



voyageplan

SS06-2008

2008

RV Southern Surveyor

program

Morphology and Chronostratigraphy of fossil reefs around Lord Howe Island

Itinerary

Mobilise Sydney 0800hrs, Tuesday 15 April, 2008

Depart Sydney 1000hrs, Wednesday 16 April, 2008

Arrive Noumea 0800hrs, Tuesday 29 April, 2008

Demobilising arrangements TBA after equipment and sample storage plans are assessed. Request to leave all gear and samples onboard until Cairns and demobilise Tuesday 15 July 2008.

Principal Investigators

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Scientific Objectives

The Lord Howe Island Marine Park is a unique example of a seamount ecosystem in the Tasman Sea, and this project aims to extend habitat and sedimentological surveys of this important area. The data collected in this survey will form a key seamount dataset for the Commonwealth Environmental Research Facilities (CERF) Marine Biodiversity Research Hub that is investigating the utility of seabed biophysical data for the prediction of patterns of marine biodiversity in the Australian marine jurisdiction.

Coral reefs appear particularly sensitive to climate change. The modern fringing reefs around Lord Howe Island are the southernmost in the Pacific Ocean, but preliminary investigations have indicated that there is an extensive system of fossil reefs on the shelf around Lord Howe Island. This voyage aims to investigate the extent of these reefs and collect samples for dating and geochemical analysis in order to understand when, and under what conditions, these reefs flourished. The record of coral growth at this critical latitudinal limit to reef development will provide essential information on how reefs have responded to past climate in the Tasman Sea and provide valuable insights into how marginal reefs may respond to global warming.

Understanding the history of this reef complex is an important part of the palaeoclimatology of this part of the Tasman Sea, which, with such limited land, has few other locations for palaeoenvironmental analysis. It will provide invaluable data on the history of reef development and the environmental conditions under which former reefs flourished. We will undertake a detailed benthic survey of a little known part of the Lord Howe Marine Park, and assess the substrate, including that which would be available for further extension of reefs, or reef-related biodiversity, under future climatic conditions. Given the remoteness of the Lord Howe reefs from other reef complexes (GBR) the fossil reef may have served as the seedstock for the present reef system. Also, any living corals on the submerged reef may be refugia for corals in a greenhouse warmed earth.

Preliminary results from a research voyage on RV Franklin in 1998 indicate that there is a Pleistocene fossil reef on the mid-shelf around most of Lord Howe Island, and that in places this contains remains of a more recent 'give-up' reef that ceased growth in early Holocene. Water depths and ages of these reefs appear comparable with those recently recorded for fossil reefs in the southern Gulf of Carpentaria, and the results of this voyage are intended to complement and extend the sea-level and palaeoenvironmental reconstructions from these, and other, sites.

Voyage Objectives

This research aims to extend our understanding of seamount habitats in the Tasman Sea, specifically mapping the bathymetry and substrate of environments around Lord Howe Island and Balls Pyramid.

The overall voyage objectives are [priority]:

- to undertake substrate and benthic habitat mapping of the marine park [1]
- to map the extent of the fossil reef around Lord Howe Island [1]
- to look for a comparable feature on the smaller Balls Pyramid platform [2]
- to determine reef morphology in detail using swath mapping [1]
- to explore stratigraphy by sub-bottom profiling and shallow core recovery [1]
- to sample adjacent sedimentary environments by grab sampling or piston coring [2]
- to recover dredge and sled samples from shelf-margin sites [2]
- to recover and redeploy ADCP at 31°24.000 S, 159°04.870 E (57m depth) [1]

Data to be collected include:

1. SWATH bathymetry and backscatter (30 kHz/300 kHz),
2. Shallow (<100 m) sub-bottom profiles (0.5 - 3.5 kHz),
3. Water conductivity, temperature, depth, surface current speed and direction,
4. Underwater video footage,
5. Seabed sediment samples, dredge and core.
6. Benthic sampling, epibenthic sled

Voyage Track

The voyage track involves a leg from Sydney to Lord Howe Island (418 nm, estimated 38 hours, 16-18 April 2008), approx 9 days survey around Lord Howe Island and Balls Pyramid (operating between 31°S and 32°S, 158°E and 160°E), and final leg Lord Howe Island to Noumea (681 nm, estimated 62 hours, 26-29 April 2008). The track is shown in Figure 1.

