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

30-day Post Cruise Report

Ship name: Falkor
Cruise Dates - Day Departed: 12/28/2020 **Day Returned**: 01/26/2021
Cruise Number: FK201228
Departure Port: Brisbane, Australia **Arrival Port**: Brisbane, Australia
Participating Organizations, Institutions, Foundations, Government Agencies, etc.:
James Cook University www.jcu.edu.au
University of Queensland https://www.uq.edu.au/
The University of Sydney https://www.sydney.edu.au/
University of Wollongong https://www.uow.edu.au/
Geoscience Australia http://www.ga.gov.au/
CSIRO https://www.csiro.au/
Parks Australia https://parksaustralia.gov.au/
Seabed 2030 Project https://seabed2030.org/
Birdlife Australia https://www.birdlife.org.au/
Funding Sources: none identified

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Country: Australia

Geographical area(s) where the science occurred and why working in this location was important or impactful:

The geology project focused on the eastern Coral Sea Marine Park and northern Tasman Sea area. Multibeam mapping effort concentrated on a large survey area over the Chesterfield Plateau, and the chain of Tasmantid Seamounts within the northern Tasman Sea. This was achieved through mostly uninterrupted, broad-scale, deep-water mapping across the 1132-4695 m depth range of this large survey box, originally planned with an area of 69,000 sq km. The voyage consisted of one leg from 28 December 2020 to 26 January 2021, using Brisbane in southeast Queensland as the start and end port.

The scientific outcomes include an improved understanding of plateau and seamount geomorphology relative to tectonic setting. This is important for understanding the evolution of the ocean basins, the oceanic lithosphere strength, the influence of pre-existing tectonic structure (e.g. faulting, spreading fabric), and the effects of intra-plate hotspot volcanism and igneous intrusions on the plateau. Further mapping of the seamounts revealed the detailed complexity of individual seamounts, such as the presence of slope failures and canyons on their steep flanks, or the finer-scale volcanic features including smaller parasitic cones.

The seabird observation project recorded seabird at-sea observations during daylight hours wherever the *Falkor* sailed in the Tasman and Coral seas. Seabirds are distributed patchily over the ocean both in space and time, and this high degree of variability has been shown to be due to both physical and biological factors. Few prey-concentrating processes utilized by seabirds have been identified either in the Coral Sea or in the northern Tasman Sea. The continued collection of these important at-sea observation data are required as a baseline, so that further linkages can be made for other species where their tracking distribution is known.

The management outcomes are improved due to the detailed multibeam bathymetry and backscatter maps collected in an ecologically important part of Australia's marine estate. The mapping of seamounts - naturally important habitats for open-ocean ecosystems - and the relatively shallower plateau of the poorly explored eastern Coral Sea Marine Park and northern Tasman Sea, help to identify areas of important conservation value. This is particularly important for Parks Australia, the managers of Commonwealth marine parks, by contributing to baseline knowledge of their geology, geomorphology, and biodiversity.

The new multibeam data were provided to the national bathymetry archive managed by Geoscience Australia, and will be made available to the public through the AusSeabed Marine Data Portal. The marine managers at Parks Australia will utilize the detailed undersea maps to help inform decisions on managing the human influences on these deeper ecosystems, such as commercial fishing activities, through the network of zoning within the Coral Sea Marine Park.

This voyage was also a demonstration of the Schmidt Ocean Institute's commitment to the UN

Decade of Ocean Science for Sustainable Development (2021-2030). By showing the world that ocean science was being conducted on the first day of this Decade, displayed SOI's support for the goals of this global endeavor and as a positive example of how philanthropy may contribute to ocean observations and research. Further, the significant amount of new multibeam data collected in this area greatly adds to the global seafloor mapping efforts through the Nippon Foundation-GEBCO Seabed 2030 Project.

Cruise Objectives:
The geology project objective was to conduct multibeam mapping within the large survey box area over the Chesterfield Plateau, and the chain of Tasmantid Seamounts within the northern Tasman Sea. This would be achieved through uninterrupted and focused, broad-scale, deep-water mapping effort, e.g. long, overlapping 'mowing the lawn' transects, across the Chesterfield Plateau and over the deepest waters of the northern Tasman Sea.

This mapping effort aimed to fill data gaps in and around the Fraser and Recorder seamounts, the surrounding Tasman Sea basin and on the Chesterfield Plateau. The new map data would reveal the spatial distribution and seafloor complexities ranging from relatively shallower Chesterfield Plateau, the surrounding deeper valleys and troughs of the plateau, a relatively steep margin from the plateau into the deeper Tasman Sea basin, and then steeply rising extinct underwater volcanoes of the Recorder and Fraser seamounts.

Additionally, the deployment of the SeaSPY2 magnetometer for selected long transects aimed to increase the science data collected across this large box area, which crosses both oceanic and continental crust, and so can provide further insight into the geological formation of the northern Tasman Sea basin and the adjacent Chesterfield Plateau.

The seabird observation project objective was to collect data according to the method described by the BIOMASS Working Party on Bird Ecology. This method has been used by researchers around Australia since 1980/81 and reflects the standard protocol for obtaining seabird at-sea data. Observations were made continuously while the vessel is underway during daylight hours from the Monkey Deck onboard *Falkor*.

This observation data aimed to build an inventory of the numbers of seabirds, species involved, and their behavior. Additionally, the ship's oceanographic and environmental sensors automatically recorded abiotic and biotic data alongside the seabird observational records. Standardized methods of data collection will ensure continuity and compatibility with extant data for the same species elsewhere and with similar studies of other species.

