

FRANKLIN

National Facility
Oceanographic Research Vessel

Cross-shelf sediment transport in the Torres Strait - Gulf of Papua Region.

CRUISE SUMMARY

RV FRANKLIN

FR 01/02

Depart Brisbane 1000 hrs, Thursday 17 January 2002
Arrive Cairns 1100 hrs, Saturday, 9 February 2002

Principal Investigators

Dr Peter Harris (Chief Scientist)
Principal Research Scientist
Geoscience Australia
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Dr Michael Hughes, University of Sydney

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Dr Michael Hughes

University of Sydney

Scientific Objectives

The objectives of this cruise were to test the hypothesis that a zone of high tidal current energy across the northern margin of the Great Barrier Reef was a cross-shelf corridor of sediment movement. The methods employed involved conducting high resolution seabed mapping at strategic locations in conjunction with seabed sampling and photography to identify mobile bed sediments and depositional end-members of the transport system.

The key goals were to: collect sufficient data to verify whether such cross-shelf transport is occurring; document benthic biological communities associated with different substrate types; and collect sediment cores to extract a time series of cross-shelf terrigenous flux.

The research is of relevance to environmental managers who require knowledge of the processes governing sediment dispersal and the distribution of biota in this environmentally sensitive and economically important geographic location.

Cruise Objectives

The methods employed were swath mapping, shallow high-resolution seismic surveying, suspended sediment sampling, current metering, coring and grab sampling. Three areas were to be mapped using a high-resolution swath mapper and Chirp shallow seismic system. It was also planned to take shallow gravity cores and surface sediment grab samples, deploy the Franklin's CTD-turbidity meter, collect water samples, and deploy and underwater camera. One current meter instrument frame was deployed to measure sediment flux in Area "A".

Area "A" is located adjacent to the seaward margin of the Fly River Delta. It is a fairly flat seabed, but previous sonar surveys have indicated the presence of subtidal bedforms in the area. Hence it is an area of active bedload transport. Area "B" is located amongst the northernmost reefs of the Great Barrier, where a 100m deep submarine valley crosses the shelf. This valley is the low sea level river channel of the Fly River and it is of interest to determine whether it remains an active sediment transport conduit at the present time. Area "C" is located at the seaward terminus of the palaeo Fly River channel, and should be the locus of low sea level sediment deposition. Sonar data show this area is characterised by low sea level (drowned) reefs, Halimeda biostromes and possible gas escape features (pockmarks) on the seabed.

