

**MARINE**  
**NATIONAL FACILITY**

# 2005 RV Southern Surveyor program

voyageplan

SS04/2005

Gulf of Carpentaria submerged reefs and benthic habitats.

### **Itinerary**

Depart Weipa 1000hrs, Tuesday 22 March 2005

Arrive Darwin 1000hrs, Wednesday 13 April 2005

### **Principal Investigator**

Dr. Peter T. Harris (Chief Scientist) – Group Leader, Marine and Coastal Environment Group, Geoscience Australia, GPO Box 378, Canberra ACT 2601

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## Scientific Objectives

The discovery of three large patch reefs in the southern Gulf of Carpentaria during GA Survey 238 (SS03/2004) points to the possibility of widespread reef occurrence in that region. The reefal limestone platforms discovered on Survey 238 were located east of Mornington island and appear to have been formed when sea level was ~30 m below its present position. The submerged platforms support live hard corals in many locations. Existing bathymetric and fisheries-derived data indicates the wide distribution of hard-bottom habitats known as "untrawable grounds" in several other locations of potential reef growth. However, the sub-surface composition of the reefs (coral versus other carbonate types) was not determined by the surface sediment sampling work carried out. These areas in the southern Gulf clearly warrant further investigation.

The aim of this voyage is to assess and verify that reef growth is occurring (or has occurred in the past) at other locations in the Gulf of Carpentaria and to determine the extent and variation within and among benthic habitats. The voyage will assess the past and present environmental conditions associated with reef growth and sample the sub-surface composition of the reefs by obtaining drill core samples. In particular, representative sections of a 100km long submerged bathymetric platform, that extends westward from Mornington Island, will be surveyed. A key objective of the cruise is to investigate the nature, distribution, abundance, and stability of benthic habitats, in relation to key extant and paleo-environments in the southern Gulf of Carpentaria. If coral reefs are found to be widespread in the southern Gulf of Carpentaria, their existence will need to be included in the development of environmental plans and fisheries management goals for the region.