Impact of the Research:
40,445 square kilometers of seafloor mapped with high-resolution multibeam data, and covered 5399 line nautical miles (9999 km) of ship track. The area mapped represents ~60% of

the original planned box size of 69,000 sq km. Mapped depths ranged from 1132-4695 m.

New seafloor map data collected around the Recorder and Fraser seamounts, the surrounding deeper Tasman Sea basin, the entrance to the Cato Trough, the gently rising Chesterfield Plateau slope and relatively shallow flat platform, and the seafloor around Cato Reef.

A complex seafloor was revealed, including submarine landslides and gravity slumps, channels and broad valleys, sand waves, scour marks, volcanic pinnacles (cinder cones), and pock marks (possibly generated by seeps).

A better understanding of the spatial relationship between all the large-scale morphological features of the eastern Coral Sea and northern Tasman Sea (e.g. individual seamounts, surrounding flat basin, slope, plateau and reef) due to the systematic 100% mapping.

Additional mapping around the northern Tasman Sea seamounts will improve basaltic volume analysis of the Tasmantid Seamounts as a group, to help explain magma production volumes at time of origin. Finer-scale volcanic cones mapped around Cato Reef (seamount) provide evidence of the extent of volcanic activity during the formation of the seamount.

1443 line km of magnetics data were collected along NE-SW and NW-SE oriented lines, and for one NW-SE oriented line collected on the long transit back to Brisbane.

The magnetics data provide further evidence of the magnetic signature of the N-S oriented extinct mid-ocean ridge in the northern Tasman Sea, and the generally E-W magnetic signatures of the spreading oceanic crust across the Tasman Sea basin.

The near-continuous collection of ADCP data provided information about oceanic currents down to 750 m depth. The ADCP current data coincides well with IMOS Ocean Currents satellite imagery data, relating to two broad-scale eddies across the area during the survey.

More than 15,000 seabirds were observed during the voyage from more than 20 different species. The study area has never been surveyed before using systematic quantitative survey protocols. These observation data provides an important baseline for marine managers.

Microplastic sampling from the underway seawater systems and via CTD water samples was trialed. Plastic microfibers were present in every sample from the surface to depths of 4500 m. Data are useful to help public understand the scale of the problem for plastics in oceans.

Relevance to managers and the local communities

The geology project addresses knowledge gaps for Parks Australia, the government agency responsible for managing Commonwealth marine parks, in terms of mapping and characterizing a poorly known frontier area of the eastern Coral Sea Marine Park.

The new multibeam data have been added to the national bathymetry archive managed by Geoscience Australia, and will be made available to the public through the AusSeabed Marine Data Portal: https://portal.ga.gov.au/persona/marine

The seabird observation project data will be incorporated into the Australasian Seabird Group database housed at CSIRO in Tasmania. The data will be made available to Parks Australia and other stakeholders.

Summary of Operations and Data Collection
See below

Did you collect Measurements or Samples, including biological specimens? Yes
Is there any suspected or confirmed new species discovered during the cruise? No
Did you deploy and/or recover any Moorings, Bottom Mounted Gear, or Drifting Systems? No
Equipment Used: N/A
Total number of CTD casts completed during the cruise: 3 CTD profile - no water collected
Total number of AUV dives completed during the cruise: 0
Total number of ROV dives completed during the cruise: 0
Total number of ROV samples collected during the cruise: 0
Total number of Unmanned Aerial Vehicle (UAV) or other vehicle deployments during the cruise: 0
Total amount of data collected during the cruise: 267 GB

Other interesting things about the cruise
There were 3 onboard Investigators, 9 virtual Investigators, 5 students, 1 Artist-at-Sea. Media release for the first day of the UN Decade of Ocean Science for Sustainable Development and the Seabed 2030 Project. Onboard science team and Artist-at-Sea provided 11 blogs over the four weeks. Two videos were made on the Seabed 2030 Project, and the Artist-at-Sea. Four Ship-to-Shore outreach events were undertaken: Ocean Discovery Institute, San Diego; National Youth Science Forum, Canberra; eXXpedition; Eckard College. Helen Bostock and Derya Gurer and SOI tweeted regularly about activities and blogs during the voyage: 37 tweets, with 487 retweets. Students on the ship provided videos and photos for several Instagram stories and 15 posts. These were 13 photo-based posts (some with multiple photos in post), and two videos.

Daily diary of FK201228

Monday 28 December 2020

Wind 14 kn 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 voyage FK201228 “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, the *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 expedition. At 1630, the *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 kn 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 northern most 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 kn from 115°. Sea state 4. Low swell.

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

The *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 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, the *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 were 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 kn from 100°. Sea state 4. Low-moderate swell.

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

Overnight, the *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 Seamount. 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 tranect near the opening to the Cato Trough, so then reversed course and commenced the southward transit back towards the Recorder Seamount. Heading south back into the swell resulted 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 kn from 115°. Sea state 4. Low-moderate swell.

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

With the weather continuing to be windy, the *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. Today is the first day of the UN Decade of Ocean Science and the *Falkor* would one of the first vessels collecting ocean mapping data for the start of this Decade. At 1400, the *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 kn from 120°. Sea state 4. Low swell.

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

The *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 were 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, the *Falkor* reversed course and commenced the northward transit back towards Cato Trough.

Sunday 03 January 2021

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

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

Overnight, the *Falkor* continued the northward transect and then reversed course southward towards the Recorder Seamounts. At 0900, the ship was about 25 km west of 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 Seamount, 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 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 kn from 100°. Sea state 3. Low swell.