Time Estimates

Table 1. Estimate of time for transit and surveys during SSO6/2008

Activity	Region	Distance	Time	Date
Transit	Sydney – Lord Howe Island	418 nm	38 hrs	16-18 April
Swath/core/sample	Lord Howe Island		c 9 days	18-26 April
Transit	Lord Howe Island – Noumea	681 nm	62 hrs	26-29 April

Weather conditions are anticipated to limit the times at which rotary coring can be undertaken on the fossil reef in around 30 m water depth around Lord Howe Island. Swath mapping, sub-bottom profiling, grab sampling and dredging will be undertaken when conditions are unfavourable for coring. The general location of fossil reef is shown in Figure 2, based on a collation of existing bathymetric data. Preliminary sites for more detailed analysis are indicated, but precise locations for sampling will be determined on the basis of the swath mapping.

Southern Surveyor Equipment

- Communications – voice, fax and data
- Navigation – archiving of underway data including time, ship position, bathymetry
- Meteorological data – air temperature, humidity
- Oceanographic data – underway logging of sea surface temperature and salinity
- DP – dynamic positioning
- Seapath Seatex 200 – for heading pitch and roll
- Simrad EK500 sounder (12, 38, 120 kHz)
- General computing facilities and marine charting software
- Smith Macintyre grab sampler (x 2)
- Rock dredge (x 2)
- CTD (seabird SBE 911 plus)
- Rosette (24 x 10 litre Niskin bottles)
- Mill-Q water supply
- Small epibenthic sled
- General purpose laboratory
- Swath deployment (EM300)
- Topas Sub-Bottom Profiler (SBP)
- ADCP (available if EM3002 not deployed)
- Controlled temperature laboratory (3-5°C)
- Fish laboratory/geoscience laboratory/sorting room
- Walk in freezer (storage of frozen benthic samples)
- CTD, Trawl and coring winches, and sensors to measure: tension, winch speed and wire-out for CTD, trawl and coring winches
- Stern A frame and 7 tonne knuckleboom crane

User Equipment

- Sparker system, CSP-D1200
- Smith Macintyre grab (spare)
- DUC II video camera system with laptop and video editing software (and/or shallow-water video camera system, subject to availability/need)
- Shallow-water Swath deployment (EM3002) (subject to availability/need)
- Submersible rotary coring rig
- Rock dredges (x2)
- Diamantina dredge
- Gravity / piston coring system

Refer Figure 3 for deck equipment weight and layout plan.

Personnel List

Scientific participants, their affiliation and position on the voyage.

Prof Colin Woodroffe	SEES, UOW	Chief Scientist
Assoc-Prof Brian Jones	SEES, UOW	Senior Scientist
Dr David Kennedy	VU, Wellington, NZ	Geologist
Javier Leon	SEES, UOW	PhD student, geospatial
Dr Brendan Brooke	GA	Deputy Chief Scientist
Dr Matt McArthur	GA	Benthic Ecologist
Cameron Buchanan	GA	Swath Technician
Andrew Hislop	GA	Mechanical Technician
Gareth Crooke	GA	Mechanical Technician
Jack Pittar	GA	Electronics Technician
Franz Villagran	GA	Electronics Technician
John Jaycock	GA	Science Technician
Ron Plaschke *	CMAR, MNF	Voyage Manager and Ops. supp
Lindsay MacDonald *	CMAR, MNF	Electronics Support
Lindsay Pender *	CMAR, MNF	Computing Support

*In accordance with AMSA requirements for additional 3 berths on *Southern Surveyor*, the following personnel are designated system support technicians:

Ron Plaschke	AMSA Certificate of Safety Training AS02925
Lindsay MacDonald	AMSA Certificate of Safety Training AS04157
Lindsay Pender	AMSA Certificate of Safety Training AS02763

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

Colin D. Woodroffe
Chief Scientist



Figure 1: Voyage track, generalised, for transit Sydney to Lord Howe Island, and Lord Howe Island to Noumea