Cruise Track

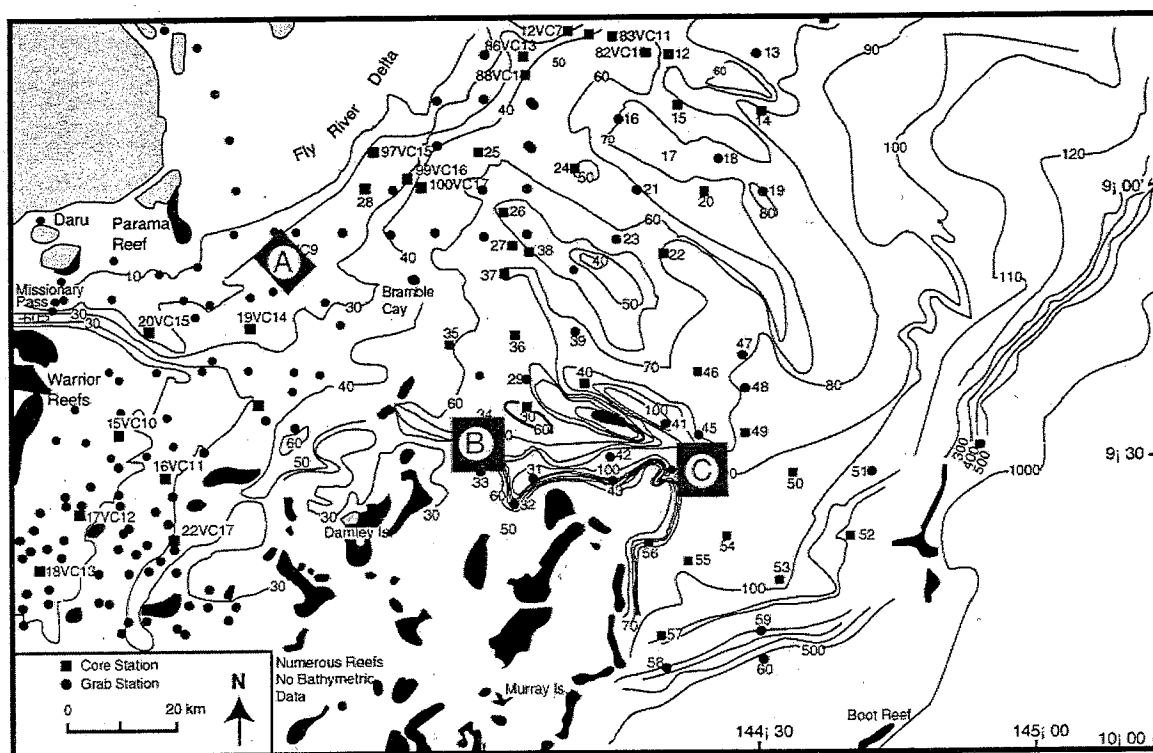


Figure 1. Location of the three study areas in the northern Great Barrier Reef region.

Results

Our instrument mooring BRUCE was successfully recovered and, after inspection, was found to have logged all data as per the program. Further results will be available once the data have been more thoroughly analyzed.

Swath mapping and Chirp sub-bottom profile data were collected along evenly spaced track lines as shown in Figures 2, 4 and 6. A total of 75 stations were occupied spread more or less evenly between the three survey areas. Station locations are listed in Appendix 1 and shown in relation to bathymetric maps in Figures 3, 5 and 7. In summary, the following samples were recovered:

- 64 Surface Grab Samples
- 64 CTD's
- 125 Filterpapers (from surface and 2m above the seabed)
- 10 Piston Cores
- 24 Gravity Cores
- 65 Underwater Video Stations
- 2 Sediment traps

None of the sample data have been analysed to date but results will be published in a Geoscience Australia record.

Cruise Narrative

Thursday 17 January.

The RV *Franklin* sailed from Cairnscross Shipyard, Brisbane, @ 1000 hrs local time. Pilot dropped at Caloundra @ 1500 hrs and ship headed north with a brisk following (southerly) breeze.

Friday 18 January.

Transit

Saturday 19 January.

The 2nd cook has injured his finger. We must detour to Cairns to take him for treatment.

Sunday 20 January.

Anchored offshore Cairns @ 1100 hrs on while 2nd Cook was taken to hospital for treatment. Underway again by 1300 hrs.

Monday 21 January.

Transit

Tuesday 22 January.

Arrived in Torres Strait and commenced work at station 1 @ 1500 hrs. Deployment of CTD, bottom video camera and grab sample were successful and the current meter frame was launched @ 1720 hrs. The probe has been named BRUCE (for Benthic Research Underwater sediment Concentration Experiment). After two sound velocity profiles were completed we commenced the swath survey @ 1900 hrs.

Wednesday, 23 January.

By 1200 hrs we had completed 13 10km survey lines. The sea conditions were excellent, quiet and calm, and the Seabat system was operating at its optimum swath width (7 times water depth). Thus we decided to increase the line spacing from 100 to 125 m. This should save us a few hours of survey time.

Thursday, 24 January.

Continue swath survey of Area "A".

Friday, 25 January.

Swath survey for Area "A" completed @1630 hrs. Proceeded to conduct a "Patch Test" (swath system calibration) before start of sampling @1900 hrs. Sea conditions remain calm.

Saturday, 26 January.

After completion of 3 stations including one piston core, an incident occurred @0015hrs when the piston core appeared to slide down the wire mid-way through deployment and come to jolting stop. Inspection of the damaged piston-core, trigger-arm assembly indicated the clamp had failed, although suspected that the winch may have spontaneously paid out wire. Coring was therefore postponed until daylight.