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

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 Fraser Seamount. Depths were around 3300 m with distinct variations on backscatter reflectance. The ship continued to map around the base of Fraser Seamount in a clockwise direction. At 1340 after a circuit around Fraser Seamount, the ship came to a stop 23 km southwest of the Fraser Seamount 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 kn 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 voyage. 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 kn 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 kn 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 the *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 so far 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 kn 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 as to 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 kn from 130°. Sea state 4-5. Moderate swell.

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

With poor weather and strong winds, the ship turned into the southeast winds to ride out the worst weather and reduced speed. With daybreak, the *Falkor* recommenced short southwest-northeast lines in the vicinity of Fraser Seamount. Depths were about 4500 m as the ship mapped closer and closer to the base of the Fraser Seamount. Through the remaining daylight hours, the ship continued mapping closer to the base of the Fraser Seamount, so that by 1900 the gap lying on the southern side of the 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 kn from 135°. Sea state 4. Low-moderate swell.

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

Weather is still windy but slowly improving. Overnight, the *Falkor* focused mapping effort northeast of 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° the extinct spreading ridge. The ship continued mapping the area east of North Fraser Seamount.0917

Monday 11 January 2021

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

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

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 larger 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 northern 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 kn from 120°. Sea state 4. Low swell.

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

The *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 kn 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 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 m high scattered across the seafloor. Their hard surfaces contrast as white pixels against background soft sediments within the 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 kn from 140°. Sea state 4. Low swell.

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

The *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 commenced with the Ocean Discovery Institute in San Diego. 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 kn from 109°. Low swell.

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

The *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. Hoping that further mapping of lines to the southeast will show the origin of this channel. At 1300, a Ship-to-Shore talk with Geoscience Australia and the National Youth Science Forum went well. The blog on the currents by Kate Malloy was posted on the Schmidt Ocean Institute website. Sieving for microplastics and bird observations from the observation deck continued through the day.

Saturday 16 January 2021

Wind 5.5 kn from 115°. Low swell.

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

The *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 help to tidy up the edges of the multibeam coverage 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 kn. Low swell.

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

The *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. After 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, lots of 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, planned as a Ship-to-Shore talk on Tuesday 19th.

Monday 18 January 2021 (Deb's Birthday)

Wind 14 kn 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 a couple of lines in the northwest-southeast direction to extend the mapping northward. This will extend the mapping coverage across the Chesterfield Plateau and also get some more information on the strange currents seen at the northwest point of the area, which switch from west to east. Seabirds and bait balls were observed through daylight hours. Sieving continued for microplastics from the ships water systems.

Tuesday 19 January 2021

Wind 13 kn from the east. Low swell.

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

The *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 far 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 through the day.

Wednesday 20 January 2021 (Eric's birthday)

Wind 25 kn from the east. Swell building.

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

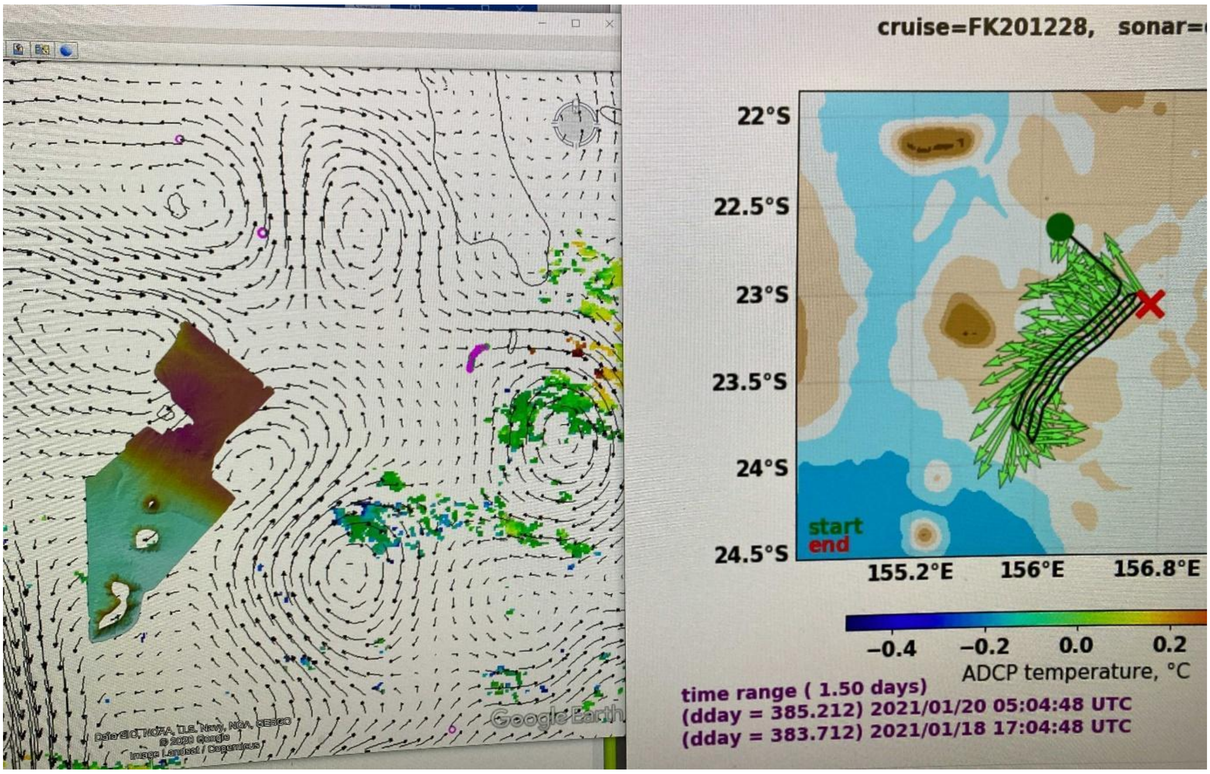
The *Falkor* has been slowly mapping east of Cato Reef and finally found the edge of the Cato seamount complex. After a slight smooth depression, it appears that the ship is now mapping a new rugged area to the east on the Chesterfield Plateau. Other channels and pinnacles become more evident coming off the Cato seamount complex. The ADCP data are showing that the southwest end of these lines are now 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 kn 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 (image courtesy of Deb Smith).



