Australia's Marine National Facility

CSIRO

VOYAGE PLAN SS2013_V02

Carbonate sedimentation at the southern margin of reef growth in the Tasman Sea

Itinerary

Mobilise Brisbane 0800hrs, Thursday 7 February 2013

Depart Brisbane 1000hrs, Friday 8 February 2013

Arrive Sydney 0800hrs, Monday 25 February 2013 and demobilise

Principal Investigators

Professor Colin D. Woodroffe

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Other Principal Investigators

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Scientific Objectives

This research aims to determine the extent and composition of carbonate environments on and around volcanic edifices in the northern Tasman Sea. We plan to undertake the following investigations, listed in order of priority:

1. Examine the bathymetry and sedimentary environments across the shelf around Balls Pyramid, the remnant of a volcanic island just south of Lord Howe Island, from which such data are presently lacking; this will provide a basis for a more complete mapping of benthic habitats in the Lord Howe Marine Park.
2. Establish, using underwater towed video, whether a relict reef exists on the Balls Pyramid platform; this will confirm preliminary evidence that there may be a feature similar to the fossil reef on the shelf around Lord Howe, and would make it the southernmost known reef in the Pacific. Extend towed video to map major habitats of the Lord Howe Island Marine Park.
3. Extract rock cores from the Lord Howe relict reef (and that on the Balls platform, if found) providing material for component, age and geochemical determinations that will yield further insights into sea-level and climate (including palaeotemperature) history.
4. Collect vibrocores from the inner shelf on the Lord Howe shelf (and on the Balls platform if suitable areas are identified), in the lee of the relict reef, to determine the stratigraphy, source and depositional history of sequences of sediment revealed on Topas sub-bottom profiles and which appear to contain generations of 'lagoonal' sediment perhaps indicating that earlier reef features predated, and may underlie, the relict reef.
5. Undertake preliminary bathymetry transects and Topas sub-bottom profiles across the margin of Middleton and Elizabeth Reefs on the transit voyage to Lord Howe Island as a pilot study to better plan further data collection around these reefs in 2014.
6. Determine whether terraces identified on the shelf edge contain evidence of earlier episodes of reef development or are cut into basalt; this will provide evidence of sea level, clarifying the nature of the shoreline when the sea was at these heights (60-70m water depth), and would extend known distribution of pre-Holocene reef if shown to be biogenic features.
7. Examine slump features around both volcanic edifices to clarify their extent, and the nature and composition of sediment that covers them; this will clarify the post-eruptive history of the volcanic islands, and show the degree to which carbonate sediment from the shelf or hemipelagic sediment veneers their margins.
8. Resolve the morphology of the toe of the volcanoes, and collect mulitbeam sonar data on one or more of the small seamounts that have been detected adjacent to the Lord Howe volcano; this will clarify the nature of sediments and sedimentary deposits at the toe, and provide insights into the origin and benthic habitats of previously unknown seamounts.
9. Deploy sea-surface drifters to track ocean currents along the eastern margin of Australia. Drifters are expendable (not recovered) and can be deployed while underway.

Voyage Objectives

This research aims to extend our understanding of shallow benthic habitats in the Tasman Sea, specifically mapping the bathymetry and substrate of environments around Lord Howe Island and Balls Pyramid. Reconnaissance survey will be undertaken at Middelton and Elizabeth Reefs, en route to Lord Howe Island, in preparation for a voyage on RV Investigator during its commissioning year to these reefs.

The overall voyage objectives are:

- to undertake substrate sampling across shelves around Lord Howe and Balls Pyramid
- to undertake benthic habitat mapping using underwater video in the LHI marine park
- to map the extent of and sample the fossil reef around the Balls Pyramid platform
- to undertake further mapping and sampling of the fossil reef around Lord Howe Island
- to determine reef morphology in detail using swath mapping
- to explore stratigraphy by sub-bottom profiling and shallow core recovery
- to sample adjacent sedimentary environments by grab sampling or Vibrocoring
- to recover dredge samples from shelf-margin sites
- deploy five ocean drifters during transits (x2) and in the vicinity of Lord Howe and Balls Pyramid (x3)