Sunday, 27 January.

Completed all cores and stations in Area "A" @0145 hrs. Transit to Area "B", arriving @0730 hrs. Delay to start of survey @ 1300 hrs caused by failure of air conditioning system and attendant shut-down of all computing systems.

Monday, 28 January.

Continue surveying Area "B"

Tuesday, 29 January.

Continue surveying Area "B"

Wednesday, 30 January.

Complete survey of Area "B" @ 1900 hrs and commenced sampling. After one successful gravity core was collected, the winch again spontaneously paid out wire with the gravity corer hanging just outside of the deployment cradle at the third station @2345 hrs. Coring work postponed until the winch can be made safe.

Thursday, 31 January.

CTD, camera and grab operations continued at the remaining stations. Ship's engineers and crew declared that the winch may be used again for gravity coring, but not piston coring, operations began @1100 hrs. Sea conditions calm to moderate, with morning nor-westerly winds up to about 15 knots.

Friday, 1 February.

Final gravity cores collected and station work in Area "B" completed @0430. Transit from Area "B" to Area "C" arriving @ 0900 and commenced swath survey.

Saturday, 2 February.

Swath survey of Area "C"

Sunday, 3 February.

Swath survey of Area "C" Strong to moderate nor westerly wind and moderate seas. Chirp tow fish hitting side of ship in larger waves caused the loss of seismic data on about 3 lines.

Monday, 4 February.

Complete swath survey of Area "C" and commence station work. Sampling sites chosen on the basis of the swath data recorded.

Tuesday, 5 February.

Station work completed @ 1900 hrs and swath surveys of selected targets commenced. A deeply scoured channel up to 220 m in depth has been discovered on the outer shelf, in an area marked as shoal on the AUS chart.

Wednesday, 6 February.

Swath survey and final station work completed @ 1700 hrs and transit to Area "A". Final underwater video and CTD stations completed and current meter mooring BRUCE successfully recovered @ 2200 hrs. This marks the end of the scientific work for the cruise. Depart Torres Strait headed for Cairns.

Thursday, 7 February.

Transit to Cairns. Scientific party packing up equipment, completing data entry work and downloading of moored instrument (current meter) data.

Friday, 8 February.

Transit to Cairns.

Saturday, 9 February.

Divers inspect hull for routine maintenance at Fitzroy Island, 0600 to 0800 hrs. Arrive Cairns @ 1100 hrs.

Summary

The RV *Franklin* sailed from Cairnscross Shipyard, Brisbane on 17-1-02 and returned to Cairns on 9-2-02. All equipment functioned properly, apart from the main winch that was barely functional at times and which caused considerable anxiety for the crew, who were understandably concerned for its operational safety. It is clear that a major overhaul of the winch and its hydraulics system are urgently needed before it is next sent to sea. On all other fronts, however, the weather, working conditions, personnel morale etc. there were no difficulties whatsoever and it was overall a very productive and positive experience for all.

From a scientific perspective, the cruise was a tremendous success. All our equipment worked smoothly and the instrument mooring was recovered safely and found to have functioned properly. All sampling stations and survey targets were met (and exceeded). The cruise discovered that a zone of strong tidal currents at the northern end of the Great Barrier Reef prevents the southward advance of sediment derived from Papua New Guinea's rivers that would otherwise bury the coral reefs. The Fly River, located in close proximity to the northern end of the Great Barrier Reef, discharges about 120 million tonnes/yr of sediment, equal to more than that all of Australia's rivers combined. This sediment does not penetrate as far south into the reef area as might be expected, because southward prograding deposits are eroded by tidal currents.

Swath sonar mapping and underwater video equipment was used to map a series of channels up to 220 m deep that extend for more than 80km from eastern Torres Strait across the northern end of the Great Barrier Reef. It appears that there are two sorts of channels - those in the north are clearly relict fluvial channels, exhibiting lateral accretion surfaces and incised channels that intersect and truncate underlying strata. Over-deepened channels in the south,

however, appear to have formed by tidal current scour. They exhibit closed bathymetric contours at both ends and are floored with well sorted carbonate gravelly sand. Oceanographic observations indicate that the channels provide a conduit onto the shelf for cool and saline (and nutrient-rich?) upwelled Coral Sea water. The deepest channels form isolated depressions, and possibly were the sites of lakes during the last ice age, when Torres Strait formed a land-bridge between Australia and Papua New Guinea.

