the National Facility and for CSIRO, with media activities both before and after the voyage.

Personnel

Scientific Participants

Ron Thresher	CMAR	Chief Scientist
Jess Adkins	California Institute of Technology	Research Scientist
Nethya Thiagarajan	California Institute of Technology	Student
Anna Beck	California Institute of Technology	Student
Dana Yoerger	Woods Hole Oceanographic Institute	Leader, ABE team
Alan Duester	Woods Hole Oceanographic Institute	ABE engineer
Andrew Billings	Woods Hole Oceanographic Institute	ABE engineer
Karen Gowlett-Holmes	CMAR	Invertebrate taxonomist
Robert Gurney	CMAR	Scientist
Alan Williams	CMAR	Research Scientist
Drew Mills	MNF	Voyage Manager/Electronics Support
Hiski Kippo	MNF	Electronics support
Anne Kennedy	FUGRO	Swath Mapping

Marine Crew

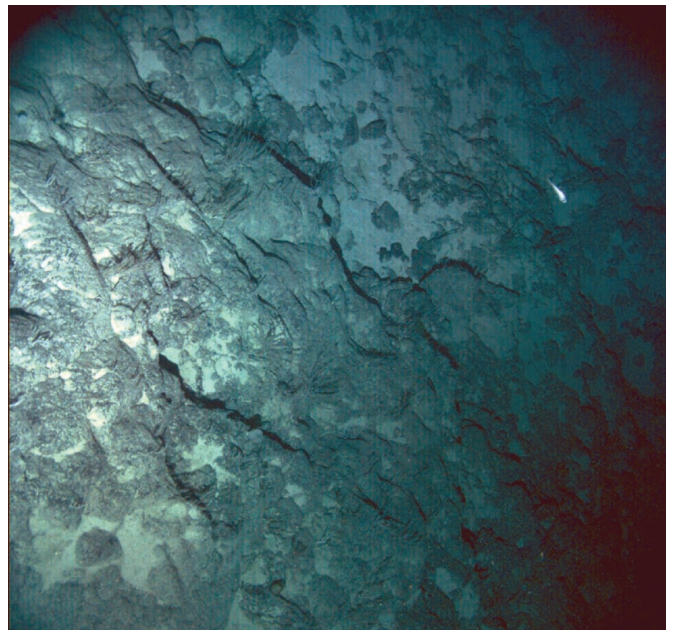
Les Morrow	Master
Brian Payne	First Mate
John Barr	Second Mate
Roger Thomas	Chief Engineer
Nick Flemming	First Engineer
Bill Bourn	Second Engineer
Charmayne Aylett	Chief Steward
Andy Goss	Chief Cook
John Fabics	Second Cook
Tony Hearne	Boatswain
Joel Wilkinson	IR
David Persson	IR
John Howard	IR
Tony Kennard	IR
Tom Watson	Deck Cadet

We particularly thank Les Morrow, Brian Payne and Tony Hearne for their patience at the very irregular and sometimes unpredictable working hours forced on us by use of the ABE. We also thank Tony and the deck crews for their assistance in maintaining (and repairing) sampling gear, and their enthusiastic assistance in launching and recovering the ABE, a difficult task under weather conditions experienced during much of the voyage.

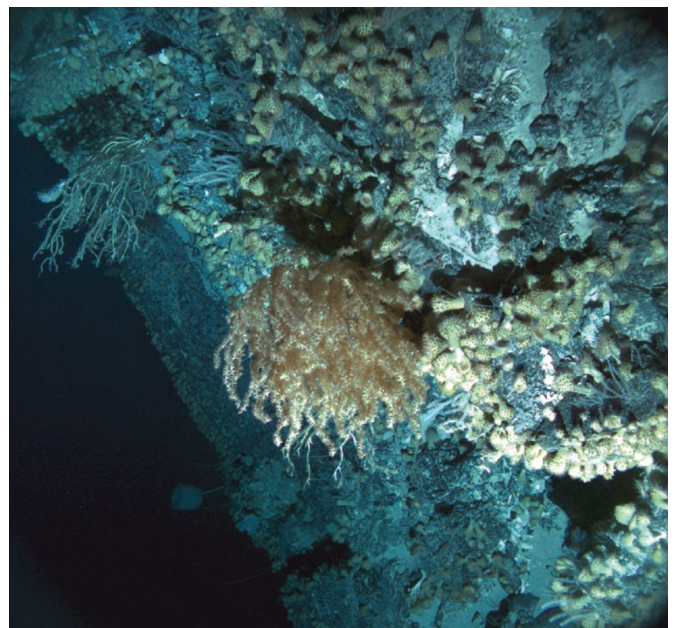
Ronald E. Thresher
Chief Scientist



Night-time launch of ABE off Southern Surveyor



The deep reef at 2650 m in the Tasman Fracture Marine Reserve. Photo credit: WHOI ABE Program.



Coral community at 2250 m in the Tasman Fracture Marine Reserve. Photo credit: WHOI ABE Program