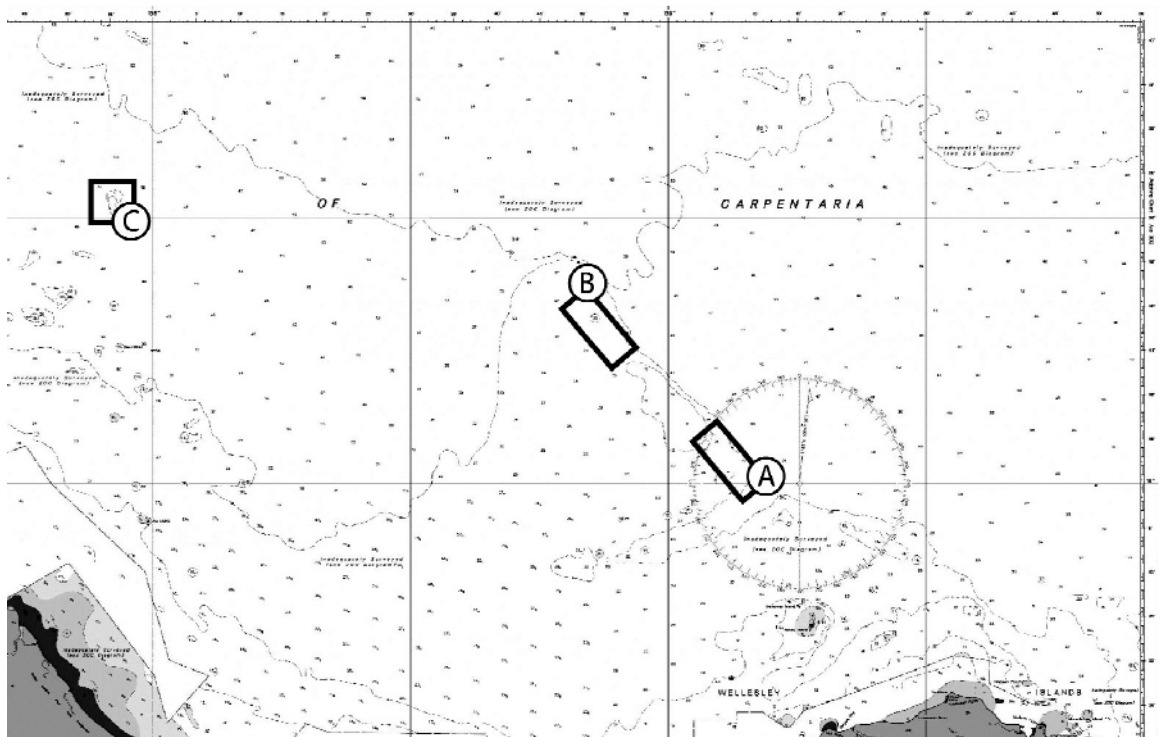
## Voyage Objectives

The hypothesis we are testing is that "the growth of coral reefs has been widespread in the Gulf of Carpentaria throughout the late Quaternary, particularly when sea level was around 30 m below its present position, resulting in numerous submerged catch-up reefs in the southern Gulf". The two main objectives of the proposed cruise are to: (A) to identify and characterise rocky reef-type substrates, and their associated biological communities in the southern Gulf; and (B) to sample and date relict reefal sediments to attempt to provide more accurate indicators of past sea levels and their time of occurrence. Four secondary objectives will be: (C) to determine the reefal extent according depth strata and their inter and intra biotic variations, (D) to collect information on the physical oceanographic environment, such as currents, water temperature, salinity, and suspended sediment concentrations; (E) collect seismic and sediment core data from deposits adjacent to the rocky substrate areas to document late Quaternary sedimentation and environmental changes; and (F) to determine the origins of carbon and nitrogen supplying the coastal benthic and pelagic food web using natural abundance stable isotopes.

## Voyage Track

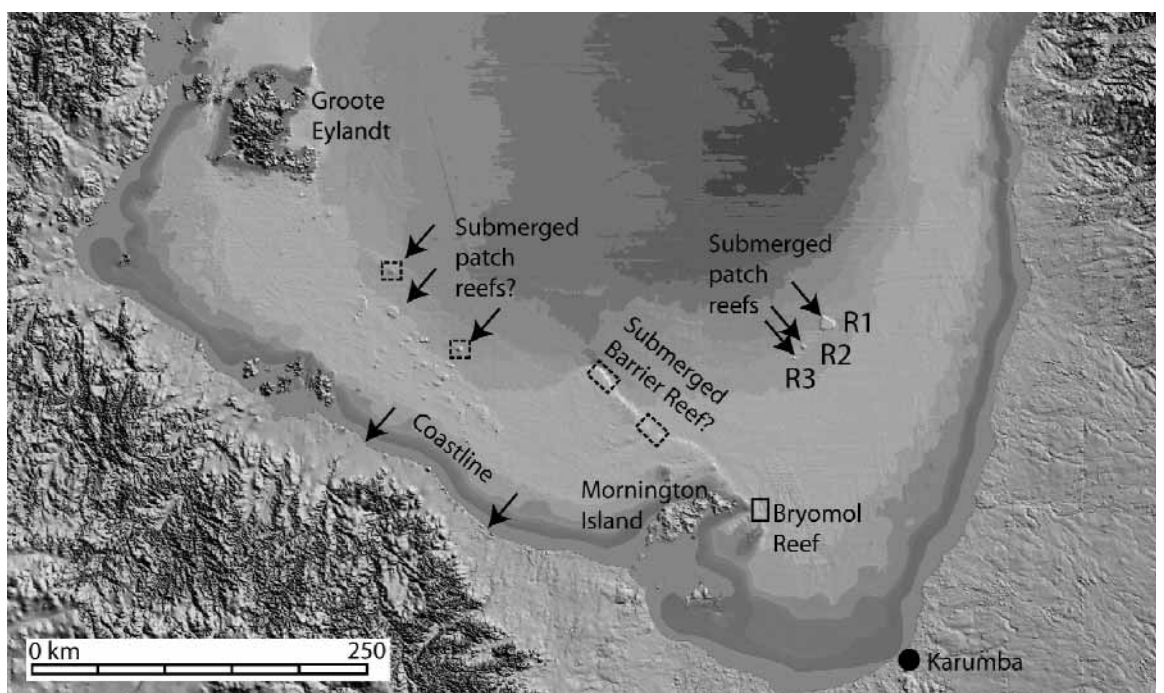
This voyage will form part of a two-voyage strategy.

Physical and geological data collected during our voyage will supplement stations where more detailed biological and bio-geo-chemical sampling was conducted on the previous voyage run by CSIRO CMR. This second voyage will depart from Weipa after a science party change-over. It will operate mainly within the same areas sampled by the CSIRO team on the previous voyage. The proposed voyage area (Fig. 1) calls for reef drilling, coupled with high density swath mapping voyages and limited seabed sampling at three locations.



**Figure 1.** Part of AUS Chart 304 showing locations of proposed work area in the southern Gulf of Carpentaria region. Positions of Stations and survey grid centre points are given in Table 1.

The first operation will be drilling on top of patch reef R1 (Fig. 2 A). Allowing 6 hours for the first drilling operation and 4 hours for subsequent drill stations, we will spend approximately 1.5 days on reefs R1, R2 and R3.



