Schmidt Ocean Institute Post Expedition Report

Pinging in the New Year: Mapping the Tasman and Coral Seas

Chief Scientist Dr. Robin Beaman

Table of Contents

1 Overview

SOI Expedition ID	FK201228
Vessel	R/V *Falkor*
Expedition Name	Pinging in the New Year - Mapping the Tasman and Coral Seas
Expedition Dates	2020/12/28 - 2021/01/26
Departure Port	Brisbane, Australia
Termination Port	Brisbane, Australia
Ocean	South Pacific Ocean

1.0.0.1 Map of Expedition Location

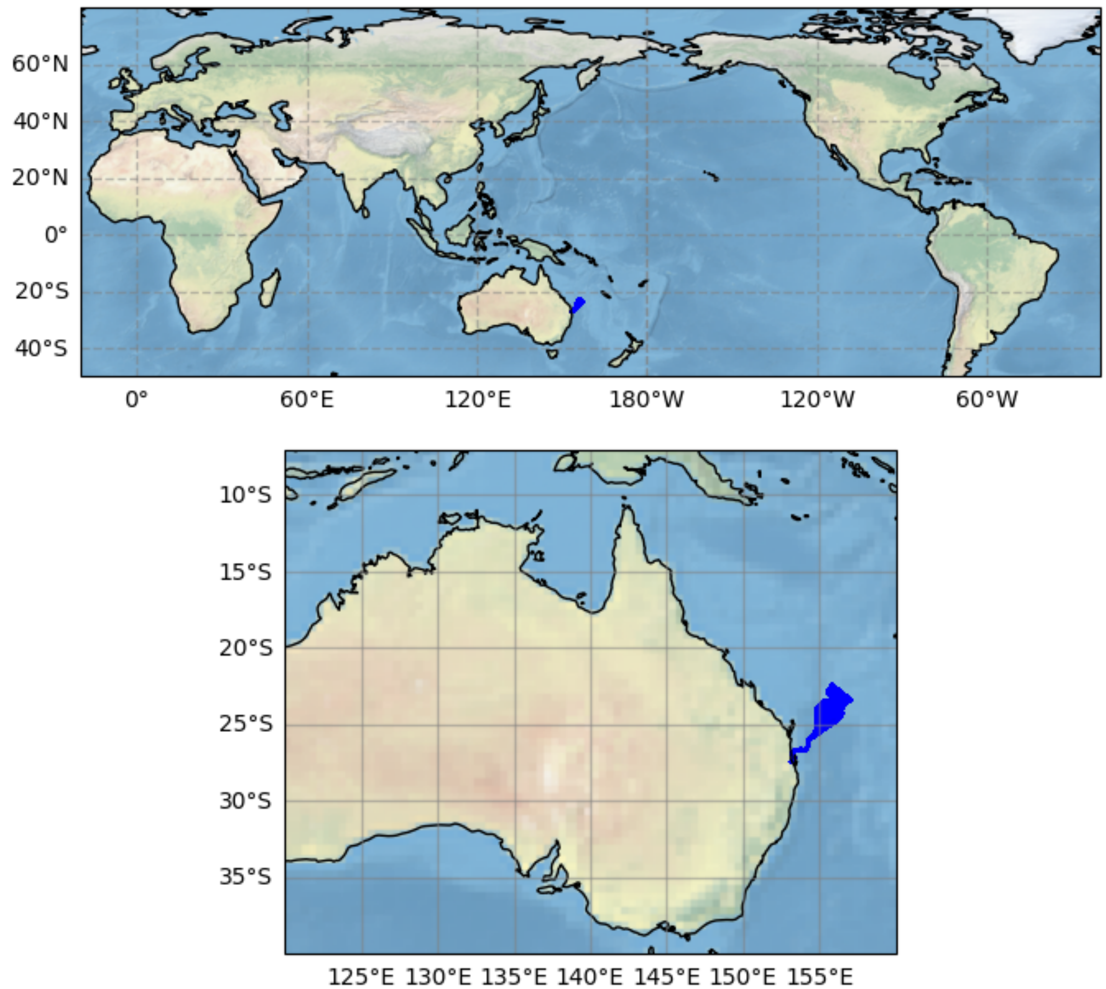

Figure 1: Map of Expedition Location

1.1 Expedition Overview

The Tasman and Coral seas are made up of deep-sea basins, as well as plateaus and ridges, which were all created by the breaking apart and thinning of continental crust during the late Cretaceous period, approximately 110-80 million years ago. The breaking up of the continental crust resulted in fragmented blocks of micro-continents spread across the region (Figure 2). After the Cretaceous period, the seafloor began to spread, generating new oceanic crust until about 52 million years ago. This was followed by a subsequent period of volcanism and land subsidence during the early Eocene, around 52 to 48 million years ago. This volcanic activity resulted in the formation of the Tasmantid Seamounts - a north-south chain of volcanoes in the centre of the Tasman Sea. The Tasmantid Seamounts are analogous to the Hawaiian archipelago in their formation.

Despite knowledge about the geological formation of the Tasman and Coral seas, the seafloor of this region was still poorly mapped and characterized. The expedition, therefore, focused on mapping the plateaus, ridges, and seamounts of the region. Understanding the full topographic complexity of the Tasman and Coral seas aids in advancing tectonic and geological studies, as well as provides critical information for the management of the Coral Sea Marine Park.

The expedition also provided an opportunity to make seabird at-sea observations. Seabirds are distributed patchily over the ocean in space and time. This high degree of variability is due to a combination of both physical and biological factors. Physical oceanographic processes influence seabird at-sea distributions and abundances by concentrating prey close to the sea surface, thus making the prey available to foraging seabirds and facilitating energy flow from the marine food web to seabirds. A high priority in seabird conservation is to link seabird at-sea distribution data from remote tracking and at-sea surveys, but appropriate seabird data are often limited in the number of instrumented birds.

This expedition featured an uninterrupted, broad-scale, deep-water mapping effort over the plateaus, ridges, and seamounts of the southeastern Coral Sea Marine Park and northern Tasman Sea. The 100% mapping of the area would reveal its full topographic complexity, providing knowledge for advancing geological and tectonic studies of the region. The expedition also provided valuable opportunities for students to contribute to all facets of field data collection to broaden their research experience.

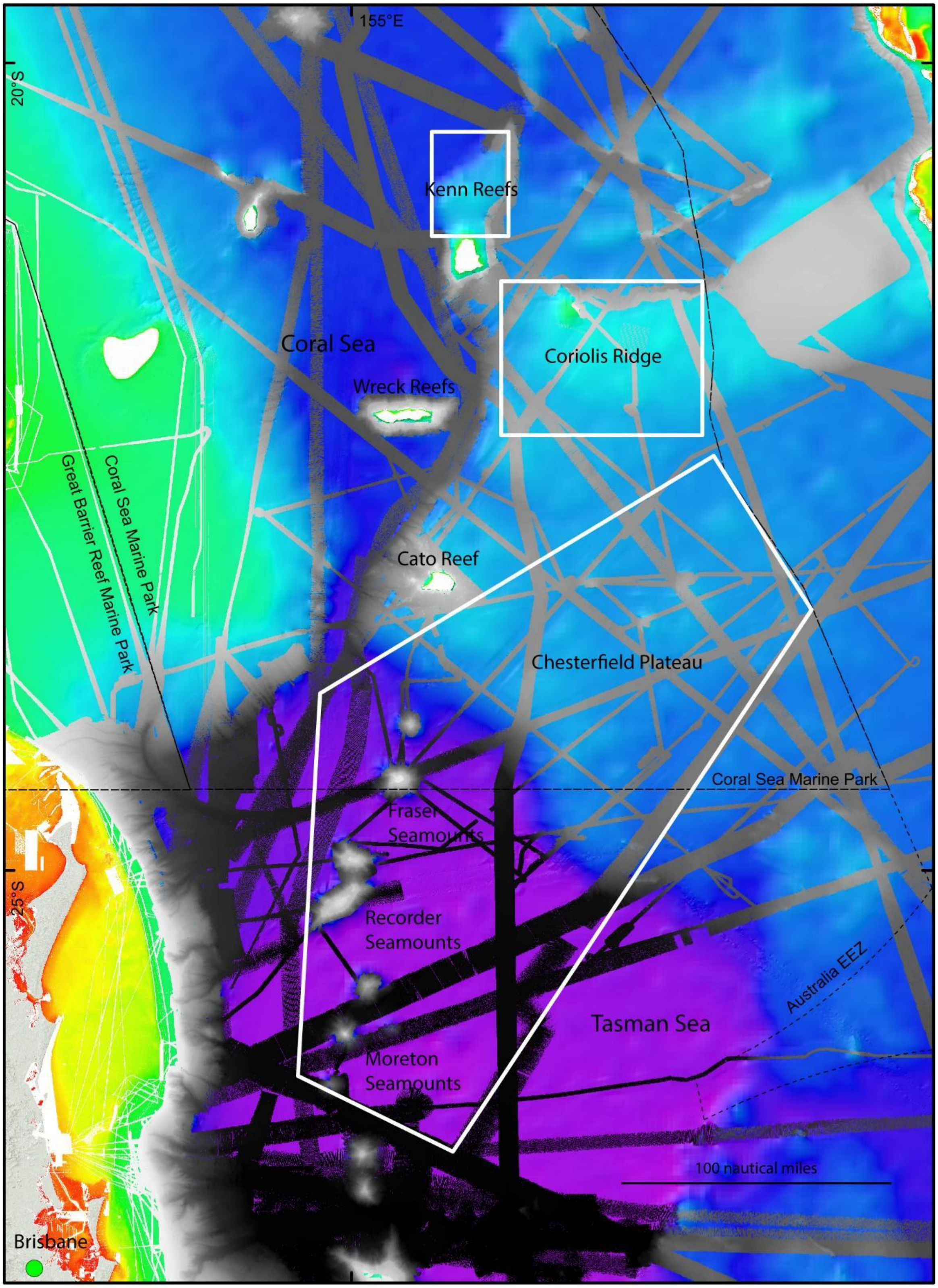

Figure 2: Map of the Tasman and Coral seas study areas (white boxes) together with the Tasmantid Seamounts lying northeast of Brisbane. Existing multibeam coverage in grey.

1.2 Authorizations and Permitting

Permit Number	Permit Authority	Permit Focus
PA2019-00131-12/13/15	Australian Marine Park Activity Permit	MBES, SBES, ADCP, SVP, XBT, CTD, ROV, aerial drone, towed magnetic sensor, access to sand cays

1.3 Expedition Timeline

The expedition commenced on December 28, 2020, departing from Brisbane, Australia, and returned to Brisbane, Australia, on January 26, 2021. The expedition was 30 days long.

1.4 Expedition Objectives

The primary objective of the expedition was to map a large area of the Tasman and Coral seas as part of the Schmidt Ocean Institute's contribution to the Seabed 2030 Project and the start of the United Nations Decade of Ocean Science for Sustainable Development (2021-2030).

The expedition plan was developed in a short time frame (~3 weeks before sailing). The study area was chosen based on the ability to achieve uninterrupted, broad-scale, deep water mapping, and included priority areas within the south-eastern Coral Sea Marine Park.