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 (Taigh's birthday)

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

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

The ship continuing mapping in the northeast-southwest direction on the Chesterfield Plateau east of Cato Reef. Several lumpy areas and pinnacles, with a flat sea valley in the northeast-southwest direction that 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 – a university course looking at deep sea technologies.

Saturday 23 January 2021

Wind ~20 kn. 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 found around on the plateau. At 1030, a voyage debrief was held with SOI staff onshore and with the ship staff discussing the mapping completed and additional science outputs, including lessons learnt, outreach and any other issues.

Sunday 24 January 2021

Wind 22-25 kn. Slight swell.

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

The *Falkor* completed mapping the box on the Chesterfield Plateau yesterday, then commenced mapping the slope and overnight from 2000 m 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 coverage is quite narrow within the Tasman Sea Basin, with only 32 degree 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 across 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 voyage to Brisbane.

Monday 25 January 2021

Wind 12-15 kn. Very slight swell.

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

The *Falkor* continued multibeam mapping and towing the magnetometer overnight from the Chesterfield Plateau slope to the Recorder Seamount. The ship stopped at 0700 for a 4600 m deep CTD dip south of Recorder Seamount in the Tasman Sea Basin. The CTD is also an opportunity to sample for deep-water microplastics. On CTD recovery, the ship then continued with another magnetometer line back towards the southeast Queensland shelf. This is the final transit back to Brisbane. At 1030, Artist-at-Sea Jessica Leitmanis gave a presentation on her work and art. At 1900, science highlights and funny photos were shown by Helen Bostock and everyone for the conclusion of the ‘Pinging the New Year’ voyage.

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.

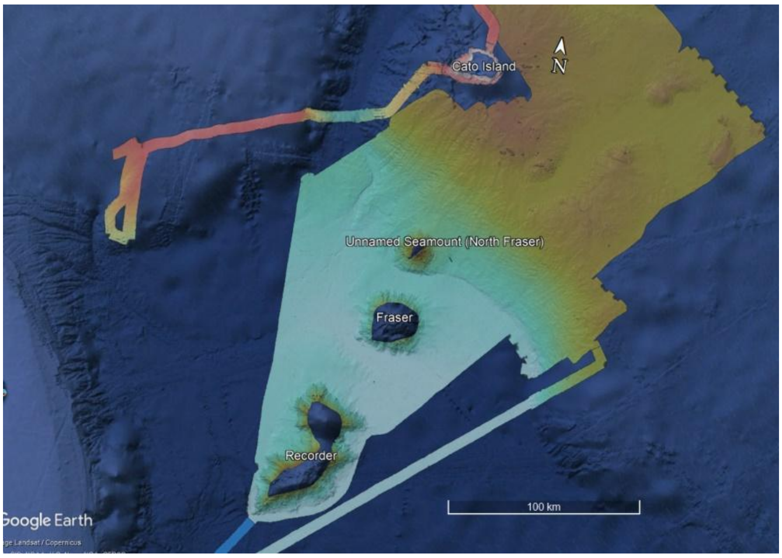
Through the night, the *Falkor* transited across the southeast Queensland shelf then shut down all multibeam systems at 0100, closing off the Qimera project. The ship collected the pilot for the transit across Moreton Bay and into Brisbane Port. At 0830, the *Falkor* berthed at Pinkenba Wharfs in the Brisbane River and concluded the voyage FK201228 “Pinging the New Year: Mapping the Tasman and Coral Seas”.