**Figure 2 (A):** Location of reefal limestone features (Bryomol Ref and Submerged patch reefs R1, R2 and R3) mapped in the southern Gulf of Carpentaria during cruise 0304 (shown as solid boxes). The bathymetry also reveals the presence of what might be a submerged (relict) barrier reef and additional submerged platforms (submerged patch reefs?). Proposed survey areas for the present study are shown as dashed boxes. The high-relief, rocky areas correspond closely with the distribution of untrawlable grounds in the Gulf derived from plotter records of Northern Prawn Fishery trawlers (Die et al. 1995).

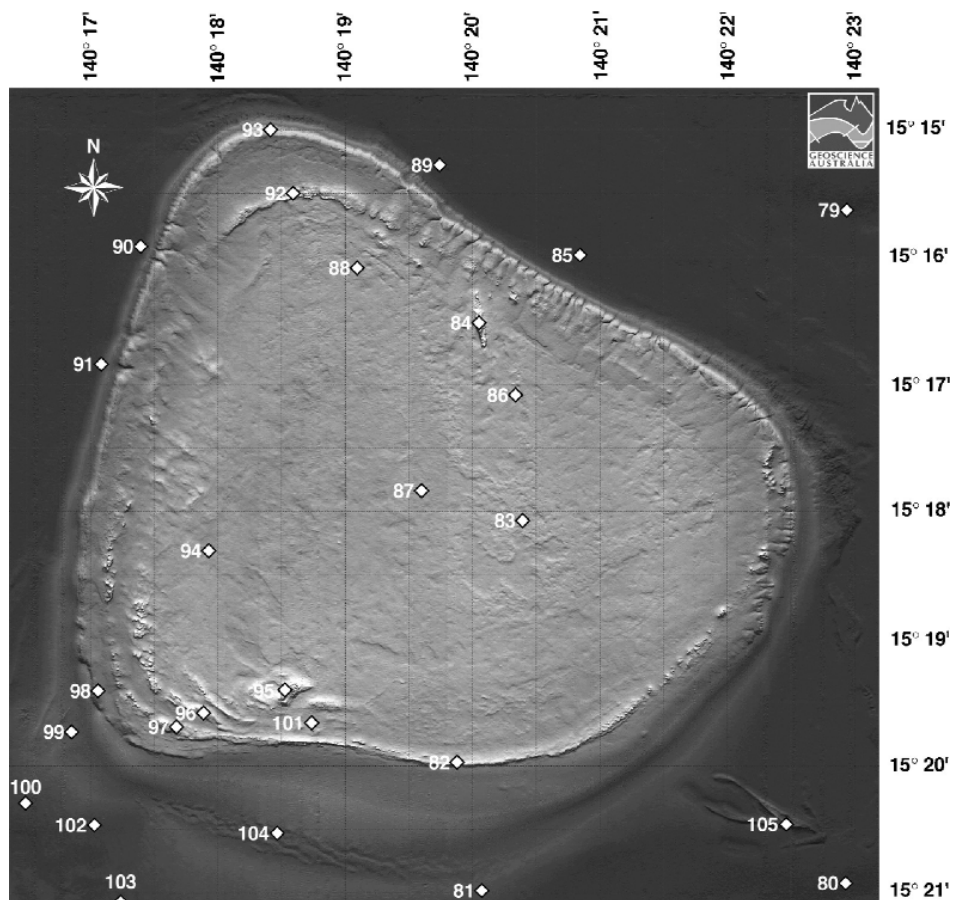
Area A (Barrier reef passage) survey will cover a tidal pass in which a current meter frame will be deployed during the CSIRO voyage. Area B (Reef Front) and Area C (patch reef) have been selected from existing bathymetry data (AUS 304) and mapping together with drilling and sampling will verify their reefal origins. Indicative centre-point coordinates for the 3 survey areas are given in Table 1.

In Area A (reef passage) the swath mapping survey will include about 100, 18 km length (= 970 miles), equally spaced survey lines to give 100% sonar coverage. Survey speed is 8 knots, making a total of 5 days survey time for this area. Sampling and drilling work at 9 stations in this area will require an additional 36 hours (1.5 days). Four hours per station is needed for deployment of equipment (vibrocoring/drill, grab, camera, benthic sled and CTD) and to allow extra time to reposition the ship between stations.

In Area B (reef front) the swath mapping survey will include about 100, 18 km length (= 970 miles), equally spaced survey lines to give 100% sonar coverage. Survey speed is 8 knots, making a total of 5 days survey time for this area. Sampling and drilling work (same equipment as at Area A) at 9 stations in this area will require an additional 36 hours (1.5 days).