Data to be collected include:

1. SWATH bathymetry and backscatter (30 kHz),
2. Shallow (<100 m) sub-bottom profiles Topas 18
3. Underwater video footage,
4. Seabed sediment samples, rock dredge, rotary cores and vibrocores.
5. Water conductivity, temperature, depth, surface current speed and direction,

Voyage Track

The voyage track involves a leg from Brisbane to Middleton Reef (343 nm, estimated 32 hours, 8-9 Feb, reconnaissance survey of Middleton, and Elizabeth Reef (37 nm south, estimated 4 hours transit, plus 10 hours survey), and then to Lord Howe Island (97 nm, estimated 9 hours, arrive 11 Feb), approx 14 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 Sydney (420 nm, estimated 40 hours, 23-25 Feb 2013). The track is shown in Figure 1. The area of operations is shown in Figure 2, with the shelves around Lord Howe Island and Balls Pyramid in Figure 3 and detail of the hydrographic chart for Balls Pyramid in Figure 4.

Time Estimates

TABLE 1. ESTIMATE OF TIME FOR TRANSIT AND SURVEYS DURING SSO2/2013

Activity	Region	Distance	Time	Date
Transit	Brisbane – Middleton Reef	343 nm	36 hrs	8-9 Feb
	Middleton-Elizabeth Reef pilot study	37 nm	14 hrs	10 Feb
	Elizabeth – Lord Howe	97 nm	9 hrs	11 Feb
Swath/ core/sample	Lord Howe Island – Balls Pyramid	c 14 days	11-23 Feb	
Transit	Lord Howe Island – Sydney	420 nm	40 hrs	23-25 Feb

Weather conditions are anticipated to limit the times at which rotary coring can be undertaken on the fossil reef in around 30-60 m water depth around Lord Howe Island. Swath mapping, grab sampling and dredging will be undertaken when conditions are unfavourable for coring.

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
- General purpose laboratory
- Swath deployment (EM300)
- Topas Sub-Bottom Profiler (SBP)
- ADCP
- 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
- Hydraulic power pack for back deck hydraulic outlets
- Stern ramp Cover
- USBL system

User Equipment

- Submersible rotary Drill Rig
- Shallow-water video camera system and intermediate-water depth video system, each which can be used with CSIRO supplied USBL
- Rock dredges (x2)
- Diamantina dredge.
- Seas 450 Vibrocorer with 3 metre core tubes.
- Ocean drifters (x5)

Special Requests

- Vibrocore / drill rig winch to be fitted to rear deck. Installation to be undertaken by GA staff
- Hydraulic Shallow water camera winch to be fitted to rear deck. Installation to be undertaken by GA staff.

Personnel List

7 February – 18 February

Prof Colin Woodroffe	SEES, UOW	Chief Scientist
Dr Brendan Brooke	GA	Deputy Chief Scientist
Mr Chris Gallen	DPI	Tow video operations
Dr Scott Nichol	GA	Geologist
Michelle Linklater	SEES, UOW	PhD student, benthic mapping
Kim Picard	GA	GIS/acoustics and Topas
Craig Wintle	GA	Mechanical Technician
Mark Sharah	GA	Mechanical Technician
Matthew Carey	GA	Electronics technician (tow video)
Stephen Hodgkin	GA	Electronics technician (tow video)
Brett Muir	CSIRO MNF	Electronics support
Rick Smith	CSIRO MNF	Swath support 1
Sascha Frydman	CSIRO MNF	Swath support 2
Bruce Barker	CSIRO MNF	Voyage Manager
Hugh Barker	CSIRO MNF	Computing support

18 February – 25 February (following crew change at Lord Howe Island)

Prof Colin Woodroffe	SEES, UOW	Chief Scientist
Dr Scott Nichol	GA	Deputy Chief Scientist
Chris Gallen	DPI	Towed video biologist
Michelle Linklater	SEES, UOW	PhD student, benthic mapping
Kim Picard	GA	GIS/acoustics/Topas
Craig Wintle	GA	Mechanical Technician
Mark Sharah	GA	Mechanical Technician
Stephen Hodgkin	GA	Electronics technician (tow video)
Matthew Carey	GA	Electronics technician (tow video)
Tanya Whiteway	GA	Technician
Brett Muir	CSIRO	Electronics support
Sascha Frydman	CSIRO	Swath support 1
Rick Smith	CSIRO	Swath support 2
Bruce Barker	CSIRO	Voyage Manager
Hugh Barker	CSIRO	Computing support