FK201228 Student Cruise Report

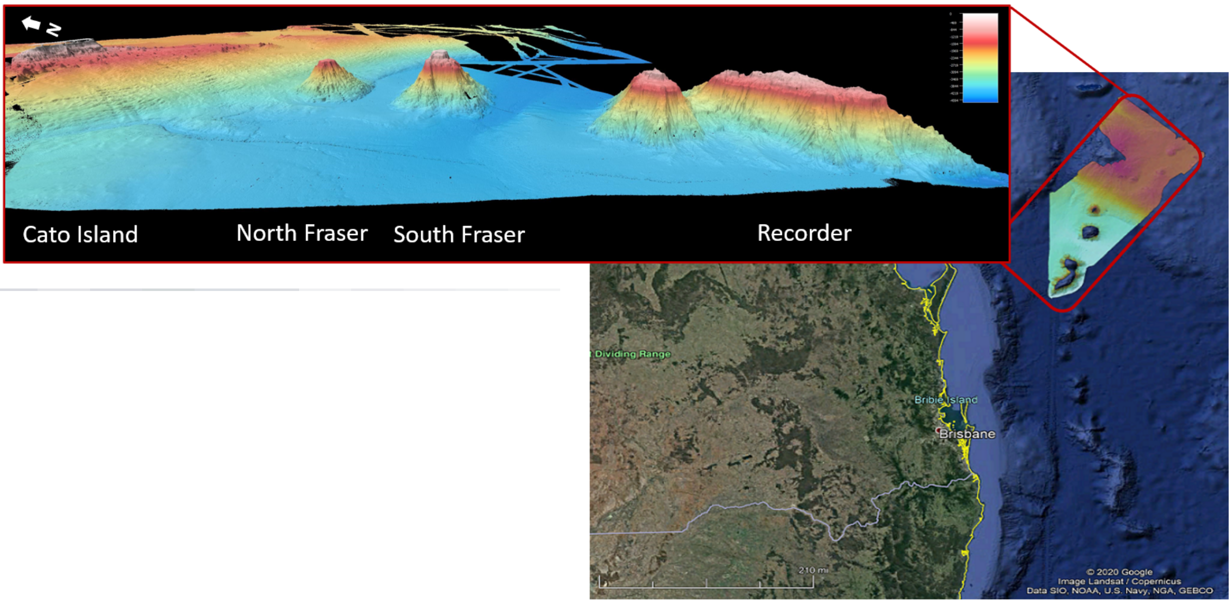
Alysha Johnson
University of Wollongong

Summary

The R/V Falkor sailed on 28th December 2020 for a 30-day mapping and seabird observation voyage in the northern Tasman Sea. The goals of this voyage were primarily to contribute to the Nippon Foundation- GEBCO Seabed 2030 Project as part of the UN Decade of the Oceans. Secondary objectives included monitoring and observation of seabirds within this understudied region. Initial plans suggested surveying the Chesterfield Plateau, Recorder, Fraser and an unnamed seamount, all within the Eastern Coral Sea Marine Park (See *Figure 1)*. The cruise was led by Dr Helen Bostock (University of Queensland) and Dr Robin Beaman (James Cook University), with the latter contributing remotely onshore. Other scientists and students (both onboard and remote) came from the University of Wollongong, University of Queensland, James Cook University, University of Sydney, University of Tasmania, Geoscience Australia and CSIRO.



Upon termination of the cruise on 26th January 2021, just over 40,555 km^2 had been surveyed covering the Chesterfield Plateau, Cato Ridge, Fraser Seamounts and Recorder Seamount (*Figure 2*). Additional to this, three CTDs (Conductivity Temperature Depth) were completed, two of these to depths exceeding 4,000m and one just over 2000m. The magnetometer was deployed for 1779.2 km transects. Acoustic Doppler Current Profiler (ADCP) was operated continuously to identify currents and eddies. A pilot study to measure microplastics was trialled, which filtered water through the ships underway and sampled water collected from the CTD. The seabird team counted 15,000 sea bird of 20 different species throughout the voyage.



Regarding outreach, nine blog posts were produced by the science team (seven published so far), and five '*Ship to Shore'* outreach calls were hosted by the science team to universities and schools in the United States and Australia.

The purpose of this report to reflect on the individual outputs completed by myself, Alysha Johnson, PhD student with the University of Wollongong during my time on the R/V Falkor. This will both explore contributions towards the purpose and goals of the cruise and towards my own PhD.

Outputs

Multibeam Assistant Documents

Whilst aboard the R/V Falkor, the students were tasked with developing, writing and updating walkthrough and assistance documents for other scientist using and processing the data with the EM302 multibeam. A total of four documents were created; *Multibeam Echosounder Walkthrough*, *Bridge Watch Multibeam Assistance*, *Watch Standers Guide,* and *Kongsberg SIS software Guide*.

Whilst aboard I produced the *Multibeam Echosounder Walkthrough* document. This guide explained the steps taken to process multibeam data once collected from the Kongsberg SIS EM302. Steps included using Qimera software, Fledermaus Software and exporting data into GeoTiff or KML forms. This document was quality control checked by a fellow student, Sienna Blanckensee and Marine Technicians Debs Smith and Paul 'Jimbo' Duncan.

I also produced the *Bridge Watch Multibeam Assistance* document. This is a summary document created for the Bridge Officers to monitor the multibeam if Marine Technicians are off watch. This document was developed in coordination with both the Marine Technicians and Bridge Officers. This was quality control checked by Debs Smith.

The other students wrote the final two documents which I assisted in quality control checking for both.

Tasmantid Literature Review

Whilst aboard I produced a literature review of the Tasmantid Seamount Chain as work for my PhD preparation. This included covering known geologic formation of the Tasman Sea and the Tasmantid Seamount Chain, geomorphic features on the volcanoes, and the region's ecological significance. Within this review I explore what unanswered questions exist regarding the geomorphic evolution of the Tasmantid Seamount Chain and how these may be integrated with my PhD questions. This is yet to be completed.

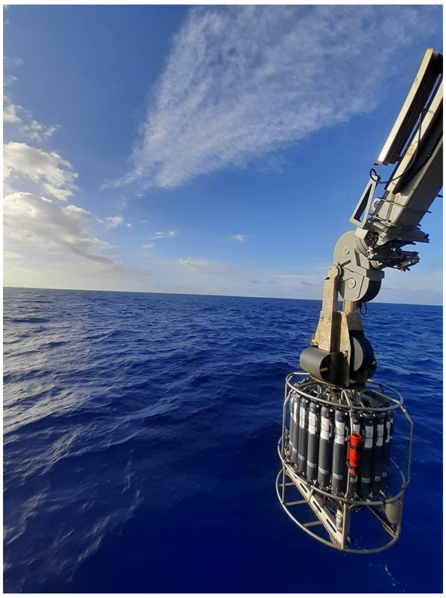
Daily Watch

Daily aboard the Falkor, all students (except Gemma Rushton who was surveying birds) were given a four-hour watch in the control room. This required monitoring the EM302 multibeam and assisting in data collection. If data was being collected cleanly, then little intervention was needed. However, in many cases, the multibeam needed management to ensure good quality data. Management included changing the beam angle, changing the 'forced depth' or changing the operation mode. Sound velocity profile was also taken into consideration, so in many watches XBTs (eXpendable BathyThermographs) were required. To do this, a probe was sent off the Aft Deck of the ship to gain temperature data in the ocean. This ensured that the sound velocity calculation being complete by the multibeam for the necessary depth calculations was accurate. A total of 31 XBTs were deployed during the voyage, most of these were undertaken by the students during their watches under supervision of the Marine Technicians.