In Area C (small patch reef) swath mapping surveys will include about 90, 10 km length (= 490 miles), equally spaced survey lines to give 100% sonar coverage. Survey speed is 8 knots, making a total of 2.5 days survey time. Sampling work at 4 stations will require an additional 16 hours (3 days), allowing 4 hours per station for deployment of equipment (same equipment as at Areas A and B).

A further 12 hours is needed for recovery of current meter in Area A and 60 miles @ 10 knots transit time between survey areas C and A.



**Figure 2 (B):** Bathymetry image from swath surveys completed on cruise SS-0304 showing morphology of submerged platform reef R1 and station locations from GA survey 238. Dark tones (eg. position of Stns 79 and 80) are about 45m depth and light tones (eg. Stns 84 and 87) are 20-30 m depth.

### **Time Estimates**

Transit from Weipa to Reef R1 = 0.5 days

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Drill Reef R1, transit to Area A and deploy current meters = 1.5 days

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Swath Survey and 12 Stations, Area A, Time subtotal = 6.5 days

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Swath Survey and 5 Stations, Area B, Time subtotal = 6.5 days

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Swath Survey and 5 Stations, Area C, Time subtotal = 5 days

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Transit to Darwin = 2.5 days

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Total time for voyage = 0.5 + 1.5 + 6.5 + 6.5 + 5 + 2.5

**TOTAL TIME FOR VOYAGE = 22.5 days**

### ***Southern Surveyor* Equipment**

Standard equipment and winches

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Milli-Q water (approx. 1L per CTD station or 30L over voyage)

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CTD with transmissometer, PAR & 4 \* 2.5L Niskin bottles.

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Smith-Macintyre Grab sampler

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Ship's swath sonar system

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### **User Equipment**

Deployment of BRUCE instrumented frame (LISST laser particle sizer, Seabird CTD, Nortek acoustic current meter plus two OBS sensors).

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Acoustic Doppler CM

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Electric-powered hydraulic drill

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Corer deployment system, Vibrocorer with 6m aluminium tower

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Bottom video camera system with armoured cable & winch

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Chirp acoustic profiling (towed system)

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Sparker seismic profiling (towed system)

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JCU Reson swath bathymetry system mounted on ADCP trolley

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*Note: It is intended to load as much SS04 equipment onboard as possible prior to vessel leaving Cairns for SS03.*

## Personnel List

Dr. Peter Harris (GA) – Chief Scientist, core site selection, sedimentology, swath sonar/Chirper interpretation

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Dr Andrew Heap (GA) – Deputy Chief Scientist, sedimentology, core site selection

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Alison Hancock (GA) – Sample logging and database support

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Dr. Mark Hemer (GA) – Oceanography, current meter deployment, computer support

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Ted Wassenberg (CSIRO) – biological sampling and camera station work

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TBA (CSIRO) – biological sampling and camera station work

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James Daniell (GA) – Computer support; swath data processing

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Kevin Hooper (JCU) – swath data acquisition

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Cameron Buchanan (GA) – Computer support; swath data processing

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Andrew Hislop (GA) – Mechanical technician (sediment sampling, drill/core operation)

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Craig Wintle (GA) – Mechanical technician (sediment sampling, drill/core operation)

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Jack Pittar (GA) – Electronics technician (Sparker-Chirper, bottom camera operations)

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Jon Stratton (GA) – Science Technician (sediment sampling, drill/core operation)

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Hiski Kippo (CSIRO) – Computing Support

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Stephen Thomas (CSIRO) – Electronics Support, Voyage Manager

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This voyage plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel *Southern Surveyor*.

### **Dr. Peter T. Harris**

*Chief Scientist*

**Table 1. Station and survey area coordinates.**

<b>Station Number</b>	<b>Latitude (S)</b>	<b>Longitude (E)</b>	<b>Target</b>
Drill Sites (Reef R1):			
RD-1	15° 17.75	140° 19.5	Reef Centre
RD-2	15° 16.5	140° 20.1	North Peak
RD-3	15° 15.15	140° 18.5	NW Outer Reef edge
RD-4	15° 19.4	140° 18.6	SW Peak
RD-5	15° 19.25	140° 17.45	SW Reef Ridge
RD-6	15° 57.5	139° 04.5	SE Reef Rim
Current Meter Deployment Sites (Submerged Barrier Reef passage):			
CM Area A	16° 01	139° 09	
CM Area A	15° 42	138° 52	
Swath Survey area centre points:			
Area A	15° 57.5	139° 04.5	
Area B	15° 43	138° 53	
Area C	15° 28	137° 55.5	