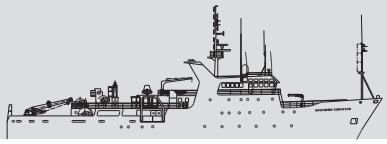

MARINE
NATIONAL FACILITY

2012 program

*RV Southern Surveyor*

**voyageplan**
**ss2012_v07**

# Tasmantid Seamounts: volcanic, tectonic, and carbonate record

## Itinerary

Mobilise Brisbane 0800 hrs, Friday 23 November, 2012
Depart Brisbane 1600 hrs, Friday 23 November, 2012

Arrive Brisbane 0800 hrs, Wednesday 19 December, 2012 and demobilise

## Principal Investigators


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CSIRO

## Scientific Objectives

The Tasmantid seamounts are a chain of underwater hotspot-derived intraplate volcanoes situated 150 to 600 km east of the Australian mainland (Figure 1). Because of the long record of hotspot-derived volcanic activity - spanning more than 2000 km and >40 million years - the seamounts provide an exceptional and largely untapped record of Australian plate velocity. Deciphering this record by obtaining volcanic samples suitable for high-resolution 40Ar/39Ar geochronology is a major objective of this expedition (Cohen, Vasconcelos, Knesel). Such volcanic samples will also record the chemical evolution of a long-lived mantle plume, and chemical analyses will reveal information on mantle reservoirs, melting, magma diversification, and the contrasting contamination effects of thinned continental lithosphere in the north versus oceanic lithosphere in the south (Knesel, Arculus). Geophysical data will also be collected over the seamounts and oceanic crust of the Tasman Sea to help study the tectonic history and lithospheric structure of the region. The larger seamounts are variably capped by fossil and modern coral reefs and/or other carbonate sediments (Webb). Although not targeted specifically, where carbonate materials are recovered with the volcanic rocks this material will provide a key biologic and climatic record of the seas east of Australia. Morphologic analysis of the seamounts will allow identification of volcanic and coral-growth geomorphology, as well as any mass wasting deposits (Cohen, Webb).

## Voyage Objectives

1. 30 kHz swath surveying of the Tasmantid seamounts (Figure 1) Priority: High. This will allow mapping of volcanic features, subsequent erosion history and carbonate reef growth, and evidence of mass-wasting. Mapping is also crucial to target dredge sites. The region of highest priority includes the large seamounts near the bend in the chain (Queensland, Britannia) and extending north towards the Louisaide Plateau.

2. Dredging volcanic rocks from the seamount flanks. Priority: High. Samples will be analysed post-cruise by geochemistry and 40Ar/39Ar geochronology.

3. Geophysical data. Priority: Medium. Combined swath and gravity data will be used to study the strength and structure of the lithosphere along the chain, with particular emphasis on how the lithosphere has responded to seamount loading, and the difference in response between continental and oceanic crust. Magnetic data will also be used to help constrain seafloor-spreading rates.

4. Sample carbonate material and deep-water organisms as ‘by-catch’. Priority: Medium-low. Samples collected on an opportunistic basis (e.g., where organisms are attached to volcanic samples) will be identified and preserved as dictated by the material. Knowledge of the deep-water organisms of the Coral Sea is very scarce. Hence, any marine biota collected along with the volcanic samples will enhance our knowledge of life in these remote and inaccessible habitats, and provide a climatic and biologic record in the Tasman Sea, potentially extending well into the mid-Cenozoic. Voucher samples of any modern species will be provided to the Queensland Museum for additional expert study.

5. Water sampling. Priority: Low. On an opportunistic basis obtain surface water samples for post-voyage geochemical analysis. Very few surface ocean trace element geochemistry analyses exist for shallow water in the Coral Sea. Collection of samples will be done when and where an opportunity exists.

## Time Estimates

Based on a steaming speed of 10 knots:

Transit port of Brisbane to -Stradbroke Guyot: 250 nm (25 hours).