Watch responsibilities also required coordination with the bridge when the ship turned corners. Due to the noisy and spacious data often collected when the ship did a tight turn, this data was separated by completing a 'Line Count'. Further, often discussions were needed with the bridge to plan routes, ensure that no gaps in data arose, or to co-ordinate changing beam angles during changes in depth.

I had the first watch of the day from 8 am to 12 pm, where I worked with Marine Technicians Debs Smith and Paul 'Jimbo' Duncan, AAD Data Officer Peter Shanks and 2nd Officer Tony McCann. From 11 am fellow student, Kate Malloy, would join me for an hour handover. During this time on watch, I assisted monitoring the EM302 multibeam in the activities summarised above, wrote up the multibeam assistance documents, helped clean and package data and completed XBTs.

CTDs



Three CTDs were completed during the voyage (insert locations of CTDs). In each of these deployments, I assisted in a different role. During the first CTD (4th January 2021), all students helped check the Niskin bottles before deployment and identify issues such as cracked O-rings. We then helped mount the bottles before deployment and then filtered the water for microplastic study after the deployment was complete. During the second deployment, I observed the actions taken by the Marine Technicians in the science control room and again helped with filtering. For the final deployment (25th January 2021), I assisted in deploying the CTD again by helping physically prepared the CTD with Jimbo Duncan. Working with Deb Smith, I supervised the CTD descending to 4600m which included troubleshooting when winch deployments stopped. On the ascent, supervision was required, and I fired the Niskin bottles to collect water at 800m and 50m depths. Lastly, the other students and I filtered the water for microplastics.

Microplastics

Dr Helen Bostok and her student Sienna Blanckensee oversaw the pilot microplastics project. Daily, 2,000 litres of water was sampled from the ships underway system and filtered through a 1250 micron sieve. What was collected from this sieve was then flushed and pumped into filter paper before being inspected under a microscope. Immediate observations were able to identify plankton, foraminifera and microplastic. In every sample microfibres were found. These were predominately blue and black fibres, with occasional red and other colours.

This filtering method was also done on water collected during the CTDs. Seventy-two (6 x 12) litres of water was collected at base depth (4600m), 800m deep, 50m and 5m. These were also filtered and analysed under a microscope for plankton and microplastics.

Although I did not play a role in the daily observation of this project, all students assisted with filtering water from the CTD. During this process, each individual

Niskin bottle (six at each depth) would be emptied through the filtering sieve (for each depth), then flushed and pumped through a coffee filter.

Outreach

Whilst aboard, all members of the Science Party were encouraged to participate in outreach activities. These included Science at Sea Seminar presentations, blog posts and '*Ship to Shore'* calls. I presented a Science at Sea Seminar for the Science Party and Crew. My presentation explored the background of volcanic island evolution, how seamounts and guyots are formed and why I am interested in my case studies: Tasmantid Seamounts, Norfolk Island and Lord Howe Island.

This allowed for the natural development of my first blog post 'What are Seamounts and Guyots?'. My blog explained the difference between guyots and seamounts and what is present in the Tasmantid Seamount Chain. My second blog post, "What I wish I knew before joining the Falkor" is yet to be published. This is a collection of tips gathered from the current science party on what life is like aboard the Falkor.

Lastly, I participated in three 'Ship to Shore' events. These were calls where the science party, Marine Technicians and SOI outreach staff engaged in conversation and ship tours with schools and universities. The first call I hosted on the 15th January with Sienne Blanckensee and Dr Helen Bostok with the Australian Youth Science Forum at Geoscience Australia. During this call, we gave a ship tour including the control room our microplastic set up in the ships wet lab, the work completed by Artist-at-Sea Jess Leitmanis and the ship's bridge. The second call on the 28th January was broadcast live over Facebook and YouTube with the charitable trust eXXpedition. This was hosted by Jess Leitmanis, Dr Derya Guerer and Deb Smith in coordination with the members of eXXpedition. During this broadcast, my role was to assist with the digital set up and help trouble shoot issues that happened whilst we were on air. My final Ship to Shore was to an oceanography class, which I hosted with Gemma Rushton and Dr Helen Bostock. Again we completed a ship tour and hosted discussions about what technology is used aboard whilst constructing science at sea.

Other

Whilst aboard, the science party got to partake in many other activities hosted by the crew. Activities included an engine room tour, fire training experience and assisting as stowaways in the crew's Stowaway Drill Training exercise. Individually, I was given the opportunity daily by Chief Officer Allan

Doyle during his evening shift 6-8 pm to help with the steering of the ship, learn the planning steps taken by the Bridge Officers to ensure the highest quality multibeam data collected, and learnt the steps taken to measure the gyro and compass error by measuring the bearing of the sun.

Observations

Geomorphology

One advantage of working and processing with the EM302 multibeam was that data could be studied and evaluated as soon as it was collected and cleaned. Of particular interest were the geomorphic observations made of Recorder Guyot, North and South Fraser Guyots and the plateau surrounding Cato Island. Though further GIS-based analysis is required, some preliminary observations, findings and thoughts can be made.