The northern Tasman Sea basin, around the Recorder and Fraser seamounts (part of the Tasmantid Seamount Chain), was the priority area for conducting seafloor mapping, which had only been partially mapped by other vessels. The next priority area was the Chesterfield Plateau and the Cato Reef/Seamount, which had been partially mapped during an earlier *Falkor* expedition.

The area north of the Fraser Seamount lies within the Coral Sea Marine Park, one of the largest marine parks in the world. The mapping data collected will contribute to a greater understanding of this extensive marine park. The broad-scale mapping effort of this expedition, therefore, provided a rare opportunity to comprehensively understand the seafloor terrain from the deeper Tasman Sea basin rising onto the Chesterfield Plateau, together with the seamounts and reefs that lie within the mapped basin and plateau.

A secondary objective of this expedition was to survey seabird at-sea populations. Observing where seabirds are in space and time allows for a greater understanding of changing ocean conditions and can facilitate the identification of productive areas in the ocean. Identifying areas where seabirds visit regularly can also help determine areas where future marine protected areas should be established. This expedition was a valuable opportunity to collect seabird observations from a remote part of Australia.

Other objectives were to opportunistically collect additional oceanographic data, such as from a towed magnetometer, to help reveal the deep tectonic fabric of the Tasman Sea basin, ADCP measurements, CTD and rosette casts, and microplastics sampling.

2 Expedition Accomplishments

2.1 At-sea Accomplishments

2.1.1 Science

Multibeam Mapping

Falkor mapped a total of 40,445 square km of seafloor, with 5399 line nm or 9999 line km of ship track (Figures 3, 4; Table 1) on this expedition. The multibeam data have been submitted to AusSeabed for publishing/downloading in the AusSeabed Marine Data Portal, and internationally to the GEBCO database for contribution to the Seabed 2030 Project. The new mapping data provides important information about the bathymetry of the southeastern Coral Sea Marine Park.

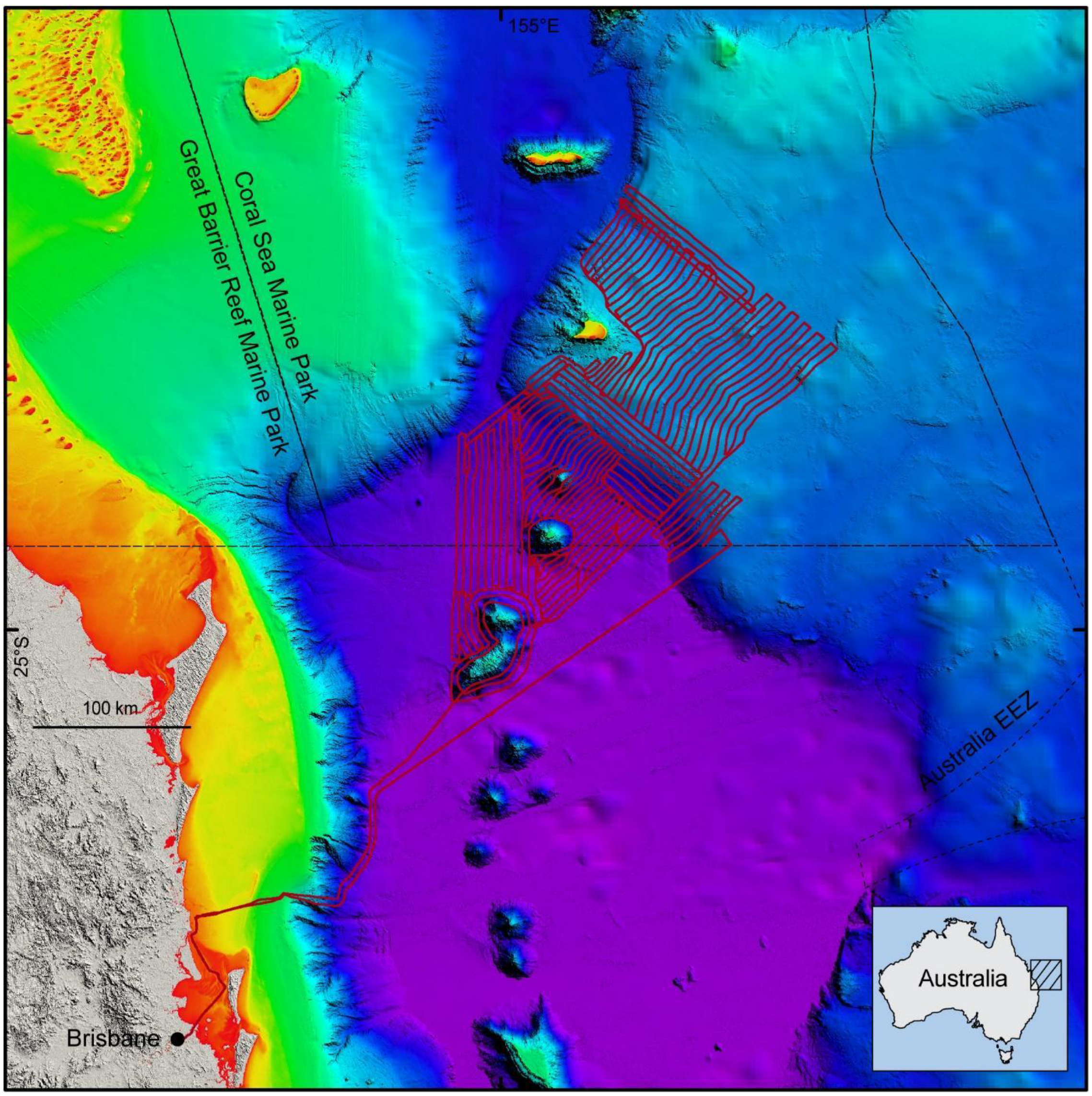

Figure 3. Regional map of the expedition study area, Brisbane to Brisbane, December 28 2020 to January 26 2021. Brown line is the ship track.

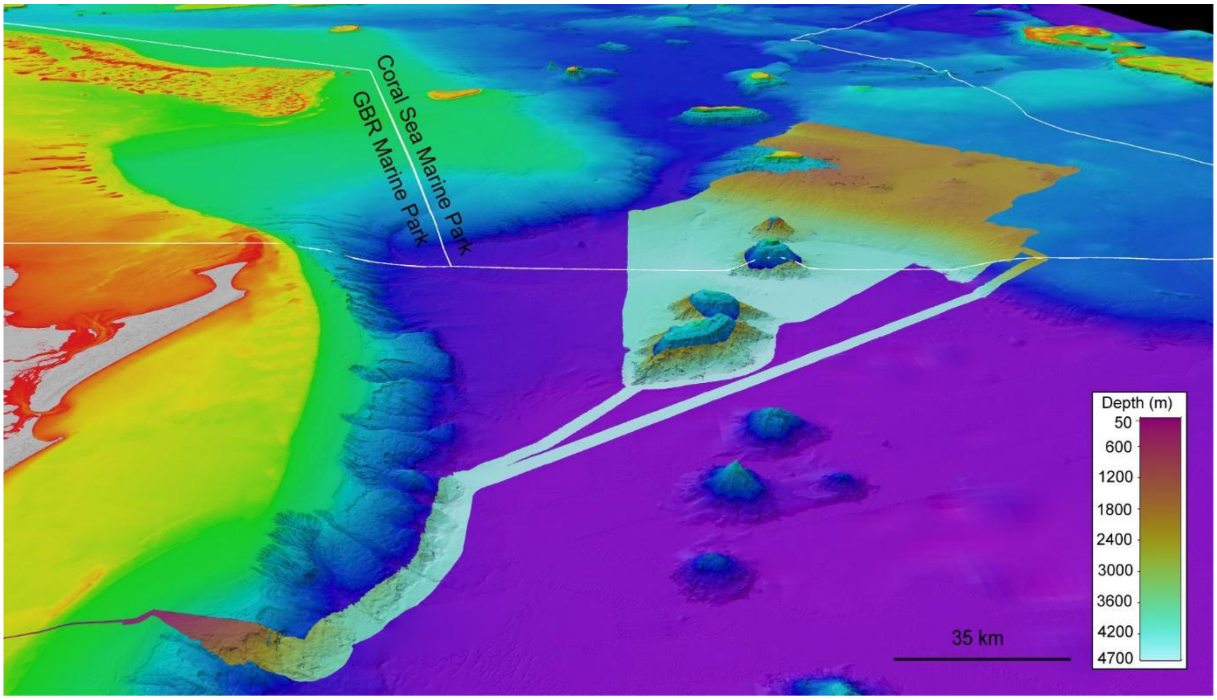

Figure 4. 3D view of the expedition study area, showing multibeam bathymetry coverage. Background 3D depth model (gbr100) from https://www.deepreef.org/2010/07/06/gbr-bathy/

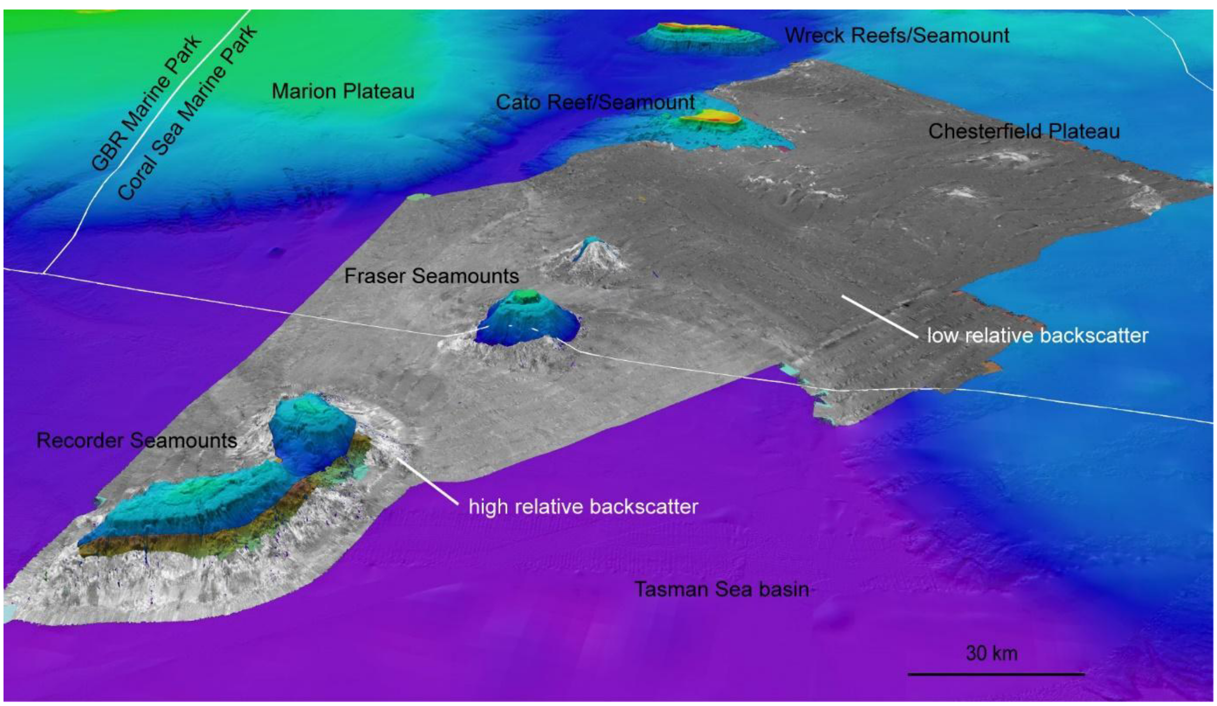

Figure 5. 3D view of the expedition study area, showing multibeam relative backscatter coverage. High relative backscatter values are found on flanks of seamounts, indicating hard/rough substrate. Low relative backscatter values are found on Chesterfield Plateau indicating soft/smooth substrate.