Transit Frederick Reef to port of Brisbane: 410 nm (41 hours).

3800 nm swath mapping on seamounts & transits between seamounts (380 hours).

30 dredges @ 4 hours each (120 hours).

2 days for contingencies (weather, equipment).

Total is 614 hours (operations and transits) = 25.6 days

## Voyage Track

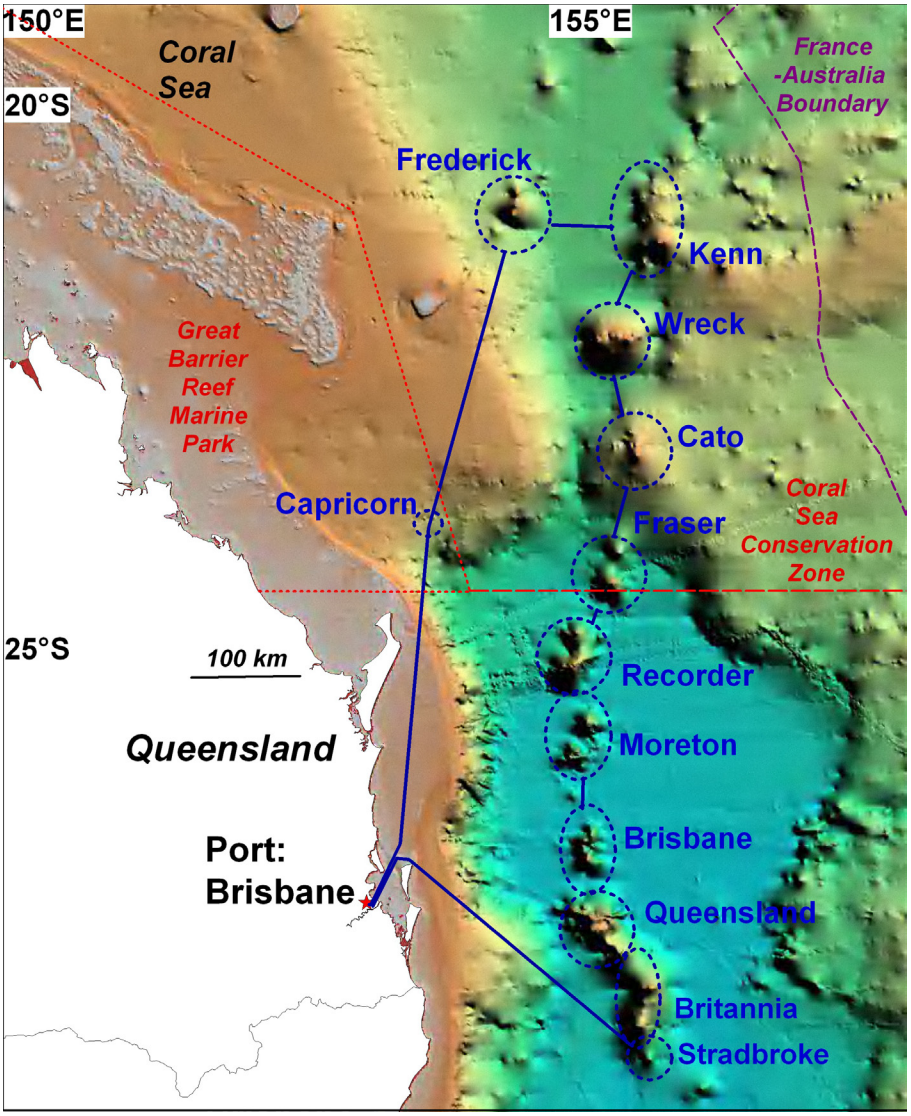


**Figure 1:** Tasmantid Seamounts with the planned ship track

| Seamount | Quadrant | Latitude (decimal degrees) | Longitude (decimal degrees) | Latitude (degrees) | Latitude (minutes) | Latitude (decimal seconds) | Longitude (degrees) | Latitude (minutes) | Latitude (decimal seconds) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| Stradbroke | SW | -29.21782 | 155.61660 | -29 | 13 | 4.148 | 155 | 36 | 59.756 | Portions of the eastern flank mapped by Marion Dufrense 153. |
| | SE | -29.21791 | 156.05972 | -29 | 13 | 4.458 | 156 | 3 | 34.974 | |
| | NE | -28.96175 | 156.09379 | -28 | 57 | 42.293 | 156 | 5 | 37.633 | |
| | NW | -28.97905 | 155.62844 | -28 | 58 | 44.569 | 155 | 37 | 42.388 | |
| Britannia | SW | -28.68604 | 155.36567 | -28 | 41 | 9.744 | 155 | 21 | 56.398 | Portions of the summit has high-resolution swath, and eastern flank mapped by Marion Dufrense 153. |
| | SE | -28.78157 | 155.66630 | -28 | 46 | 53.666 | 155 | 39 | 58.673 | |
| | NE | -27.94933 | 155.77040 | -27 | 56 | 57.599 | 155 | 46 | 13.444 | |
| | NW | -28.04521 | 155.54572 | -28 | 2 | 42.770 | 155 | 32 | 44.581 | |
| Queensland | SW | -28.04521 | 155.54572 | -28 | 2 | 42.770 | 155 | 32 | 44.581 | No pre-existing swath data. |
| | SE | -27.94933 | 155.77040 | -27 | 56 | 57.599 | 155 | 46 | 13.444 | |
| | NE | -27.26343 | 155.13904 | -27 | 15 | 48.348 | 155 | 8 | 20.530 | |
| | NW | -27.43083 | 154.90824 | -27 | 25 | 50.977 | 154 | 54 | 29.664 | |
| Brisbane | SW | -27.02416 | 154.99218 | -27 | 1 | 26.969 | 154 | 59 | 31.834 | No pre-existing swath data. |
| | SE | -27.03403 | 155.15721 | -27 | 2 | 2.519 | 155 | 9 | 25.956 | |
| | NE | -26.68105 | 155.16385 | -26 | 40 | 51.766 | 155 | 9 | 49.860 | |