Scientific Personnel

Peter Harris ¹	Geoscience Australia	Cruise Leader
Michael Hughes ⁴	Sydney University	Co-Cruise Leader
Andrew Heap ²	Geoscience Australia	Sedimentologist
Vicki Passlow ³	Geoscience Australia	Sedimentologist
Rick Smith ¹	Geoscience Australia	Computing & GIS
Jon Stratton ³	Geoscience Australia	Science Technician
Lyndon O'Grady ³	Geoscience Australia	Science Technician
Kevin Hooper ⁵	James Cook University	Geophysical Technician
Rob Beaman ⁶	University of Tasmania	PhD Student
Mark Hemer ⁷	University of Tasmania	PhD Student
Eric Madsen ⁸	CSIRO DMR	Science Technician
Bernie Heaney ³	CSIRO DMR	Science Technician

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3. Geoscience Australia, Petroleum and Marine Division, GPO Box 378, Canberra, ACT 2601
4. School of Geosciences, University of Sydney, Sydney NSW 2006, Australia
5. School of Earth Sciences, James Cook University of North Queensland, Townsville Qld.
6. School of Geography and Environmental Studies, University of Tasmania, GPO Box 252-80, Hobart TAS 7001
7. Antarctic CRC, University of Tasmania, GPO Box 252-80, Hobart TAS 7001
8. CSIRO Division of Marine Research, GPO Box 1538, Hobart TAS 7001

Ships' Crew

Ian Taylor	Master
Arthur Staron	Chief Officer
John Boyes	Second Officer
Gordon Gore	Chief Engineer
Greg Pearce	First Engineer
Paul Dickson	Second Engineer
Malcolm McDougall	Bosun
Louis Jacomos	IR
Graham McDougall	IR
Tony Hearne	IR
Phillip French	Greaser
Shaun McQuaid	Chief Steward
Peter Williams	Chief Cook
Aung Zin	Second Cook

Acknowledgements

Thanks to the National Facility Steering Committee for making the ship time available and to Geoscience Australia for logistical and financial support. Thanks also to captain Ian Taylor, the ships crew and to the CSIRO support personnel for making the voyage a pleasant experience and a successful scientific operation. This cruise is also listed as Geoscience Australia cruise 234.

Peter T. Harris
Chief Scientist.