Summary statistics	Value
Duration (days)	30
Ship track line (km)	9999
Multibeam coverage (sq km)	40,445
Minimum depth (m)	51
Maximum depth (m)	4714
ROV dives	nil
CTD casts	3
Sound speed profiler casts	nil
XBT casts	31
Data size (TB)	0.5

Table 1. Summary statistics of the expedition.

The first priority area for mapping was the northern Tasman Sea basin around the Recorder and Fraser seamounts (part of the Tasmantid Seamount Chain), which had only been partially mapped by other vessels (Figure 6). The next priority area was the Chesterfield Plateau and the Cato Reef/Seamount, which had also been partially mapped during an earlier *Falkor* expedition in 2020 and by other vessels (Figures 7, 8). The area north of the Fraser Seamount is designated as the Coral Sea Marine Park, one of the largest marine parks in the world, and so the new mapping data contributed to a greater understanding of the southern area of this extensive marine park. In particular, mapping would reveal how the ~4000 m deep Cato Trough, which separates the Chesterfield Plateau from the Marion Plateau, enters the northern Tasman Sea basin

The new mapping data revealed broad-scale submarine landslides, deep basin channels, sediment waves and scour marks around the Tasmantid Seamounts. Numerous volcanic pinnacles (cinder cones) and pock marks (possibly generated by seeps) were found around Cato Reef/Seamount. The multibeam data will be used by students researching the seamounts, combined with rock samples previously collected by other vessels to understand the evolution of the Tasmantid Seamounts and associated magmatic hotspot. Further, the deep basin seafloor channels and sediment waves provide new geomorphic information about the influence of near-seabed, deep-water flows in the region, which have not been previously studied.

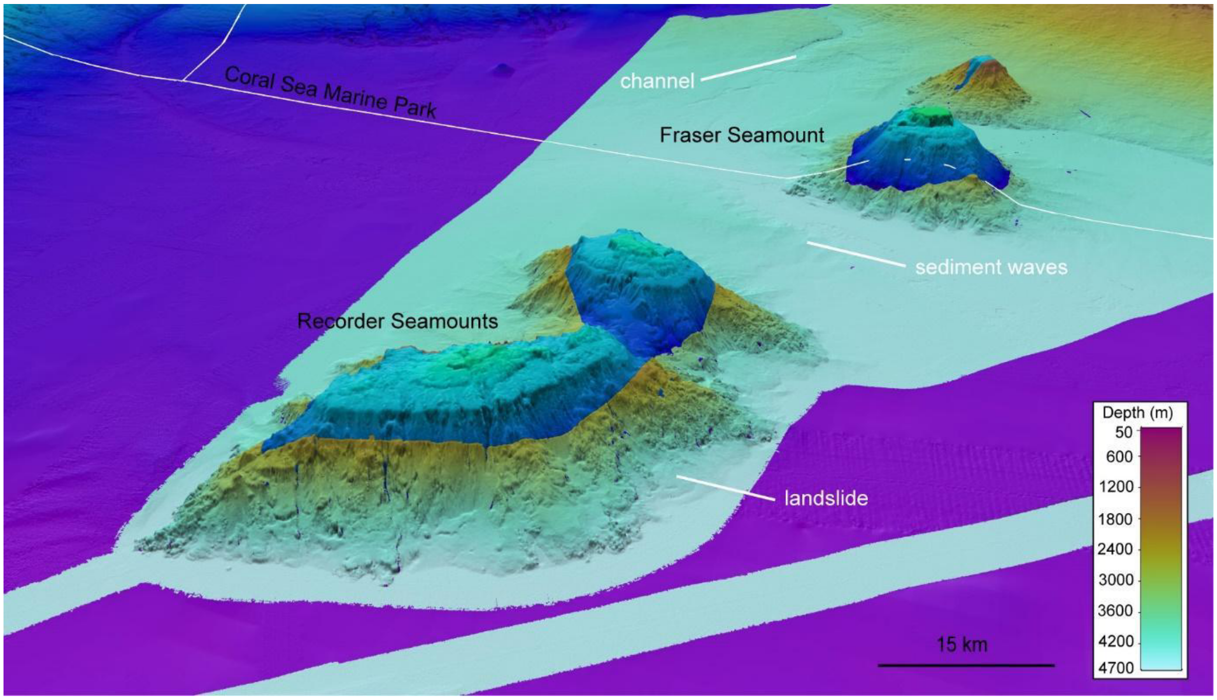

Figure 6. 3D view of northern Tasman Sea basin Recorder and Fraser seamounts, part of the Tasmantid Seamount Chain. Seamount flanks show rough terrain due to mass transport complexes of submarine rockfalls and sediment landslides. A broad, low relief channel northwest of Fraser Seamount is the exit of the Cato Trough into the Tasman Sea basin.

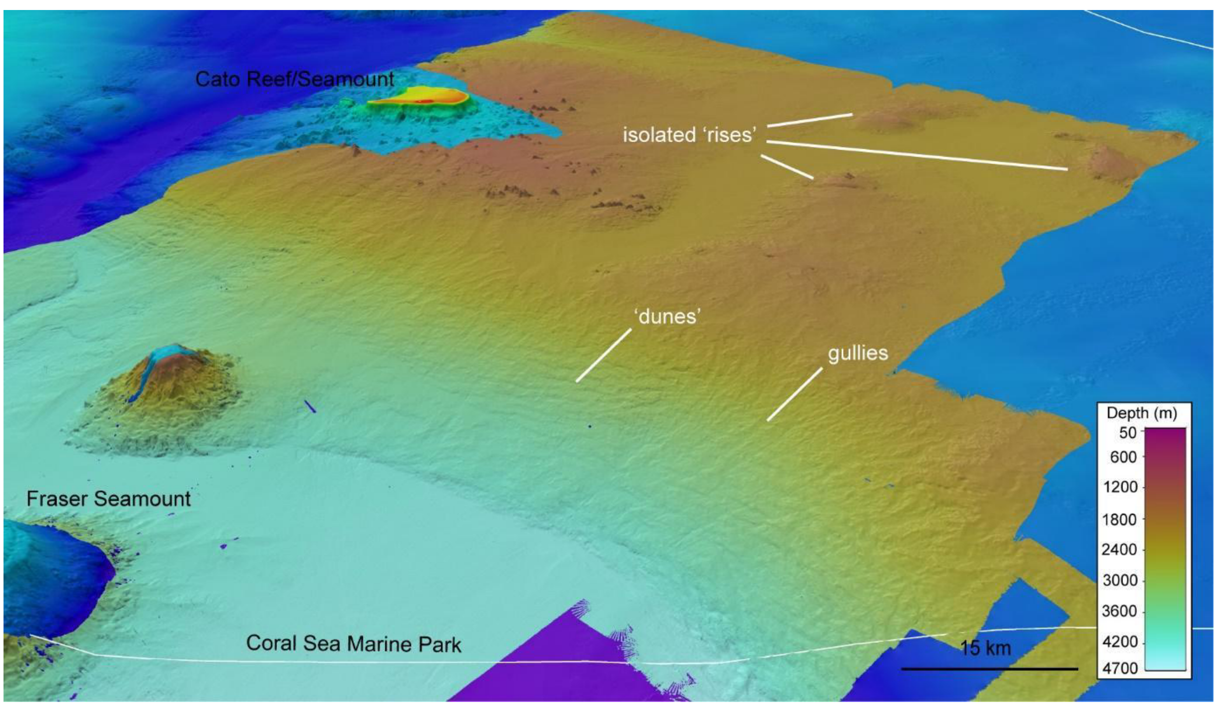

Figure 7. 3D view of Chesterfield Plateau. Steeper slopes of the plateau show sediment creep downslope as 'dunes' with ~1.5 km wavelength and incised with gullies. The upper surface of the Chesterfield Plateau shows large (15-30 km wide) isolated 'rises' separated by broad valleys.

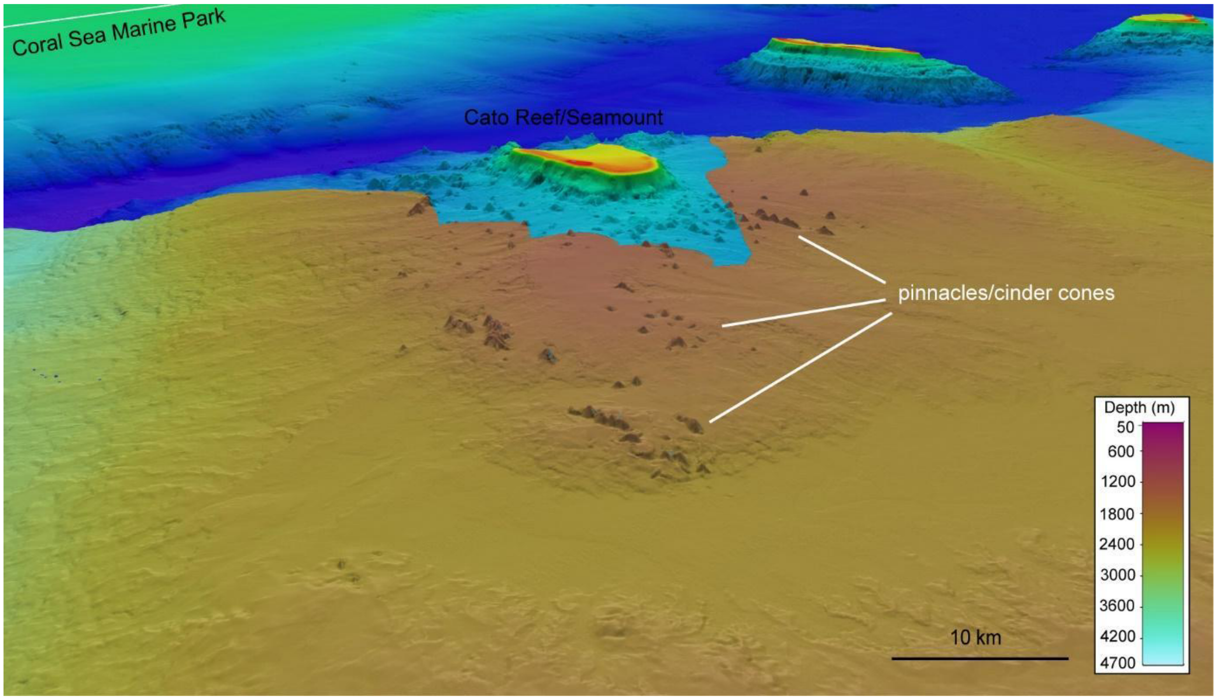

Figure 8. 3D view of the Cato Reef/Seamount. Numerous small (~100-200 m high) pinnacles, likely volcanic cinder cones, surround the broader flanks of Cato Seamount on the Chesterfield Plateau up to ~50 km distance from Cato Reef edge.