| | NW | -26.66012 | 154.97861 | -26 | 39 | 36.432 | 154 | 58 | 42.978 | |
| Unnamed | SE | -26.38137 | 154.96957 | -26 | 22 | 52.918 | 154 | 58 | 10.438 | No pre-existing swath data. |
| | NW | -26.30079 | 154.85014 | -26 | 18 | 2.851 | 154 | 51 | 0.511 | |
| Moreton (S) | SW | -26.06609 | 154.94793 | -26 | 3 | 57.910 | 154 | 56 | 52.537 | Portions of the southern and eastern flanks have been swath mapped. |
| | SE | -26.01496 | 155.04865 | -26 | 0 | 53.845 | 155 | 2 | 55.129 | |
| | NE | -25.90824 | 154.97776 | -25 | 54 | 29.653 | 154 | 58 | 39.925 | |
| | NW | -25.94358 | 154.85747 | -25 | 56 | 36.888 | 154 | 51 | 26.903 | |
| Moreton (N) | SW | -25.79535 | 155.03598 | -25 | 47 | 43.249 | 155 | 2 | 9.510 | No pre-existing swath data. |
| | SE | -25.72397 | 155.19771 | -25 | 43 | 26.306 | 155 | 11 | 51.767 | |
| | NE | -25.61281 | 155.10942 | -25 | 36 | 46.109 | 155 | 6 | 33.908 | |
| | NW | -25.66442 | 154.97835 | -25 | 39 | 51.923 | 154 | 58 | 42.049 | |
| Recorder (S) | SW | -25.15439 | 154.77059 | -25 | 9 | 15.786 | 154 | 46 | 14.117 | Portions of the western flank and centre have swath data. |
| | SE | -25.38278 | 154.83497 | -25 | 22 | 57.990 | 154 | 50 | 5.896 | |
| | NE | -25.11460 | 155.16683 | -25 | 6 | 52.549 | 155 | 10 | 0.574 | |
| | NW | -25.07108 | 154.93668 | -25 | 4 | 15.881 | 154 | 56 | 12.052 | |
| Recorder (N) | SW | -25.07108 | 154.93668 | -25 | 4 | 15.881 | 154 | 56 | 12.052 | Centre of guyot crossed by ss2012 _ t02. |
| | SE | -25.11460 | 155.16683 | -25 | 6 | 52.549 | 155 | 10 | 0.574 | |
| | NE | -24.81921 | 155.09297 | -24 | 49 | 9.160 | 155 | 5 | 34.681 | |
| | NW | -24.84925 | 154.86442 | -24 | 50 | 57.289 | 154 | 51 | 51.916 | |
| Fraser | SW | -24.51474 | 155.20037 | -24 | 30 | 53.068 | 155 | 12 | 1.339 | Crossed by several swath lines, including from SS5/2004 and SS02/2005. |
| | SE | -24.51551 | 155.40372 | -24 | 30 | 55.822 | 155 | 24 | 13.396 | |
| | NE | -24.37298 | 155.40983 | -24 | 22 | 22.739 | 155 | 24 | 35.381 | |
| | NW | -24.36003 | 155.21350 | -24 | 21 | 36.101 | 155 | 12 | 48.600 | |