Figures

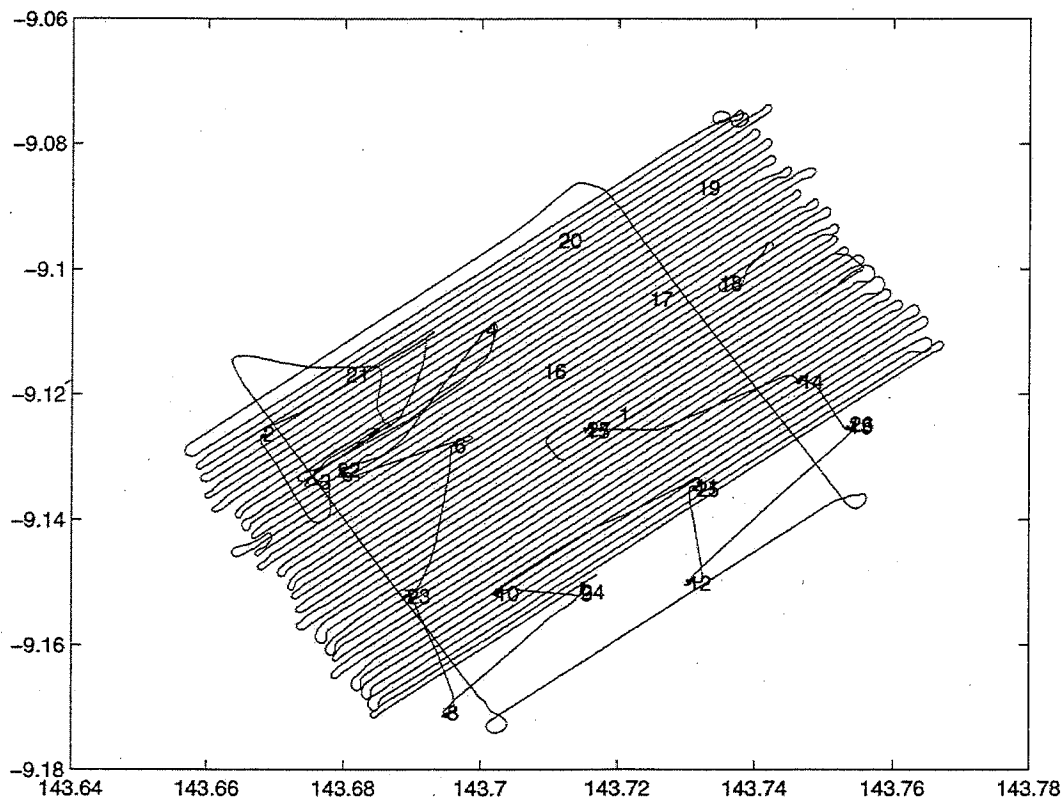


Figure 2. Survey track lines completed in Area "A", adjacent to the Fly River Delta.

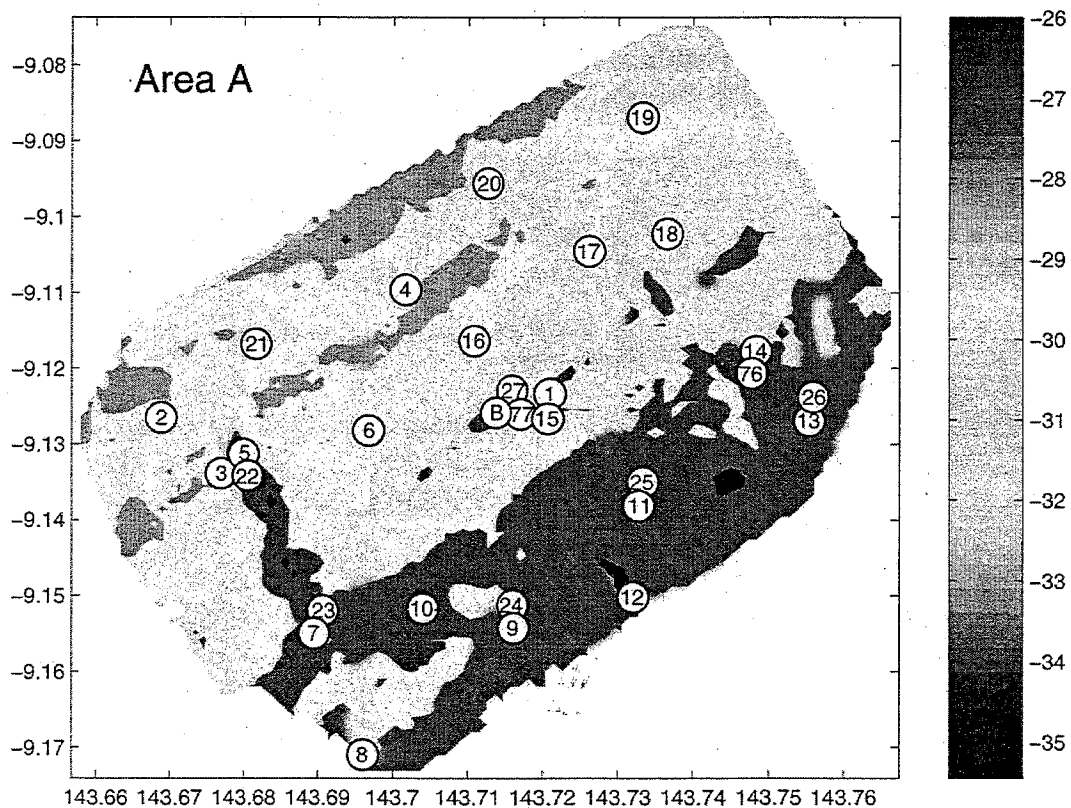


Figure 3. Location of stations occupied in Area "A" in relation to regional bathymetry.