Seabird Observations

Another objective of the scientists on board was to study the seabirds at sea. Seabird observations were undertaken during the expedition, typically for 12 – 13 hours/day, except in bad weather, when the visibility was significantly limited by rain (Figures 9, 10). An opportunistic study on the diving and feeding success of boobies was undertaken by student Gemma Rushton. The data from these observations will provide important new knowledge about the boobies foraging ecology, and likely the basis for a thesis and/or publication.

Almost 19,000 seabirds were observed over the four-week expedition, with over 20 different species identified (Table 2). This region of the Tasman and Coral seas had never been surveyed in such a systematic way and the data will help the management of the Coral Sea Marine Park. The seabird observation data contributes to the much larger Australasian Seabird Group database that Dr. Eric Woehler has been developing to understand these protected species in the near-shore and offshore waters around Australia.

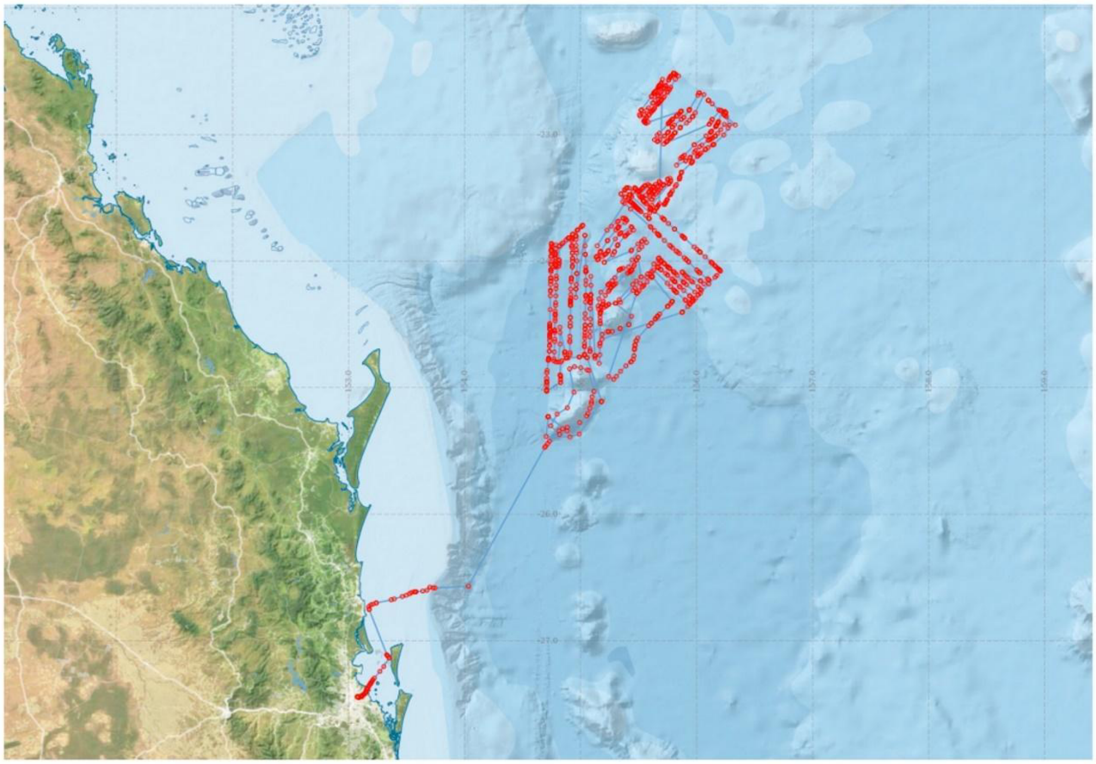

Figure 9. Map of seabird observations made during the expedition. Red dots show the positions of seabird observations. Note that observations were limited to daylight hours for onboard observers.

Figure 10. Example of a Masked Booby (*Sula dactylatra*) flying close to R/V *Falkor*. Photo by Eric Woehler.

Scientific name	Common name	Occurrences	Birds
Puffinus pacificus	Wedge-tailed Shearwater	758	14857
Sula sula	Red-footed Booby	251	1381
Sula dactylatra	Masked Booby	157	375
Sterna anaethetus	Bridled Tern	80	302
Sula leucogaster	Brown Booby	79	436
Puffinus carneipes	Flesh-footed Shearwater	25	16
Pterodroma rostrata	Tahiti petrel	24	20
Fregata minor	Great Frigatebird	19	15
Sterna fuscata	Sooty Tern	18	47
Larus novaehollandiae	Silver Gull	15	753
Sterna bergii	Crested Tern	12	302
Phaethon rubricauda	Red-tailed Tropicbird	10	9
Fregata ariel	Lesser Frigatebird	8	13
Phalacrocorax varius	Pied Cormorant	8	28
Phaethon lepturus	White-tailed tropicbird	6	5
Sterna spp	tern spp	5	203
Ardea alba	Great Egret	4	8
Sterna sumatrana	Black-naped tern	4	1
Pelecanus conspicillatus	Australian Pelican	3	47
Anous stolidus	Brown Noddy	3	27
jaeger spp	jaeger spp	2	1
petrel spp	petrel spp	2	1
Puffinus tenuirostris	Short-tailed Shearwater	1	1
Phalacrocorax melanoleucos	Little Pied Cormorant	1	40
Pterodroma macroptera	Great-winged Petrel	1	1
Phaethon spp	Tropicbird spp	1	0
Stercorarius parasiticus	Arctic Jaeger	1	1
Phalacrocorax carbo	Black Cormorant	1	1
Haliastur indus	Brahimny Kite	1	1
Sterna nereis	Fairy Tern	1	2
Pterodroma inexpectata	Mottled Petrel	1	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	1	2

Table 2. List of seabirds recorded during the expedition.

Magnetometer

Existing magnetometer lines were collected in an east-west orientation in the 1970s, which is not the most favorable orientation to identify the tectonic structure of the northern Tasman Sea basin (Figure 11). During the FK201228 voyage, opportunistic magnetometer lines were collected using a towed Marine Magnetics SeaSPY2 magnetometer along the ship track. The ten new lines were collected in a favorable orientation (generally southwest to northeast) and roughly perpendicular relative to tectonic structures seen as gravity anomalies from satellite data. The new magnetometer data will be combined with the previous magnetometer data, and the subsequent FK210206 voyage magnetics data, to help refine tectonic reconstructions of the seafloor underlying the Tasman Sea basin, including the opening of the Tasman Sea.

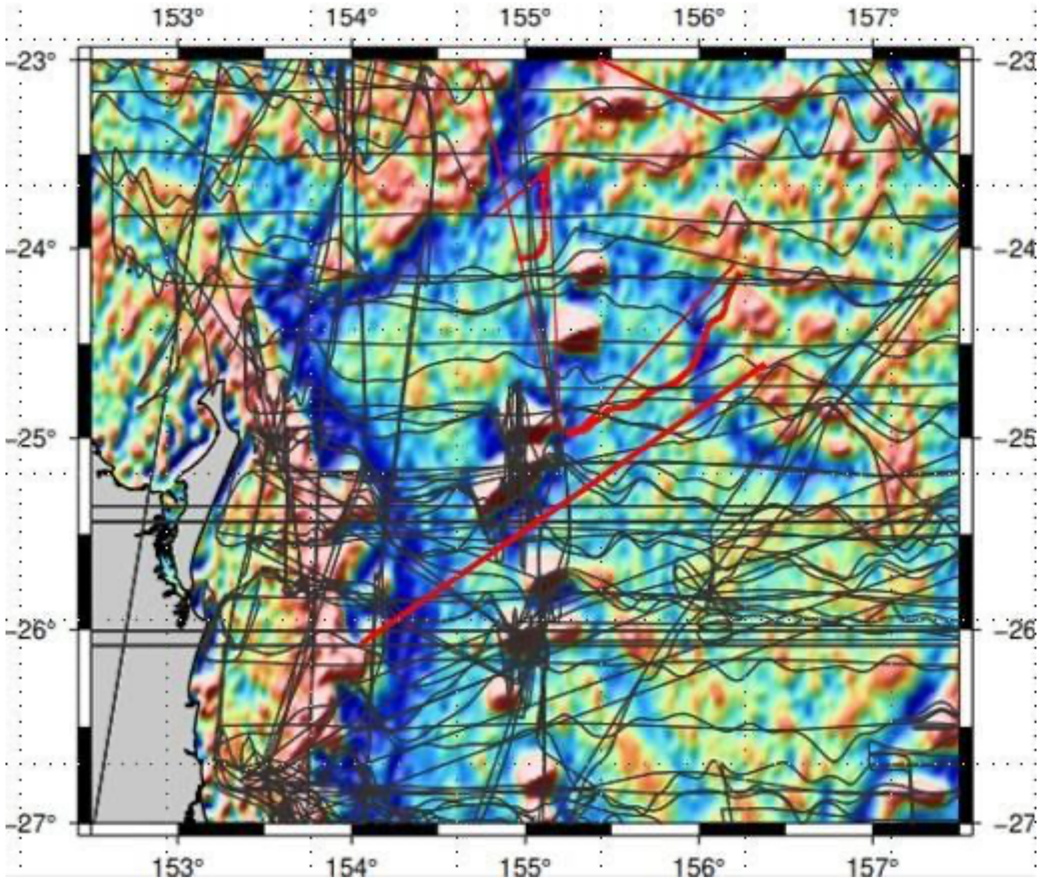

Figure 11. Existing magnetometer (black) lines across the northern Tasman Sea basin study area showing deep tectonic fabric and satellite gravity anomalies. Red lines indicate towed magnetometer lines conducted during the FK201228 voyage along with bulk magnetic directions.

Oceanographic Data

The *Falkor's* onboard OS75 Acoustic Doppler Current Profiler (ADCP) system, which provides current velocity data to ~800 m depth, was run continuously along the ship track throughout the expedition. This allowed for observation of eddies and prevailing currents in the upper layers of the ocean and their interaction with the seamounts and complex seafloor of the north Tasman Sea. The ADCP data map (Figure 12) shows that the currents are generally flowing westerly, possibly linked to the westerly-flowing surface current South Caledonian Jet (SCJ).

At a finer-scale, on the relatively shallow Chesterfield Plateau to the east of Cato Reef/Seamount, an interesting counter-clockwise circulation pattern is evident in the ADCP data, which matches with a similar counter-clockwise surface eddy shown in satellite data observed from IMOS Ocean Currents map for the same time period. The ADCP data indicate that the subsurface currents are also influenced by topography and display interesting finer-scale flow and eddies around the Recorder and Fraser seamounts. These data reveal how these tall (~3500-4000 m height) seamounts steer oceanic currents around their edifice.