Recorder Guyot

Recorder Guyot was in the southernmost site studied, but it is one of the oldest in the Tasmantid Seamount Chain (Richards et al., 2018). Recorder is defined as a guyot as rather than being a peaked seamount, as it has a flat-topped summit and terraces (*Figure 5*). This flat top and terraces indicate that it must have been near the surface to either be eroded by wave action or grow carbonate terraces. The Tasman Sea basin is extensional, which means it is suspectable to subsidence (Vogt and Conolly, 1971). The mechanism which formed the terraces is yet to be defined. In comparison with the Fraser guyots, Recorder's profile and terraces are much more rugged. Future GIS analysis may provide insight into the origin of these terraces, such as carbonate/constructional or erosional.

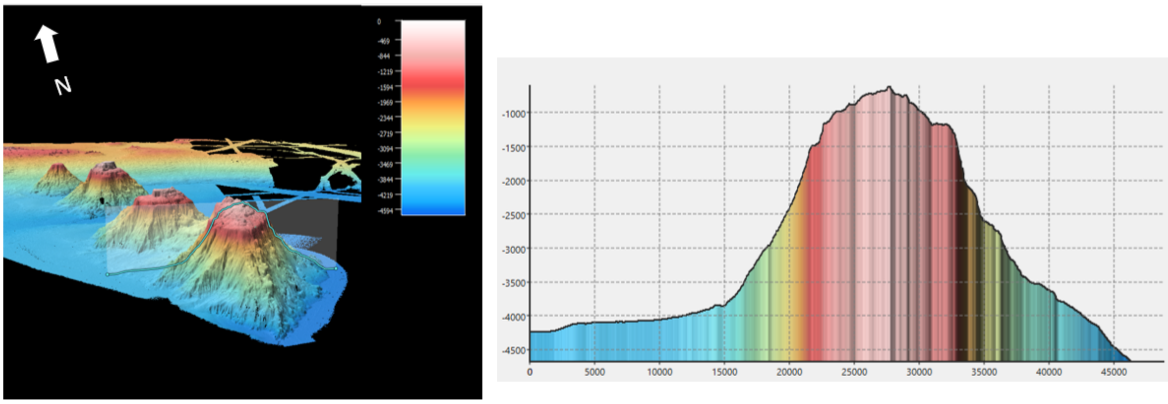
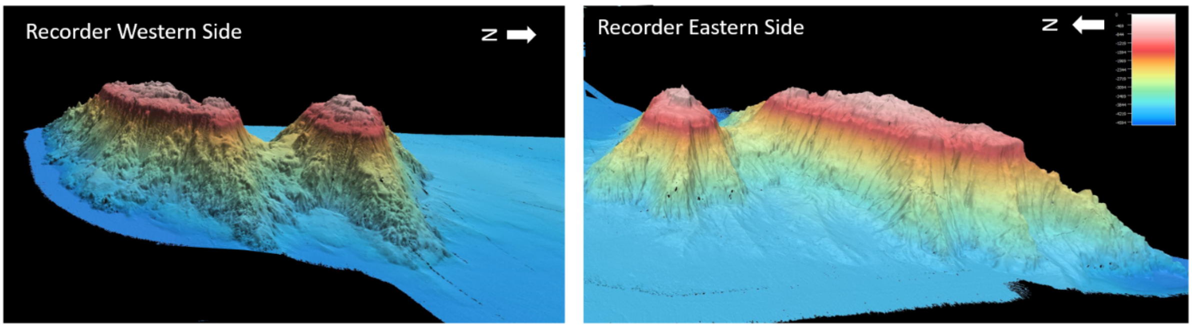
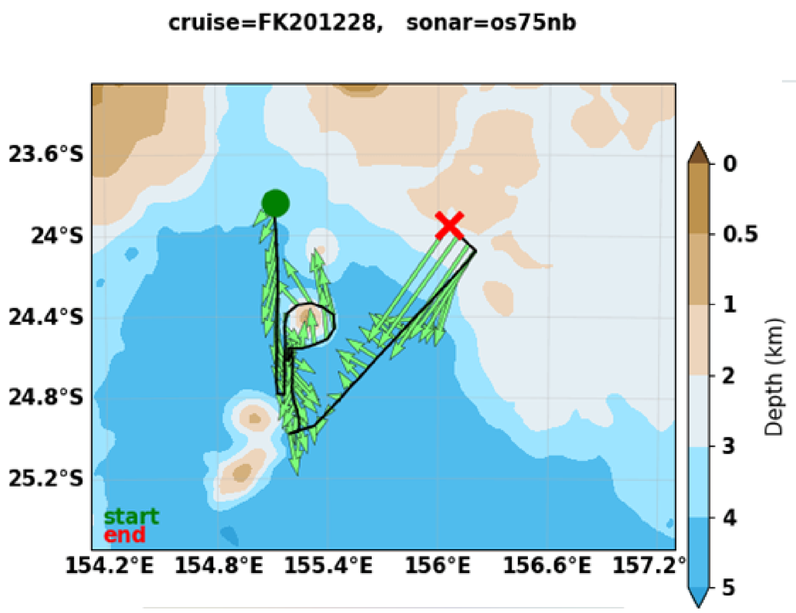


Figure 5: Profile of Recorder Guyot showing a rugged summit but terrace shaped steps at 1500m and 1200m in depth. Note Vertical Exaggeration 5x

From the new data collected during FK201228 shows how the Recorder Guyot merges with the seafloor. Recorder Guyot has the most noticeable mass wasting events on the guyot's western side (*Figure 6*). The guyot's western side appears to have a build-up of landslide or mass wasting sediment on the seafloor. These locations also coincide with where the formation of ‘chutes’ or larger landslide scarps can be seen in Recorder’s flanks. Further, looking at the base of these flanks, there is a sharp mark between the flank and seafloor, suggesting that there may be fast flowing seafloor currents in this region that strip sediment away. The mass wasting deposits are sheltered within embayments between flanks, and thus may be protected from this sediment transport.