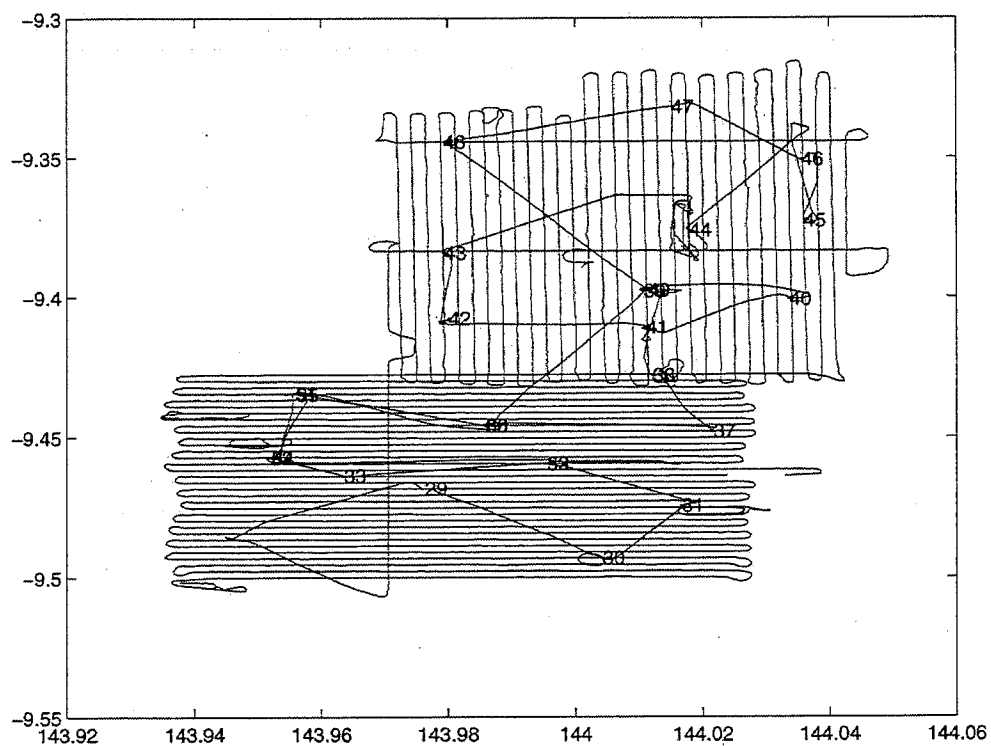


Figure 4. Survey track lines completed in Area "B", on the middle part of the Torres Strait shelf, north of Darnley Island.