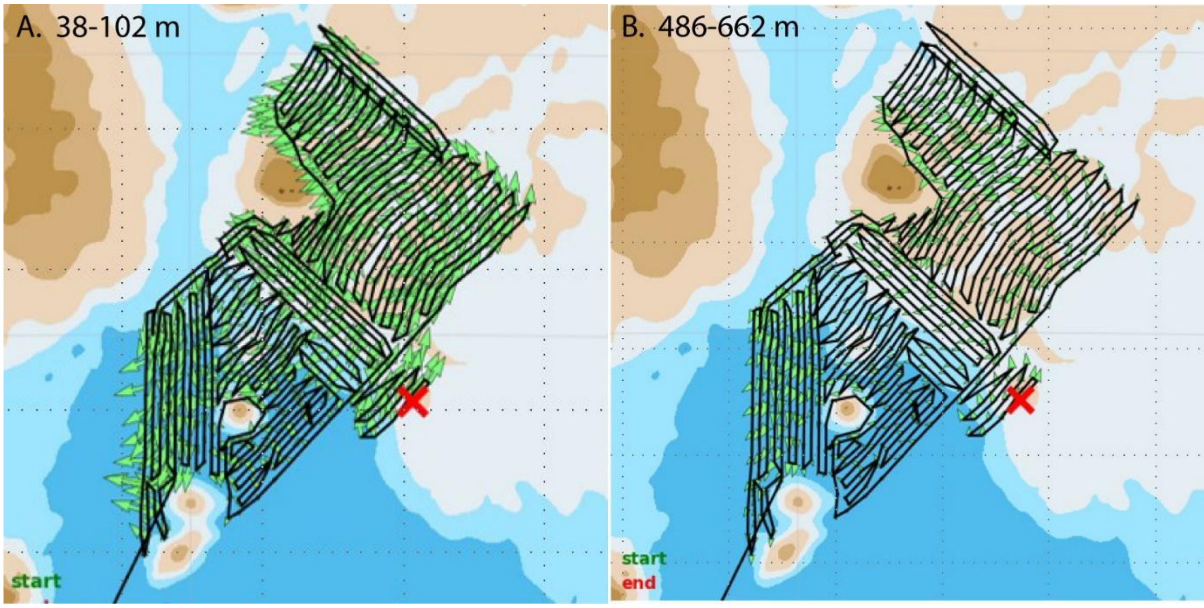

Figure 12. OS75 ADCP data collected during the expedition. (A) Reference layer depth range 38-102 m. (B) Reference layer depth range 486-662. Oceanic currents generally flow in a westerly direction, possibly linked to the South Caledonia Jet (SCJ) which is the prevailing current for this latitude.

Additionally, three deep Conductivity, Temperature Depth (CTD) casts were deployed during the expedition: CTD0001 about 20 km southwest of the South Fraser Seamount; CTD0002 75 km northeast of Cato Reef on the Chesterfield Plateau; CTD0003 28 km south of the Recorder Seamounts (Table 3). The CTD sensor measurements provide information about the water mass characteristics of the different layers in the ocean, which all have unique properties depending on their sources, mixing, and currents at different depths.

An example of the data from the 4500 m deep CTD0003 dip (Figure 13) shows a shallow halocline at ~20 m, then a subsurface peak in salinity and oxygen. Low oxygen and evidence of mixing lies between 150-500 m. This upper layer overlies the low salinity, high oxygen Antarctic Intermediate Water (AAIW) between 500-1000 m. Below AAIW are the low oxygen, Circumpolar Deep Waters (CDW) between 1000-4500 m. Water samples taken with Niskin bottles during CTD0003 confirmed the cold (1.2°C) and relatively salty (1534 psu) and dense nature of the CDW near seabed, which originate from the Southern Ocean and Antarctica.

Date	Time	Sample Name	Event	Longitude	Latitude	Depth
2021-01-04	03:58:22.542 Z	FK201228_CTD0001	Deployed	155.186267	-24.615023	4448
2021-01-16	22:04:13.784 Z	FK201228_CTD0002	Deployed	156.246235	-22.822605	2104
2021-01-24	20:32:19.000 Z	FK201228_CTD0003	Deployed	154.907103	-25.525414	4631

Table 3. Date, time and position of three deep CTD casts taken during the expedition.

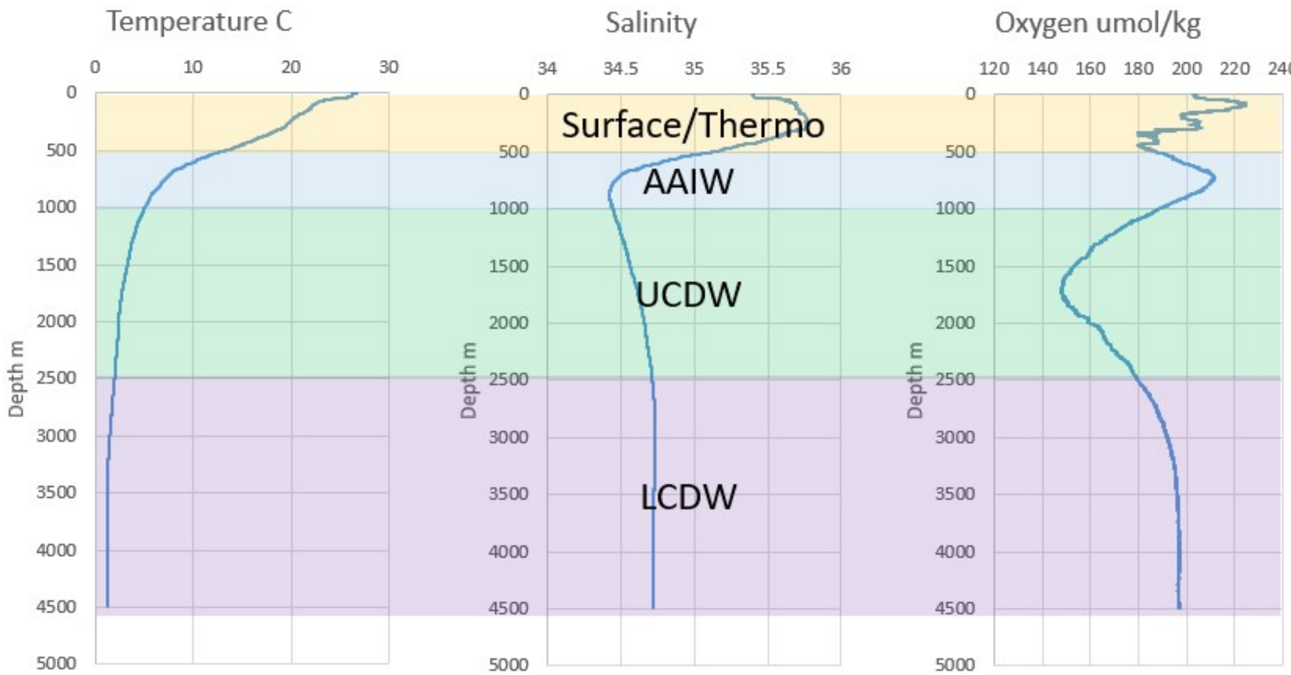

Figure 13. Temperature, salinity, and oxygen profiles for CTD0003. The mixed Surface/Thermocline water mass to 500 m overlies AAIW (Antarctic Intermediate Water) to 1000 m, then UCDW (Upper Circumpolar Deep Water) to 2500 m, and LCDW (Lower Circumpolar Deep Water) to 4500 m.

Microplastics

Forty surface water samples were obtained from *Falkor*'s underway cooling system and four CTD water samples were taken from CTD0003 at depths: 5, 50, 800 and 4500 m. These water samples were filtered for microplastics (Figure 14). A new microplastics sampling protocol was developed to sample directly from the underway seawater system onboard and from the CTD water samples, which attempted to eliminate any major sources of contamination. Preliminary results suggest that there are microfibers (<5 mm in size) present in every sample from the surface to depths of 4500 m.

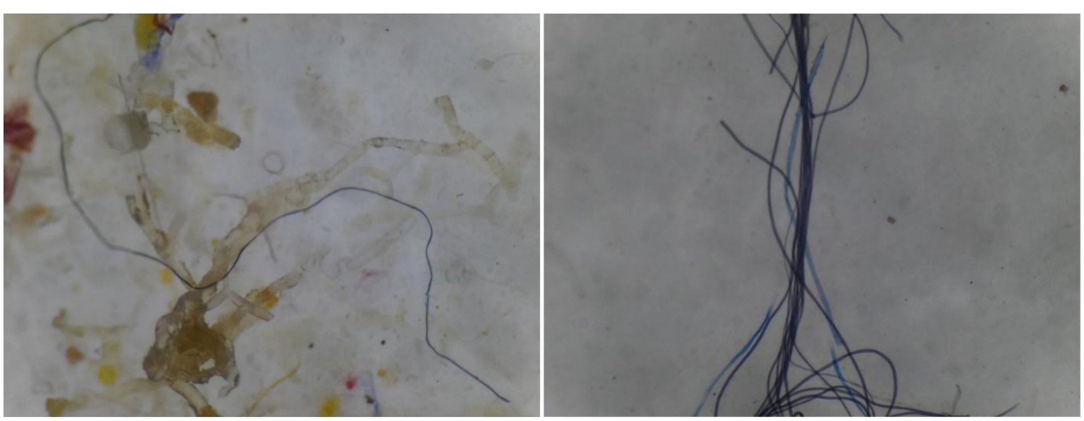

Figure 14. Photos of microplastics found in water samples viewed under microscrope at magnification of 45x. Pictures show long dark-colored microfibers mixed with organic material.

2.2 Post-Expedition Activities and Accomplishments

Multibeam data

The EM302 and EM710 multibeam data were submitted to Geoscience Australia for publishing/download in the AusSeabed Marine Data Portal and to the GEBCO database for contribution to the Seabed 2030 Project. The Seabed 2030 project is an ongoing global effort to map the Earth's entire seabed by the year 2030. Having a complete map of the ocean floor will aid in better understanding ocean circulation patterns and is vital for the sustainable development of the Blue Economy, natural hazard mitigation, and the establishment of marine protected areas.

The multibeam data around Cato, Fraser and Recorder seamounts were utilised for a PhD project by Alysha Johnson at the University of Wollongong. The thesis, titled "Geomorphic Evolution of Oceanic Volcanoes in the Southwest Pacific" was submitted in June 2024, and is presently under examination. The data collected on this expedition were combined with multibeam data collected on a 2021 *Falkor* expedition with existing data from AusSeabed. High-resolution geomorphic maps and morphometric analysis were produced of nineteen of the volcanoes within the Tasmantid Seamount Chain, together with a conceptual model of the geomorphic evolution of these volcanoes.

Seabird observations

The Tasman and Coral Seas have never been surveyed in such a systematic way before, and the data will help the management of the Coral Sea Marine Park. The seabird observation data contributes to a much larger database of Australian seabirds that Dr. Eric Woehler has been developing to understand these protected species in the waters around Australia. These data, combined with other seabirds at sea data, were used to publish a paper: "Seabird assemblages are linked to the major western boundary current off eastern Australia" (see publications below)

Magnetic data

The magnetic data were used as basis for the following FK210206 voyage. Post-cruise magnetic modeling and integration with existing seismic data aim to determine the nature and age of the basin and specifically the last tectonic spreading in the northern Tasman Sea basin. Despite a dampened signal (owing to sedimentation), the combined magnetics datasets hold clues for the geological evolution of the Tasman and Coral seas and the microcontinent of Zealandia as part of a project led by Prof. Dr. Derya Gürer (Heidelberg University, Germany) with A/Prof. Roi Granot (Ben Gurion University of the Negev, Israel). This tectonics study based on new geophysical data will be used to determine the nature of the crust, which has first order implications for the breakup history of Gondwana and the outlines of the submerged portions of Zealandia.

Oceanographic data

The CTD and ADCP oceanographic data have been combined with data collected during the subsequent FK210206 voyage. These combined datasets have been used for student thesis projects at the University of Queensland (see publications below).

Microplastics sampling

The CTD and ADCP data will be used in conjunction with the microplastic samples to understand the distribution and source of the plastics. This will likely be a future student postgraduate project at the University of Queensland.