As per AMSA requirements for additional berths on Southern Surveyor, the following personnel are designated as System Support Technicians and are required to carry their original AMSA medical and AMSA Certificate of Safety Training on the voyage:

Name	AMSA Certificate of Safety Training No.
Brett Muir	CBP24633
Sascha Frydman	ACM40349
Bruce Barker	BBO6292
Hugh Barker	ACM41826

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

Colin D. Woodroffe
Chief Scientist

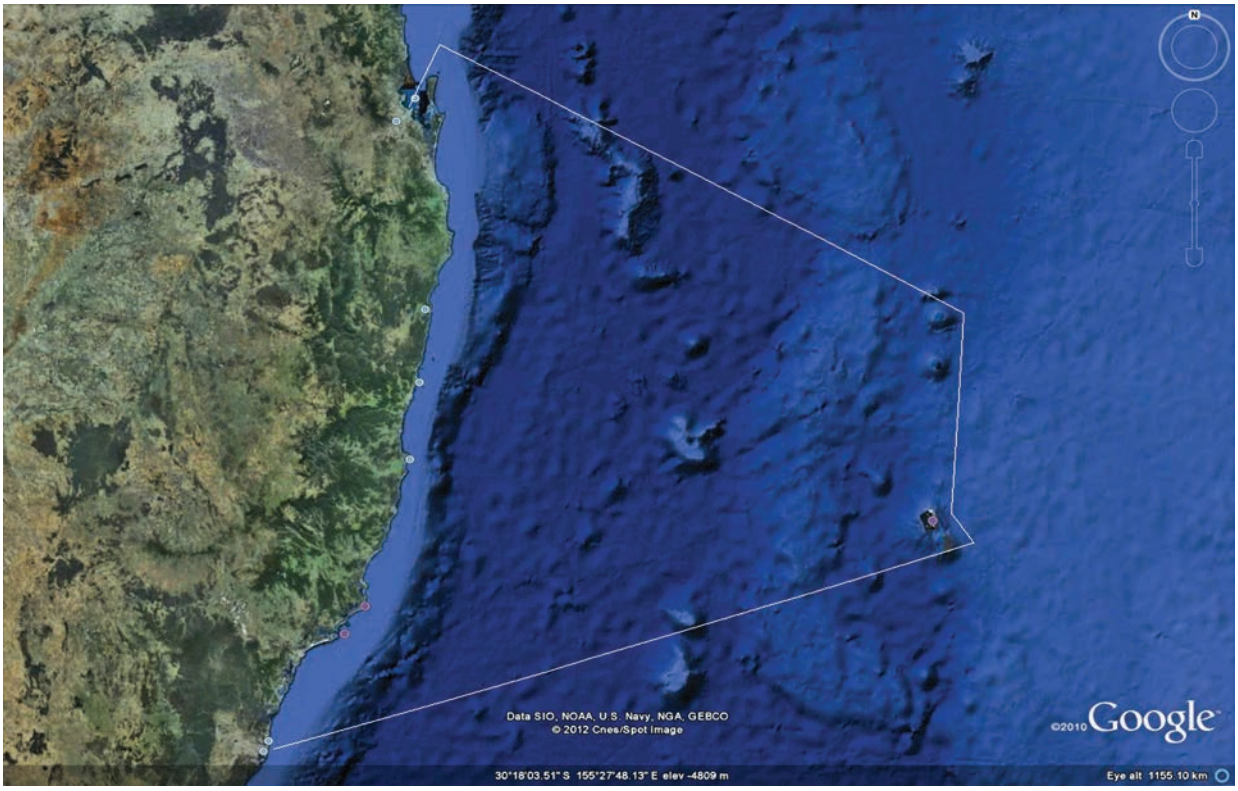

Figure 1. Route from Brisbane to area of operations, and return leg to Sydney

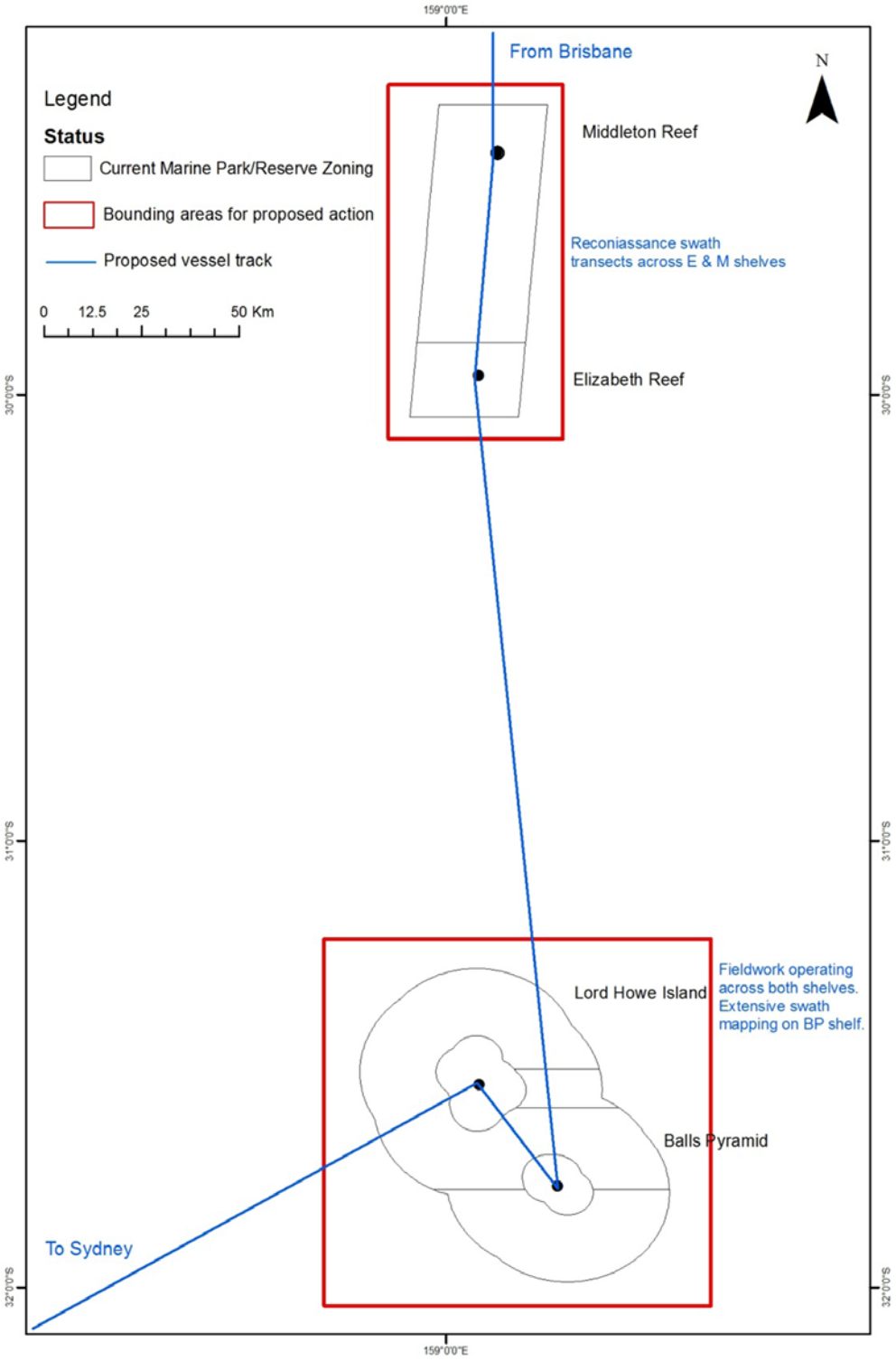

Figure 2. Area of operations around Middleton and Elizabeth Reefs (on transit voyage), and the Lord Howe Island Marine Park.