| Unnamed | SW | -24.11573 | 155.29161 | -24 | 6 | 56.642 | 155 | 17 | 29.807 | Portions of western flank have swath data from SS5/2004. |
| | SE | -24.14226 | 155.39611 | -24 | 8 | 32.140 | 155 | 23 | 45.992 | |
| | NE | -24.06464 | 155.42913 | -24 | 3 | 52.715 | 155 | 25 | 44.872 | |
| | NW | -24.04411 | 155.32108 | -24 | 2 | 38.800 | 155 | 19 | 15.881 | |
| Cato | SW | -23.38592 | 155.49979 | -23 | 23 | 9.312 | 155 | 29 | 59.244 | Portions of W and S flanks have SS5/2004 swath. Avoid shallows around island. Area west of ~155.362 may also be of interest. |
| | W | -23.17556 | 155.41259 | -23 | 10 | 32.009 | 155 | 24 | 45.335 | |
| | N | -23.05368 | 155.51811 | -23 | 3 | 13.259 | 155 | 31 | 5.207 | |
| | SE | -23.32991 | 155.74757 | -23 | 19 | 47.690 | 155 | 44 | 51.259 | |
| Wreck | SW | -22.30138 | 155.16967 | -22 | 18 | 4.982 | 155 | 10 | 10.819 | Avoid shallow areas around islands. |
| | SE | -22.29024 | 155.61550 | -22 | 17 | 24.878 | 155 | 36 | 55.786 | |
| | NE | -22.06680 | 155.60353 | -22 | 4 | 0.494 | 155 | 36 | 12.694 | |
| | NW | -22.05610 | 155.03087 | -22 | 3 | 21.946 | 155 | 1 | 51.128 | |
| Kenn | SW | -21.50830 | 155.75299 | -21 | 30 | 29.880 | 155 | 45 | 10.750 | Avoid shallow areas around islands. |
| | SE | -21.23381 | 155.97841 | -21 | 14 | 1.709 | 155 | 58 | 42.276 | |
| | NE | -20.96550 | 155.79293 | -20 | 57 | 55.811 | 155 | 47 | 34.562 | |
| | NW | -21.13051 | 155.48037 | -21 | 7 | 49.825 | 155 | 28 | 49.318 | |
| Frederick | NE | -20.79915 | 154.46115 | -20 | 47 | 56.929 | 154 | 27 | 40.147 | No pre-existing swath data. |
| | SE | -21.06947 | 154.41905 | -21 | 4 | 10.078 | 154 | 25 | 8.591 | |
| Capricorn | eastern | -23.80953 | 153.64890 | -23 | 48 | 34.300 | 153 | 38 | 56.050 | No pre-existing swath data. |
| | western | -23.83390 | 153.58041 | -23 | 50 | 2.040 | 153 | 34 | 49.480 | |
| Gardner Bank | NW | -24.98333 | 153.51000 | -24 | 59 | 0.000 | 153 | 30 | 36.000 | Adding swath to east of region surveyed during ss2012 _ t02. |
| | SE | -25.13667 | 153.57333 | -25 | 8 | 12.000 | 153 | 34 | 24.000 | |