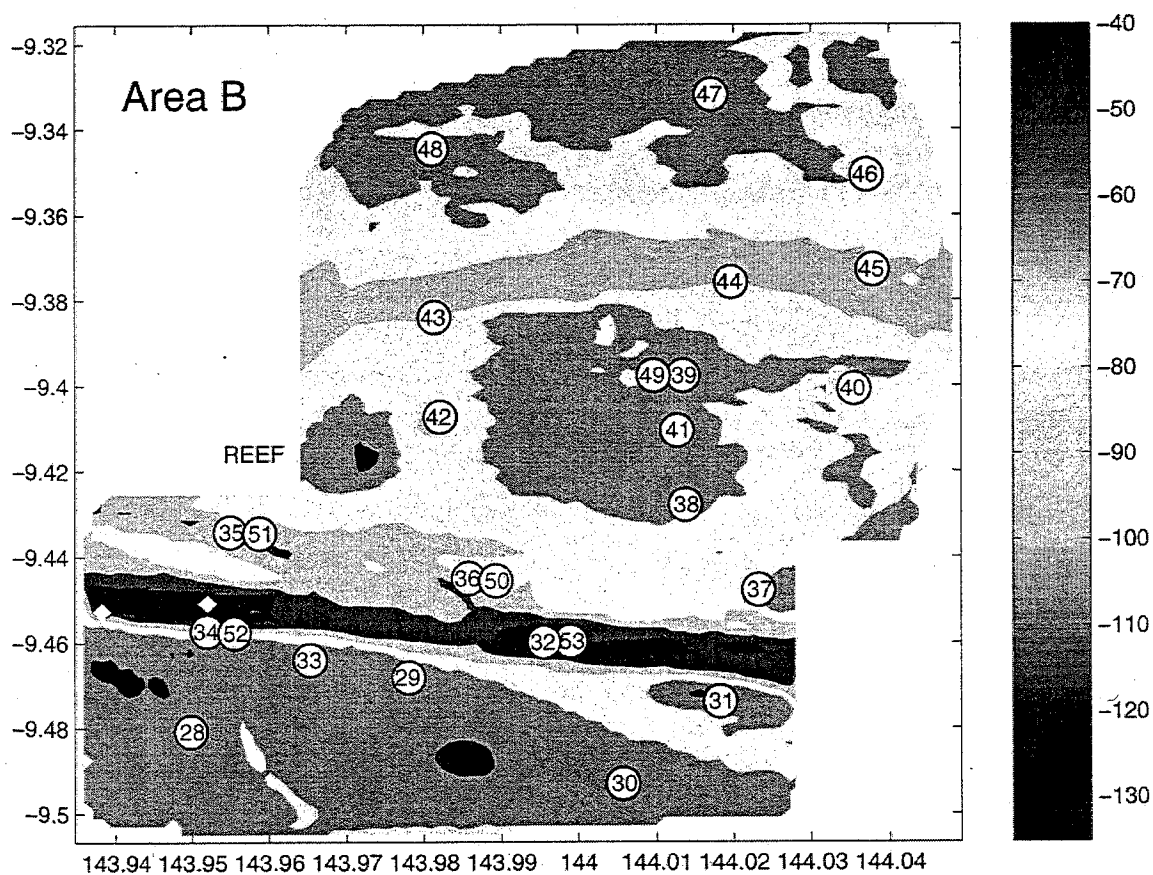


Figure 5. Location of stations occupied in Area "B" in relation to regional bathymetry.