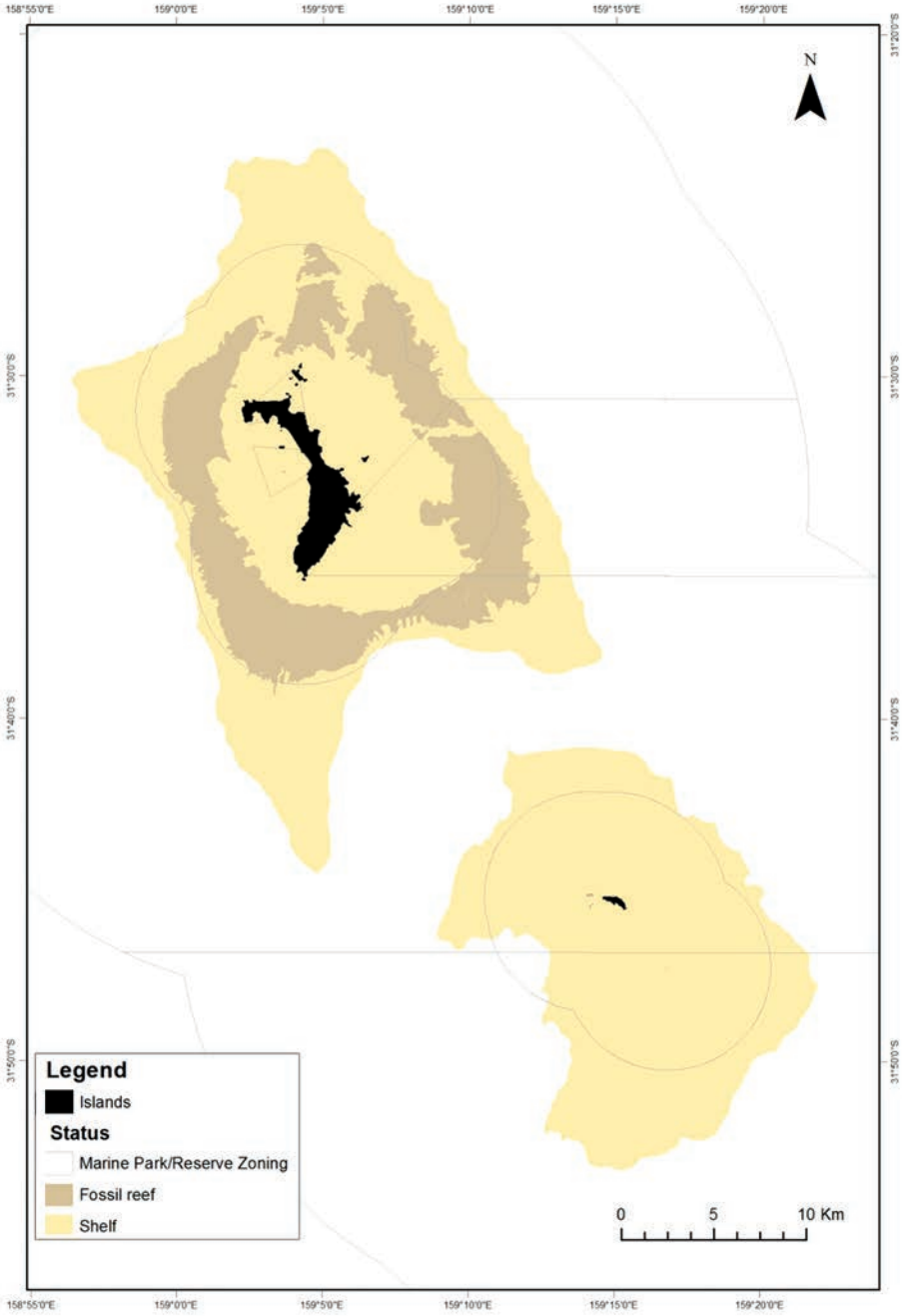

Figure 3. The shelves around Lord Howe Island (above) and Balls Pyramid, showing the extent of known fossil reef.