## Southern Surveyor Equipment

- Kongsberg EM300 swath mapper – swath bathymetry, swath seabed reflectance.
- TOPAS sub-bottom profiler.
- Simrad EK60 sounder for bottom detection and biological research (38 and 120 kHz).
- Rock dredge, safety links, and spares. Winch.
  Stern ramp cover to be in place for dredging operations.
- Smith-McIntyre grab.
- Rock saw.
- Laboratory space for sorting, cleaning, and storing rock samples.
- Laboratory freezer (for preservation of carbonates/biological samples).
- ADCP.
- XBT's.
- Underway data.
- Ship attitude - heave, pitch, roll, and heading.
- Data from winch sensors (tension, winch speed, and wire out).
- Bridge log.

## User Equipment

- Towed SEASPY magnetometer, winch, and power source, on loan from GA. This equipment will already be in place from the previous voyage. Instrument to be run during swath surveying.
- Micro-g Lacoste Air-Sea II seagoing gravimeter, UPS, spares, and peripherals (including laptop computer), on loan from NOC, UK. This equipment will already be in place from the previous voyage. Instrument to be run continuously, weather permitting.
- LaCoste-Romberg Series G land gravimeter, on loan from NOC, UK, for land-ties at beginning and end of voyage.
- Rock sampling equipment (hammers, chisels), sample bags, plastic sample buckets.
- Chemicals to preserve organisms (nitric acid, ethanol, sodium hypochlorite).

## Special Requests

Deck-space, tie down sockets, and hydraulic outlets for the SEASPY magnetometer winch. RS232 cable input to computer in Operations room. These items will already be installed and tested from the previous voyage.

Gravimeter (600 x 800 x 900 mm) installed on floor of photographic darkroom. RS232 cable input to computer in darkroom. These items will already be in place and tested from the previous voyage.

## Personnel List

| Participant | Affiliation | Position |
|---|---|---|
| Benjamin Cohen | University of Queensland | Chief Scientist |
| Gregory Webb | University of Queensland | Carbonates |
| James Sadler | University of Queensland | Carbonates |
| Lara Kalnins | University of Oxford | Geophysics |
| Tracey Crossingham | University of Queensland | Igneous Petrology |
| Beatriz Pruina | University of Queensland | Igneous Petrology |
| Ian Fortes | University of Queensland | Igneous Petrology |
| Toby Cunningham | University of Queensland | Igneous Petrology |
| Abbas Babaahmadi | University of Queensland | Petrology/Geophysics |
| Rebecca Norman | Australian National University | Petrology |
| TBD | | |
| Lisa Woodward | CMAR | MNF Voyage manager |
| Tara Martin | CMAR | MNF Swath Mapping |
| Rod Palmer | CMAR | MNF Electronics Support |
| Anoosh Sarraf | CMAR | MNF 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. |
|---|---|
| Lisa Woodward | BB01145 |
| Tara Martin | BB05761 |
| Rod Palmer | BB05328 |
| Anoosh Sarraf | BB02298 |

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

Benjamin Cohen
Chief Scientist