2.3 Software Utilized

- QPS Fledermaus and Qimera software: https://qps.nl/
- Teledyne CARIS HIPS&SIPS software: https://www.teledynecaris.com/en/HOME/
- ESRI ArcGIS software: https://www.esri.com/en-us/arcgis/products/index

3 Impact to date

This R/V *Falkor* expedition ended the year 2020 and began 2021 on a month-long investigation in the Tasman and Coral seas to conduct uninterrupted, broad-scale seafloor mapping, and to observe the concentration of seabirds in the area. The *Falkor* collected the first multibeam data ping of the UN Decade of Ocean Science for Sustainable Development, which began on January 1, 2021. *Falkor* was the first ship to fly the Seabed 2030 initiative flag while collecting seafloor mapping data.

The mapping efforts concentrated on a large, previously unmapped survey area over the Chesterfield Plateau and along the chain of Tasmantid Seamounts within the northern Tasman Sea. A magnetometer was also towed during select, long transects to provide further insight into the geological formation of the northern Tasman Sea basin and the adjacent Chesterfield Plateau. Over 40,000 square km of seafloor was mapped and the data made publicly available.

At-sea seabird observation data were collected using standard protocols to establish baselines in the region. The goal of the seabird study was to better understand species distribution over space and time, which is often influenced by seafloor features and ocean productivity. Some 19,000 seabirds were observed with over 20 different species. These observation data have been compiled together with other observation records to generate a peer-reviewed publication (see publications below).

The expedition was an important opportunity to train five postgraduate students and an early career researcher in blue water marine science skills, particularly at the time of COVID when such field trips were rare anywhere in the world. The scientists would like to acknowledge Captain Peter Reynolds and the crew and marine technicians for all their help and expertise in making the expedition such a success.

4 Data

Datasets acquired during this expedition and those derived from the analysis of collected data and samples as of the date of this report's publication.

Dataset	Repository	Completed
Raw environmental sensor data	Rolling Deck to Repository	Yes
Multibeam backscatter, bathymetry, magnetics and navigation	MGDS	Yes
ADCP	University of Hawaii Data Acquisition System	Yes
Multibeam data (processed)	CUBE-gridded bathymetry data available on the AusSeabed Marine Data Portal: *Search Map Layers > Elevation and Depth > Bathymetry – Survey > 'Tasman and Coral Seas Bathymetry 2021 64m'*	Yes
Seabird observation records	Commonwealth Scientific and Industrial Research Organisation and Ocean Biodiversity Information System (OBIS)	Yes
Google Earth	Google Earth KMZ files of ship track, multibeam	Yes
Multibeam images	Geotif hillshade images of multibeam data	Yes
Shapefiles	Zipped shapefiles of 1 min interval ship track as point shapefile and equivalent line shapefile	Yes
Ship track	Excel spreadsheet of 1 min interval ship track	Yes

Table 4. List of all publicly available data.

5 Publications

Daudt, N.W., Woehler, E.J., Schofield, M.R., Smith, R.O., Bugoni, L., Rayment, W.J., 2024. Seabird assemblages are linked to the major western boundary current off eastern Australia. Progress in Oceanography 223. doi: 10.1016/j.pocean.2024.103215.

Johnson, A., 2021. Bathymetric exploration of the Tasman and coral seas aboard the R/V *Falkor*. Quaternary Australasia 38(1), 11-13. doi: 10.3316/informit.891792655549501.

6 Appendix

6.1 Science Party Information

Scientist	Institution
Robin Beaman	James Cook University
Helen Bostock (onboard)	University of Queensland
Brendan Brooke	Geoscience Australia
Jody Webster	University of Sydney
Colin Woodroffe	University of Wollongong
Will White	Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Kevin MacKay	National Institute of Water and Atmospheric Research (NIWA)
Kim Picard	Geoscience Australia
Alysha Johnson (onboard)	University of Wollongong
Derya Gürer (onboard)	University of Queensland
Maria Seton	University of Sydney and EarthByte Group
Martin Russell	Coral Sea Marine Park
Eric Woehler (onboard)	BirdLife Australia and University of Tasmania
Sienna Blanckensee (onboard)	University of Queensland
Gemma Rushton (onboard)	University of Tasmania
Rebekah Bradshaw (onboard)	University of Sydney
Kate Malloy (onboard)	James Cook University

Table 5. List of scientists and students during the expedition.

6.2 Conferences/Presentations/Posters

- Beaman, R.J., 2021. Schmidt Ocean Institute RV *Falkor* Australia campaign 2020-2021, Queensland–Smithsonian Fellowship Speaker Series. Oceans: life on the edge, 16 November 2021. Queensland Department of Environment and Science - Smithsonian Institution, Remote conference, pp. 13. Available at: https://www.deepreef.org/2021/11/17/soirvfalkor-australia/
- Beaman, R.J., 2021. Schmidt Ocean Institute RV *Falkor* Australia campaign 2020-2021, SubCommittee on Regional Undersea Mapping (SCRUM), GEBCO Week, 11-15 January 2021. General Bathymetric Chart of the Oceans (GEBCO) www.gebco.net, Virtually from Paris, France. Available at: https://www.deepreef.org/2021/01/13/soi-falkor-campaign/

- Johnson, A.M., Dickson, M.E., Hamylton, S., Woodroffe, C.D., 2023. Geomorphic and slope analysis of the Tasmantid Seamount Chain. GeoHab Conference. La Réunion, France
- Johnson, A.M., Dickson, M.E., Hamylton, S., Woodroffe, C.D, 2023. Geomorphic evolution of oceanic volcanoes in the south-west Pacific. University of Wollongong SEALS HDR Symposium. Wollongong, Australia
- Johnson, A.M., 2022. Geomorphic evolution of oceanic volcanoes in the South-West Pacific. Hydrospatial. Cairns, Australia
- Johnson, A.M., Beaman, R.J., Bostock, H. C., Brooke, B.P., Gürer, D., Woodroffe, C.D., 2022. Geomorphology of the Tasmantid seamounts, guyots and carbonate reefs. Ocean Science Meeting
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- Johnson, A.M., Beaman, R.J., Bostock., Gürer, D., Woodroffe, C.D., 2021. Preliminary interpolation of multibeam bathymetry collected by the R/V *Falkor* during 2021 in the Tasman and Coral seas. GeoHab Conference. Canberra, Australia

6.3 Student Projects, Thesis, and Dissertations

- Johnson, A.M., 2024. Geomorphic Evolution of Oceanic Volcanoes in the Southwest Pacific. Doctoral Thesis. University of Wollongong. Wollongong, Australia (under examination July 2024)
- Jeffers, M., 2021. Intermediate and deep-water circulation of the Tasman Sea and Cato Basin based on oceanographic and seafloor bathymetric data. BSc-GEOS3400 Research Topic Thesis. University of Queensland. Brisbane, Australia, pp. 32.

6.4 Cruise Records

- Cruise Logs.

6.5 Media

- SOI media release First New Seafloor Map of the Decade Collected on New Year's Expedition in Australian Waters: https://schmidtocean.org/first-new-seafloor-map-of-the-decade-collected-on-new-years-expedition-in-australian-waters/.
- Onboard interviews took place with Radio ABC Sydney, Radio ABC Brisbane, Nine News Queensland and ABC San Francisco.
- YouTube video: SOI and Intergovernmental Oceanographic Commission of UNESCO Partnership to Support Ocean Decade: https://www.youtube.com/watch?v=aojO7Y9Tt0A.
- YouTube video: Schmidt Ocean Institute's 2020 Year in Review: https://www.youtube.com/watch?v=V_q9XHMnsVo.
- YouTube video: Pinging in the New Year: https://www.youtube.com/watch?v=jI6047Vct2s.
- YouTube video: Weaving Underwater 3D Landscapes ft. Jessica Leitmanis Artist at Sea: https://www.youtube.com/watch?v=Fj_02meh0Uk.

- YouTube video: RV *Falkor* Live - Ship2shore with eXXpedition: https://www.youtube.com/watch?v=MgLoxZRExy8.
- Ship to shore outreach events with Ocean Discovery Institute - San Diego; National Youth Science Forum – Canberra; eXXpedition Eckard College - Florida.

6.6 Community Outreach

- Gürer, D., April 2021. "From microplates to microplastics". UQ-Women in Science Research Networking Night.
- Bostock, H., June 2021. "UN Ocean Decade". Talk for World Ocean Day.
- Gürer , D., June 2021. "*Falkor* voyages". Talk for World Ocean Day.
- Gürer, D., July 2021. "What is at the bottom of the ocean?" Fig Tree Pocket Kindergarten, Brisbane.
- Bostock, H., July 2021. Talk for Queensland Marine Teachers Professional Development.
- Bostock, H., Sept 2021. Talk for Queensland Marine Teachers Association Annual Conference.
- Bostock, H., November 2021. "Plastic pandemic". University of Queensland outreach program - Young Change Makers 2021.
- Johnson, A.M., 2021. "Voyaging aboard the R/V *Falkor*: Guyots and reefs in the Tasmantid Seamount Chain". University of Queensland HDR Presentation Seminars.
- Johnson, A.M., 2021. "Using bathymetry to explore the seafloor". Interaction Magazine, 49(4), 21 -23. Article in support of AusSeabed as example in use of bathymetric mapping.

6.7 Daily Diary

Monday 28 December 2020

Wind 14 knots from 020°. Sea state 3. Nil swell.

0900 in position 27.388638°S 153.156505°E in Brisbane River.

At 0800, the *Falkor* left its berth position at Hamilton Wharf and headed out of the Brisbane River for the start of "Pinging in the New Year: Mapping the Tasman and Coral Seas". At 0900, the ship entered Moreton Bay for the ~3-hour pilotage through the bay. Seabird observations commenced inside Moreton Bay with the birding team comprised of Eric Woehler and Gemma Rushton. By 1230, *Falkor* had completed the pilotage and headed east across the shallow shelf east of Stradbroke Island towards the deeper shelf edge. At 1420, the Kongsberg EM302 multibeam system was turned on for the start of this significant mapping-focused expedition. At 1630, *Falkor* crossed the shelf and commenced mapping down the steep continental slope heavily incised with canyons. Depths dropped rapidly to ~3500 m. At 1800, the ship turned northward to edge map the existing multibeam data lying at the bottom of the continental slope. Depths were ~3800 m cutting across the foot of canyons lying on the slope. The *Falkor* continued northward towards the start of the large mapping box in the northern Tasman Sea.

Tuesday 29 December 2020

Wind 14 knots from 070°. Sea state 3. Low swell.

0900 in position 25.122053°S 155.092307°E in vicinity of Recorder Seamount.

Just after midnight, the *Falkor* left the continental slope and headed northwest across the Tasman Sea basin towards the southernmost Recorder Seamount. Depths were ~4600 m and generally flat.

At 0500, the ship arrived at the base of the Recorder Seamount and commenced mapping the eastern lower flanks of the seamount in depths ~2600 m. The seafloor was very rugged indicating hard rock, likely basalt. By 1200, the ship had rounded the top of the northernmost Recorder Seamount in depths ~2500 m. *Falkor* had completed the first full lap around the base of both Recorder Seamounts by 1715. For the next lap, depths were deeper and farther away from the flanks at around 3300 m. Very high backscatter reflectance showed a seafloor as hard rock exposed at the seafloor.