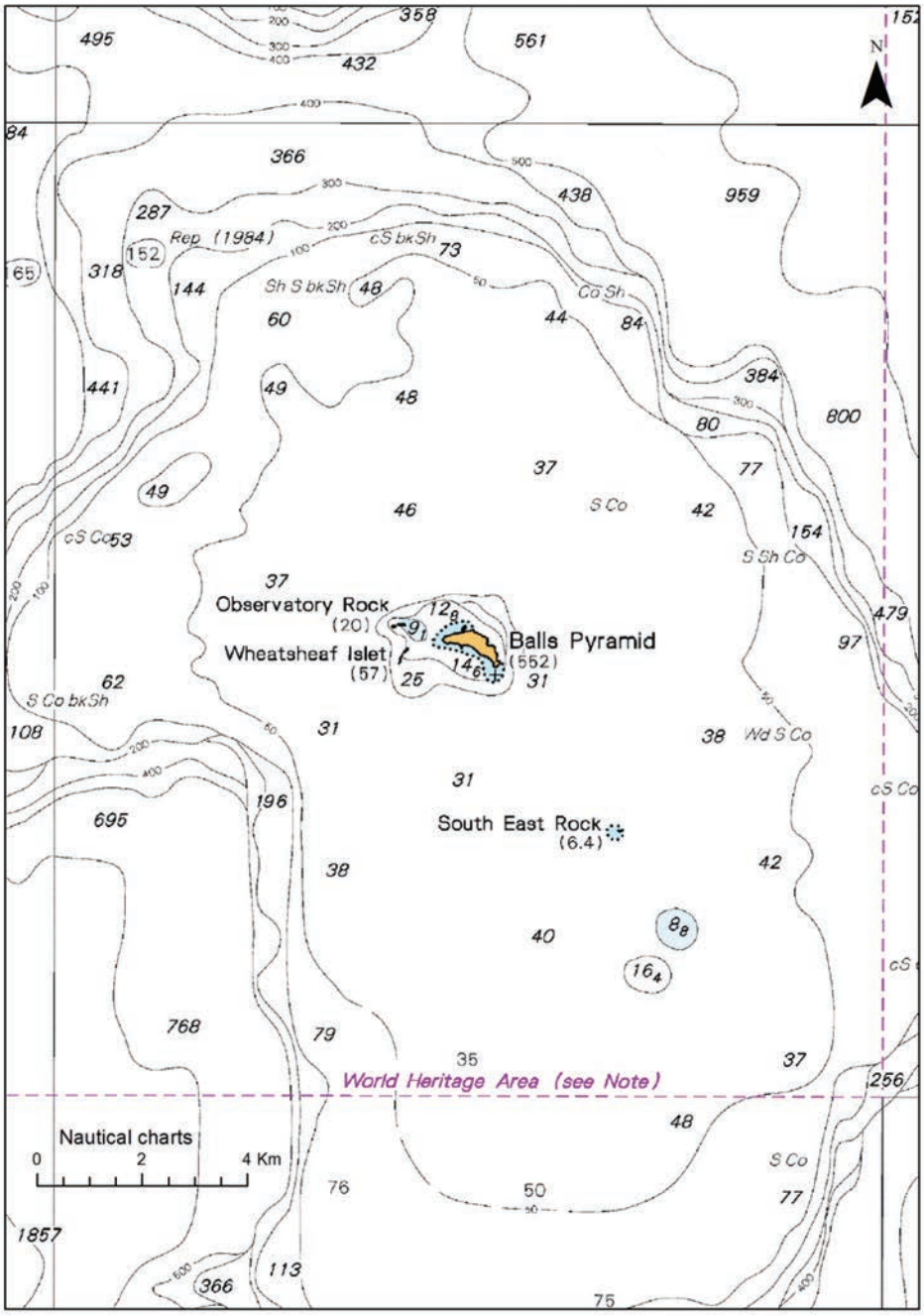

Figure 4. Detail of hydrographic chart for Balls Pyramid