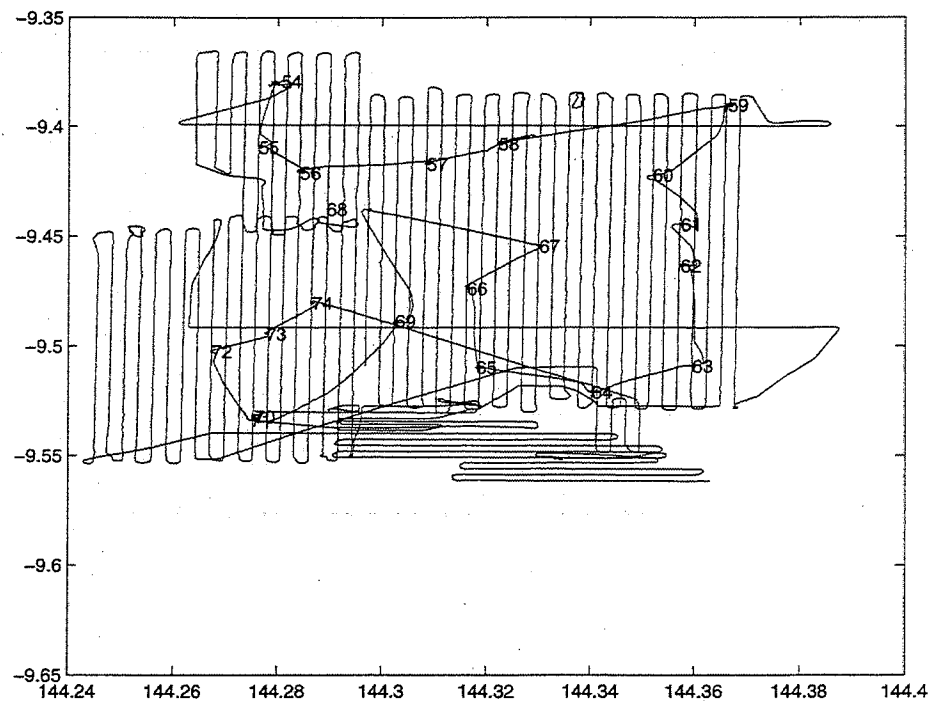


Figure 6. Survey track lines completed in Area "C", outer shelf of the Gulf of Papua, adjacent to East Cay.

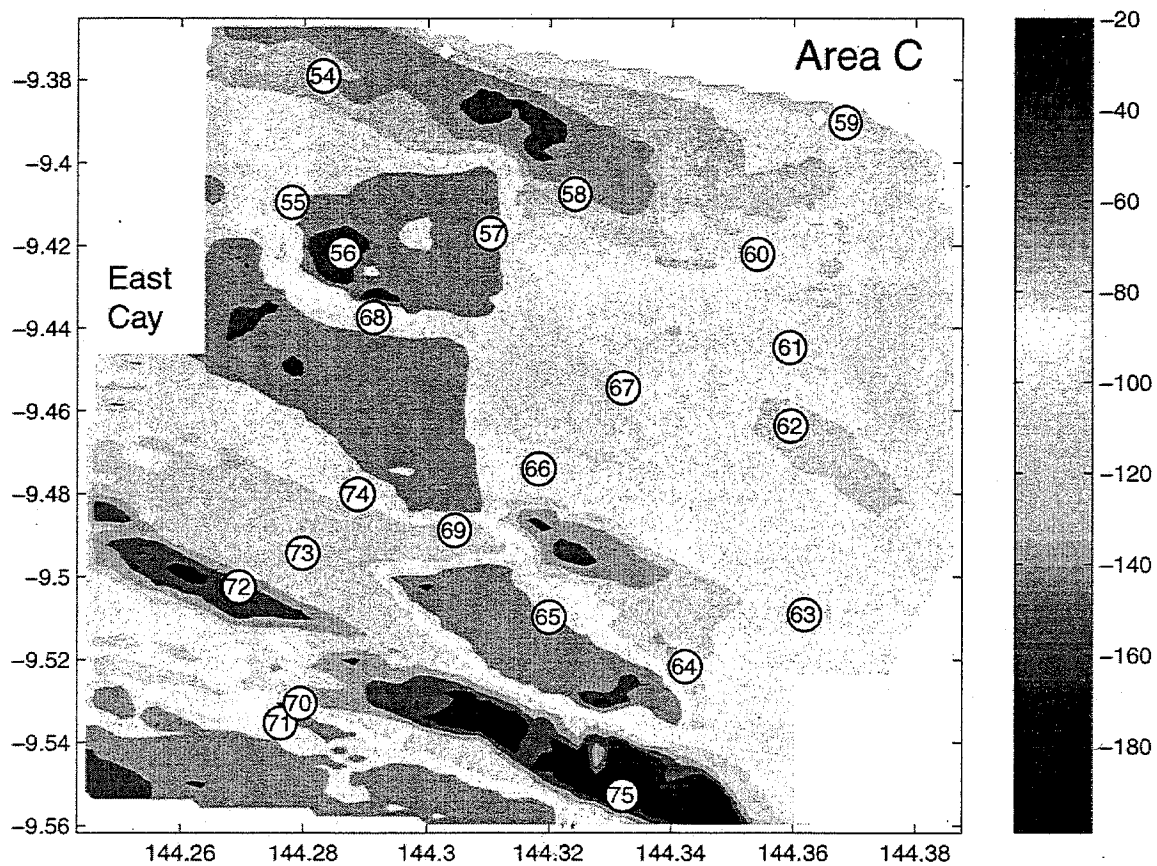


Figure 7. Location of stations occupied in Area "C" in relation to regional bathymetry.