Wednesday 30 December 2020

Wind 14 knots from 115°. Sea state 4. Low swell.

0900 in position 25.331012°S 155.067142°E in vicinity of Recorder Seamounts.

R/V *Falkor* continued a counter-clockwise mapping loop around the Recorder Seamounts through the early morning and at sunrise was back to the eastern side of the seamounts in depths ~4500 m. The multibeam settings were in Very Deep mode, with swath coverage width 6-7 km. These third passes around the base of the seamounts clearly show the base where it merges into the flat Tasman Sea basin, and also shown in the change in backscatter reflectance from high to low reflectance pixels as the seafloor becomes progressively more sediment-covered. By 1400, *Falkor* had completed three laps of the seamount and was at the northern end of the seamount in depths ~4300 m. The base of the flanks was nearly completely mapped, so the aim was to do one last lap around the seamount and then start longer, straight transects across the basin. By 1900, the ship was well within the basin in depths ~4000 m then turned northward to commence long north-south transects across the basin in the vicinity of the seamounts.

Thursday 31 December 2020

Wind 21 knots from 100°. Sea state 4. Low-moderate swell.

0900 in position 24.500704°S 154.734264°E in vicinity of Recorder Seamounts.

Overnight, *Falkor* worked mapping the western side of the Recorder Seamounts filling in the gaps up to the western boundary of the large box. Poor weather and stronger winds led the ship to conduct long north-south transects, so by 1000 the ship was 50 km west of the Fraser Seamounts. ADCP data collected during the north-south transect showed a westerly-flowing water mass, likely the South Caledonia Jet, at depths below 200 m. The poor weather reduced seabird observations. At 1400, the ship reached the top of the first north-south long transect near the opening to the Cato Trough, so then reversed course and commenced the southward transit back towards the Recorder Seamounts. Heading south back into the swell resulted in rough seabed returns with many dropped pings. Water depths were around 3800 m. With data quality quite poor, the decision was made to reverse course at 1700 and try a different northeast track to minimise effect on ship and mapping. At 1830, the SeaSPY2 magnetometer was deployed over the side, towed behind the ship on 300 m of cable while the ship transited across the opening to the Cato Trough.

Friday 01 January 2021

Wind 19 knots from 115°. Sea state 4. Low-moderate swell.

0900 in position 24.152411°S 154.789080°E in vicinity of Fraser Seamounts.

With the weather continuing to be windy, *Falkor* transited northeast towards Cato Reef, then reversed course back towards the entrance to the Cato Trough. At 0700, the ship commenced a southward leg back towards the Recorder Seamounts in depths ~4100 m. This day was the first day of the UN Decade of Ocean Science and *Falkor* would be one of the first vessels collecting ocean mapping data for the start of the Decade. At 1400, *Falkor* reached the end of the long southward leg, then turned around at a point about 20 km northwest of the North Recorder Seamount, and then commenced the next north-going leg in depths 4200 m.

Saturday 02 January 2021

Wind 17 knots from 120°. Sea state 4. Low swell.

0900 in position 24.329260°S 154.913899°E in vicinity of Fraser Seamounts.

R/V *Falkor* had remained on north-going leg through the night and by 0900 was 40 km west of Fraser Seamount. Depths were ~4300 m over the flat northern Tasman Sea basin. Weather conditions had improved so the quality of the multibeam data was better than previous days. By 1300, the ship had reached the northern end of the long north-south transect about 50 km northwest of the North Fraser Seamount. This area is the very northern part of the Tasman Sea basin and depths were ~3700 m. The ship then turned around and commenced the long southward transit back towards the Recorder Seamounts. At 1600, the ship passed over the faint edge of a low-relief channel, likely draining the entrance to Cato Trough. At 2030, *Falkor* reversed course and commenced the northward transit back towards Cato Trough.

Sunday 03 January 2021

Wind 12 knots from 110°. Sea state 3. Low swell.

0900 in position 24.372469°S 155.041246°E in vicinity of Fraser Seamounts.

Overnight, *Falkor* continued the northward transect and then reversed course southward towards the Recorder Seamounts. At 0900, the ship was about 25 km west of the South Fraser Seamount in depths ~4300 m. Weather conditions were improved and mapping data quality was good. At 1200, the ship reached the end of the southward-going leg near the Recorder Seamounts, then reversed course to head back northward towards the Fraser Seamounts. At 1400, while on the northward transit, the multibeam data revealed the western limit of the base of the South Fraser Seamount, shown by the higher reflectance backscatter. With night-time, the ship crossed the low-relief channel draining out of the Cato Trough. The depth of the channel is 4060 m, flat floored, and 1-2 km wide. At 2030, the ship reached the north limit of the long transect at the entrance to the Cato Trough, then reversed course and commenced the southward transect back to the Recorder Seamounts. It is taking about 8-9 hours to do each of these north-south transects.

Monday 04 January 2021

Wind 10 knots from 100°. Sea state 3. Low swell.

0900 in position 24.348227°S 155.228811°E in vicinity of Fraser Seamounts.

Overnight, the *Falkor* continued the north-south transit over the northern Tasman Sea basin, then at 0830 commenced edge mapping previous map data around the western flank of the South Fraser Seamount. Depths were around 3300 m with distinct variations on backscatter reflectance. The ship continued to map around the base of the South Fraser Seamount in a clockwise direction. At 1340 after a circuit around the South Fraser Seamount, the ship came to a stop 23 km southwest of the summit, to conduct a deep CTD test of the winch and cable to a depth of 4500 m. The CTD test was completed at 1830, then the ship commenced a southward mapping transit between the Fraser and Recorder seamounts. At 2200, the ship turned east and deployed the magnetometer for a pass across the north Tasman Sea towards the Chesterfield Plateau.

Tuesday 05 January 2021

Wind 05 knots from 130°. Sea state 2. Low swell.

0900 in position 24.000851°S 156.115988°E in vicinity of Chesterfield Plateau.

The easterly transect to the Chesterfield Plateau was completed at 0810 and the magnetometer recovered on board. The *Falkor* then turned northwest for a long transit along the Chesterfield Plateau. The aim was to take advantage of the good weather window to map this direction, so that when weather turned bad, most of the Chesterfield Plateau margin had been mapped. Depths were around 2000 m. The mapping is revealing a more complex seafloor topography compared to the deeper Tasman Sea basin mapped during the first week of the expedition. Here, depths range from ~2000 to 1800 m, with very low depressions – possibly parts of broad valleys – appearing. Occasional brighter backscatter reflectance and localised rises in the seafloor, point to the possibility of small volcanic cones protruding through the background sediment. More mapping in the area will resolve if these are volcanic cones. At 1530, the ship reached the end of the southeast-northwest transect, close to the Cato Reef, then turned around and commenced a northwest-southeast transect away from Cato Reef.

Wednesday 06 January 2021

Wind 06 knots from 150°. Sea state 2. Low swell.

0900 in position 23.655743°S 155.510426°E in vicinity of Chesterfield Plateau.

With calm weather, the workboat was deployed to test engines and take photos of the *Falkor* on flat seas. At 0900, the *Falkor* was near the northern end of the northwest-southeast transects across the Chesterfield Plateau margin, in depths of ~2200 m. By 1500, the ship had reached the southern end of the northwest-southeast transect, taking about 24 hours to do three legs of these transects. Depths were about 2500 m at this southern leg, so depths drop about 300 m from 2200 m in the north to 2500 m towards the southern mapped area of the Chesterfield Plateau. Backscatter appears relatively uniform across these deeper parts of the plateau. The ship continued the northwest-southeast transects through the night taking advantage of the good weather.

Thursday 07 January 2021

Wind 12 knots from 160°. Sea state 3. Low swell.

0900 in position 24.048404°S 155.755821°E in vicinity of Chesterfield Plateau.

Weather conditions remained good and so *Falkor* mapped along the northwest-southeast transects across the Chesterfield Plateau through the morning. Poor weather was expected by end of the day, so likely would require a change in transit direction. Depths were around 3500 m, dropping relatively quickly into the northern Tasman Sea basin. At 1400, the ship had progressed far enough westward so as to map the base of the plateau margin where it met with the flat Tasman Sea basin. Depths were around 3800 m. The mapped area to date was 14,000 square km, with 1800 nautical miles travelled. As the weather deteriorated, shorter southwest-northeast lines were initiated over the Tasman Sea basin.

Friday 08 January 2021

Wind 21 knots from 120°. Sea state 4. Low-moderate swell.

0900 in position 24.744864°S 155.459379°E in vicinity of Fraser Seamount.

Poor weather overnight resulted in short southwest-northeast lines over the Tasman Sea basin so aligned with the wind direction to help reduce the effect on mapping data quality. Depths were around 4500 m and relatively flat as expected over the basin. Weather continued to deteriorate through the evening, so that progress remained slow and mapping data quality reduced in the higher seas.

Saturday 09 January 2021

Wind 27 knots from 130°. Sea state 4-5. Moderate swell.

0900 in position 24.447073°S 155.547064°E in vicinity of Fraser Seamounts.

With poor weather and strong winds, the ship turned into the southeast winds to ride out the worst weather and reduced the speed. With daybreak, the *Falkor* recommenced short southwest-northeast lines in the vicinity of South Fraser Seamount. Depths were about 4500 m as the ship mapped closer and closer to the base of the South Fraser Seamount. Through the remaining daylight hours, the ship continued mapping closer to the base of the seamount, so that by 1900 the gap lying on the southern side of the South Fraser Seamount was nearly all mapped with the base of the seamount fully revealed. However, weather conditions remained marginal into the evening and so the ship kept speeds to ~7 kn to cope with the rough seas.

Sunday 10 January 2021

Wind 21 knots from 135°. Sea state 4. Low-moderate swell.

0900 in position 24.145793°S 155.599826°E in vicinity of Fraser Seamounts.

Weather is still windy but slowly improving. Overnight, *Falkor* focused mapping effort northeast of the North Fraser Seamount filling in data gaps between the seamount and the Chesterfield Plateau margin. The ship continued short southwest-northeast lines, then at 0930 deployed the magnetometer. The aim was to detect magnetic variability across the Tasman Sea basin while transiting at ~90° to the extinct spreading ridge. The ship continued mapping the area east of North Fraser Seamount.

Monday 11 January 2021

Wind 24 knots from 130°. Sea state 4. Low-moderate swell.

0900 in position 24.296020°S 155.200643°E in vicinity of Fraser Seamounts.

Through the early morning, the *Falkor* fully mapped the area east of North Fraser Seamount, then from daybreak on, worked on mapping the area directly north of the South Fraser Seamount. Transit lines were short southwest-northeast lines to edge map and complete the mapping between the two adjacent seamounts. Depths were ~3700 m and clearly showed where the bases of the seamounts merged into the flat basin. From 1100, the ship commenced transits around the flat guyot top of the North Fraser Seamount. Depths around the base were ~4000 m, then rose suddenly up steep flanks to a summit of ~1200 m. After passing the summit, the *Falkor* continued northeast towards the Chesterfield Plateau margin. Depths became progressively shallower to ~3000 m, then the ship reversed course and headed back towards the North Fraser Seamount. The remainder of the day was spent mapping along the northern Tasman Sea basin around the seamount.

Tuesday 12 January 2021

Wind 20 knots from 120°. Sea state 4. Low swell.