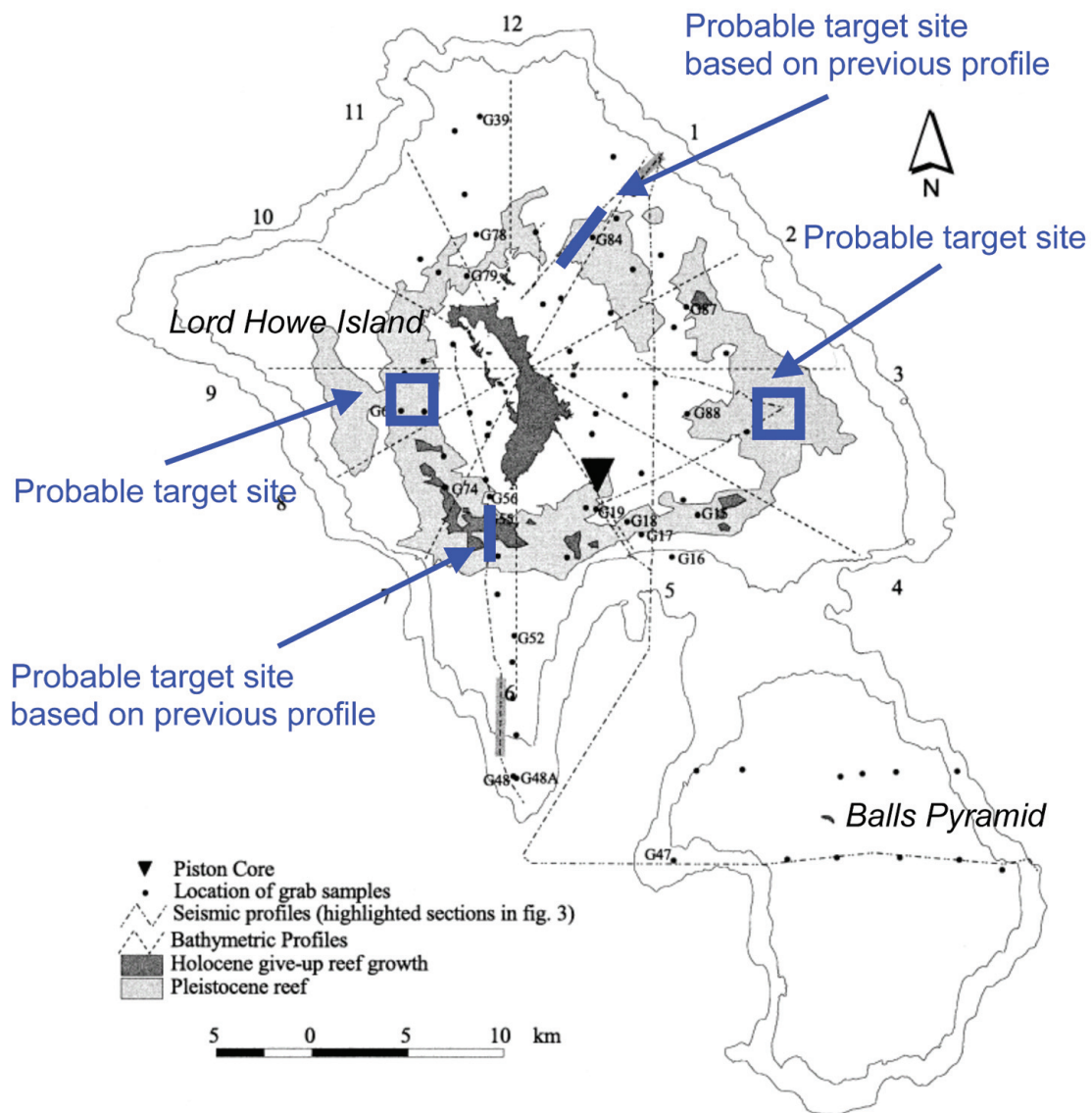
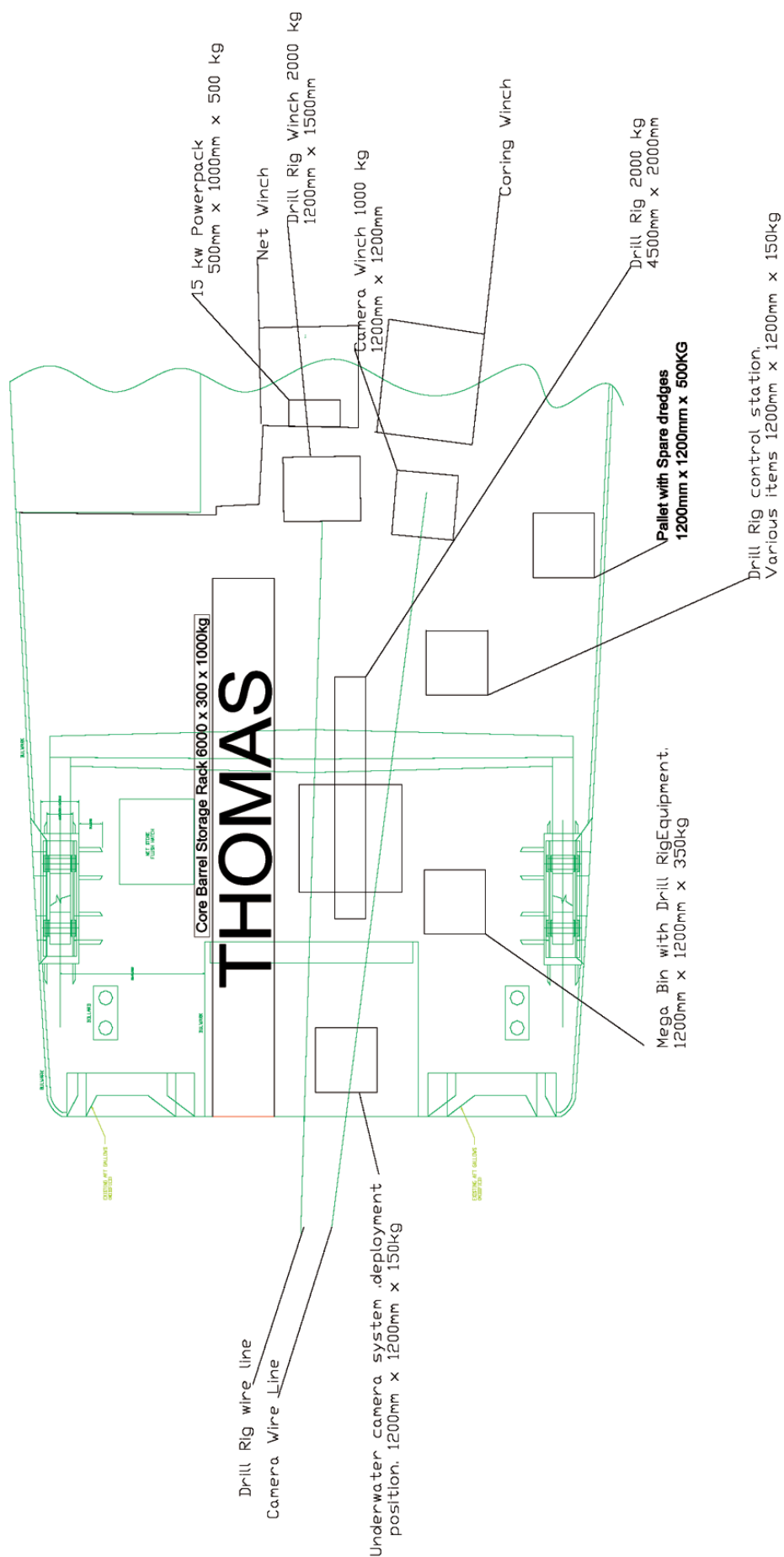


Figure 2: Preliminary location of Pleistocene and give-up Holocene reefs, and former sampling sites from 1998 voyage, with potential sites for attempted rotary coring indicated



PLAN VIEW

Deck Layout Survey SS04/2008 Pro Colin Woodroffe

Figure 3: Proposed aft deck layout for SS06/2008