0900 in position 23.746394°S 155.382847°E in vicinity of Fraser Seamounts.

R/V *Falkor* continued mapping on the north-western side of the North Fraser Seamount over the remaining unmapped area of the Tasman Sea basin. The ship conducted short southeast-northwest lines between the deeper basin and the gradual rise of the Chesterfield Plateau margin. Depths were around 3600 m with indications of slumping on the margin itself. By midday, the ship was mapping well into the far northern part of the Tasman Sea basin towards the entrance to Cato Trough in depths ~3800 m. Through the afternoon and evening, the *Falkor* continued to close the last gaps in the area northwest of North Fraser Seamount. Within this gap, the ship mapped higher up onto the margin at the western side of the entrance to Cato Trough in 2300 m depth.

Wednesday 13 January 2021

Wind 19 knots from 125°. Sea state 4. Low swell.

0900 in position 23.427259°S 155.613322°E in vicinity of Cato Reef.

In the early morning, the *Falkor* completed the last gap remaining northwest of the North Fraser Seamount and over the Chesterfield Plateau margin. The ship then headed towards Cato Reef, edge mapping around the limits of previously collected multibeam data. At 0900, the *Falkor* was 14 km south of Cato Reef and mapping new parasitic cones on the surrounding seafloor in depths ~1500 m. These were likely cinder-like eruptions leaving small conical features ~100-200 m high scattered across the seafloor. Their hard surfaces contrast as white pixels against background soft sediments within the multibeam backscatter maps. The ship continued to map around the southern side of Cato Reef through the day. At 1830, an unusual shaped cone was mapped with a distinctly triangular shape in plan view with crests joined together in a tri-star shape.

Thursday 14 January 2021

Wind 15 knots from 140°. Sea state 4. Low swell.

0900 in position 22.535370°S 155.780210°E in vicinity of Cato Reef.

R/V *Falkor* continued mapping around the southern side of Cato Reef through the early morning, then mapped northward to about 50 km due north of Cato Reef. The ship then commenced southwest-northeast lines along the Chesterfield Plateau margin. At 1000, a Ship-to-Shore lecture took place with the Ocean Discovery Institute in San Diego, California, USA. By 1130, the mapping had detected numerous small gullies of canyons draining down the side of the margin into the Cato Trough. Sieving for microplastics using the shipboard water systems and bird observations continued through the daylight hours.

Friday 15 January 2021

Wind 15-20 knots from 109°. Low swell.

0900 in position 23.0079°S 155.7263°E in vicinity of Cato Reef.

R/V *Falkor* continued mapping southwest-northeast lines north of Cato Reef yesterday afternoon along the Chesterfield Plateau margin. There is evidence for a deep narrow gully off the northwest flank of Cato Seamount with a significant pinnacle and a hole within it. Farther northeast, there is a larger channel running in the southeast-northwest direction. The scientists hoped that further mapping of lines to the southeast would show the origin of this channel. At 1300, a Ship-to-Shore talk with Geoscience Australia and the National Youth Science Forum went well. Sieving for microplastics and bird observations from the observation deck continued throughout the day.

Saturday 16 January 2021

Wind 5.5 knots from 115°. Low swell.

0900 in position 23.0239°S 156.0554°E northeast of Cato Reef.

R/V *Falkor* continued mapping southwest-northeast lines north of Cato Reef yesterday afternoon along the Chesterfield Plateau margin. The wide channel running in a southeast-northwest direction continues towards the southwest and appears to branch in at least two directions, possibly three. The next few lines will give more detail. The aim is to map two more 4-hour lines in this direction and then deploy the magnetometer for two lines in the northwest-southeast direction along the northern edge of the lines, while the sea conditions are good. This is the preferred direction for magnetics data and will also help to improve the multibeam coverage edges within this box. ADCP currents show strong westerly flow in this region, possibly linked to the South Caledonia Jet. Marine microplastics sieving and bird observations continued, although because of the hot day today, observers needed to take regular breaks.

Sunday 17 January 2021

Wind 10 knots. Low swell.

0900 position 22.8229°S, 156.2464°E northwest of Cato Reef.

R/V *Falkor* mapped two long lines in the northwest-southeast direction overnight, towing the magnetometer in this preferred direction while the sea conditions were calm. Some interesting upper ocean flows were observed around this area within the ADCP data. Following a deep CTD dip in the morning after breakfast, the ship resumed mapping in the southwest-northeast direction to fill in the rest of the block east of Cato Reef. A few more small volcanic cones have become evident in the mapping data directly east of Cato Reef. The CTD showed a shallow halocline at ~20 m, then a subsurface peak in salinity and oxygen. Low oxygen and evidence of mixing lies between 150-400 m. This layer overlies the low salinity, high oxygen Antarctic Intermediate Water between 600-1000 m, with low oxygen, deep waters down to the seafloor at ~2200 m. The CTD was also sieved for microplastics. At the north-western end of the mapping area (mapped overnight on the magnetometer line), the currents changed from the dominant westerly direction to easterly, according to the ADCP data. At mid-morning, a fire and abandon ship drill was conducted. During the day, many seabirds and several bait balls were observed, including some common noddys. An oceanic white tip shark circled the ship during the CTD. Derya Gurer also gave a Science-at-Sea talk about microplastics and the eXXpedition citizen science project she is involved with.

Monday 18 January 2021

Wind 14 knots from the east. Low swell.

0900 position 23.7258°S, 155.8031°E east of Cato Reef on the Chesterfield Plateau.

Mapping continued overnight in the northeast-southwest direction east of Cato Reef on the Chesterfield Plateau. A few more cinder cones were mapped to the southeast of Cato Reef, but no other major features were evident. The plan today is to head northeast again and then while the weather is calm for the next two days, do several lines in the northwest-southeast direction to extend the mapping northward. This will expand the mapping coverage across the Chesterfield Plateau and get some more information on the strange currents seen at the northwest point of the area, which appear to switch from west to east. Seabirds and bait balls were observed through daylight hours. Sieving continued for microplastics from the ship's water systems.

Tuesday 19 January 2021

Wind 13 knots from the east. Low swell.

0900 position 23.2151°S, 156.2770°E northeast of Cato Reef on the Chesterfield Plateau.

R/V *Falkor* conducted two more lines in the northwest-southeast direction overnight and reconfirmed the easterly-flowing currents at the north-western tip of the region using the ADCP data. The additional lines clearly outline the slope of the east-west channel in the northern part of the area, with the channel curving to the north. There is some evidence of up to 5-20 m deep, ~150 m wide pockmarks in the multibeam data at the northeast end of the area. To the southeast of Cato Reef there are clusters of pinnacles/cinder cones still evident in the data. We will continue to map in a northeast-southwest orientation to fill out the region for the next few days before heading back to Brisbane. Another successful Ship-to-Shore talk was conducted this morning with eXXpedition about plastic in the ocean. Derya Gurer and Jess Leitmanis were in front of the camera, supported by Deb Smith. Seabird observations and sieving for microplastics continued throughout the day.

Wednesday 20 January 2021

Wind 25 knots from the east. Swell building.

0910 position 23.5460°S, 156.1329°E east of Cato Reef.

R/V *Falkor* has been slowly mapping east of Cato Reef and finally found the edge of the Cato seamount complex. After a slight smooth depression, it appears that the ship is now mapping a new rugged area to the east on the Chesterfield Plateau. Other channels and pinnacles became more evident coming off the Cato seamount complex. The ADCP data shows that the southwest end of these lines is again experiencing easterly currents. Seabird observations and sieving for microplastics continued. A Science-at-Sea talk was given by Kate Malloy about being a nurse, the medical equipment used on the ship, and what it is used for.

Thursday 21 January 2021

Wind 25-30 knots from the east. Significant swell.

0900 position 23.335°S, 156.573°E east of Cato Reef on the Chesterfield Plateau.

The *Falkor* continued to map in the northeast-southwest direction to fill in the rest of the box to match up with the original mapped area in the Tasman Sea Basin. A few lumps and bumps were evident on the Chesterfield Plateau from the mapping conducted yesterday and overnight. An interesting circulation pattern is evident in the ADCP data, which matches up well with eddies shown in satellite data from the IMOS Ocean Currents map. Weather conditions deteriorated with the morning too rough and windy for seabird observations on the Monkey deck. Bird observations recommenced in the afternoon as the sun came out and the wind dropping slightly. Microplastics sieving continued.

Friday 22 January 2021

Wind 18-20 knots from the east. Significant swell.

1330 position 23.4657°S, 156.6485°E east of Cato Reef on the Chesterfield Plateau.

The ship continued mapping in the northeast-southwest direction on the Chesterfield Plateau east of Cato Reef. Several lumpy areas and pinnacles were mapped, with a broad, relatively flat valley across the plateau surface mapped in a northeast-southwest direction, which may be filled in with sediment as there are no obvious features within it. A successful Ship-to-Shore talk was conducted at 0800 with Eckard College, Florida, USA.

Saturday 23 January 2021

Wind ~20 knots. Slight swell.

0900 position 23.6012°S, 156.7113°E east of Cato Reef on the Chesterfield Plateau.

The ship continued to map in the northeast-southwest direction to finish off the box east of the Cato Reef on the Chesterfield Plateau. More lumps and bumps were mapped on the plateau surface.

Sunday 24 January 2021

Wind 22-25 knots. Slight swell.

0900 position 24.5773°S, 156.0046°E on the Chesterfield Plateau slope.

R/V *Falkor* completed mapping the box on the Chesterfield Plateau yesterday, then commenced mapping the slope overnight from 2000 to >4000 m water depth in a northeast-southwest direction. This mapping direction was not optimal for mapping, but was the best direction for the weather being experienced. Swath mapping across track coverage is quite narrow within the Tasman Sea Basin, with only +/-32° beam angles for the depths >4000 m. Similar step-like features were observed on the slope, as seen farther north, but slightly steeper. These step-like features are likely due to sediment slumps through gravity, leaving hummock-shaped, step-like features down the slope. The ADCP data shows a current flowing north along the slope, possibly part of an eddy. Chief Officer Alan Doyle gave a talk in the library at 1030. The magnetometer was deployed in the afternoon for a long tow across the Tasman Sea during the return to Brisbane.

Monday 25 January 2021

Wind 12-15 knots. Very slight swell.

0900 position 25.5249°S, 154.9087°E south of the Recorder Seamounts, Tasman Sea Basin

R/V *Falkor* continued multibeam mapping and towing the magnetometer overnight from the Chesterfield Plateau slope to the Recorder Seamounts. The ship stopped at 0700 for a 4600 m deep CTD dip south of the Recorder Seamounts in the Tasman Sea Basin. The CTD is also an opportunity to sample for deep-water microplastics. On CTD recovery, the ship continued with another magnetometer line back towards the southeast Queensland shelf. This is the final transit back to Brisbane.

Tuesday 26 January 2021

Wind 12-15 kn. Nil swell.

0900 position 27.432557°S, 153.116387°E at Pinkenba wharf in the Brisbane River.

Through the night, the *Falkor* transited across the southeast Queensland shelf then shut down all multibeam systems at 0100, closing off the Qimera project. The ship collected the pilot for the transit across Moreton Bay and into Brisbane Port. At 0830, the *Falkor* berthed at Pinkenba Wharfs in the Brisbane River and concluded the expedition "Pinging the New Year: Mapping the Tasman and Coral Seas."