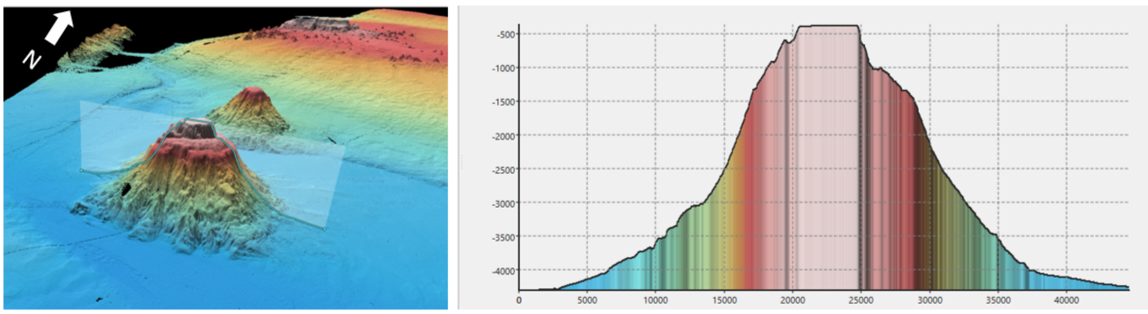


In contrast, the eastern side of Recorder appears to be dendritic and does not have a sharp termination of the lateral flanks. Instead, the flanks blend into the seafloor. It has been recognised in the ADCP data that these guyots force currents to change flow around them dramatically and can cause eddies (*Figure 7*). Though the ADCP data was only collected at 800 m depth, and cannot be used to indicate the currents at the seafloor, it does suggest that ocean flows change dramatically through these seamounts. Thus, it seems reasonable to assume that variations in flow will occur around the guyots' locations.



Fraser Guyots

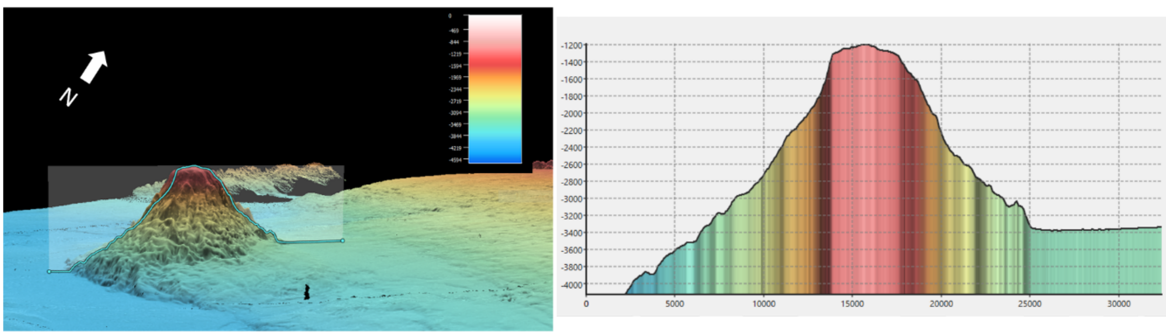
Two further guyots are located to the north of Recorder Guyot. These are North and South Fraser Guyots. Formally, the seamount north of Fraser has not yet been named, but for the purpose of this report it will be called North Fraser. Both of these guyots have clearly defined erosion at their summit, confirming them as guyots. As seen below, North Fraser is notable as it has clearly defined



erosional channel between itself and the South Fraser Guyot.

Figure 8 shows the profile of South Fraser Guyot. This has a planar flat summit just under 500m deep with some further erosional steps at 650m, 1000m and 1400m deep. Additionally, the summit is flatter and considerably less rugged than that of Recorder. Though further GIS analysis is required, due to the planar summit, South Fraser Guyot was likely planated by erosion and has subsided at least 500m to its current depth.

North Fraser does not reach as shallow a depth as South Fraser, with a maximum depth of 1200m and lacks the terraces. Though its summit is planated, it does have greater rugosity (*Figure 9*). Most



interesting regarding North Fraser is the erosional scarp that has developed on its southern flank. A sharp termination of flank is present before the seafloor extends out relatively flat. This suggests that deeps sea currents are eroding and reworking sediment at the base of these guyots. Furthermore, as this area lies between North and South Fraser guyots, it suggests that these guyots may be forcing accelerated deep-sea current flow. This is immediately contrasted with the northern flank of North Fraser which sits upon textured sediment of Chesterfield Plateau slope and there is no dramatic evidence of such erosion.

Cato Island

Cato Island lies on the Chesterfield Plateau, an elevated plain which marks the boundary between the Tasman and the Coral Seas. Cato Island has a volcanic origin and is significantly shallower than Recorder and Fraser Guyots. Most notably, Cato is surrounded by parasitic cinder cones as part of a volcanic field. Though these parasitic cinder cones were previously recognised, data collected by voyage FK201228 found that these cones extended 60km from the island itself. This region was also found to have a deep channel which feeds off Chesterfield Plateau and into the Tasman Sea. (*Figure 10*).

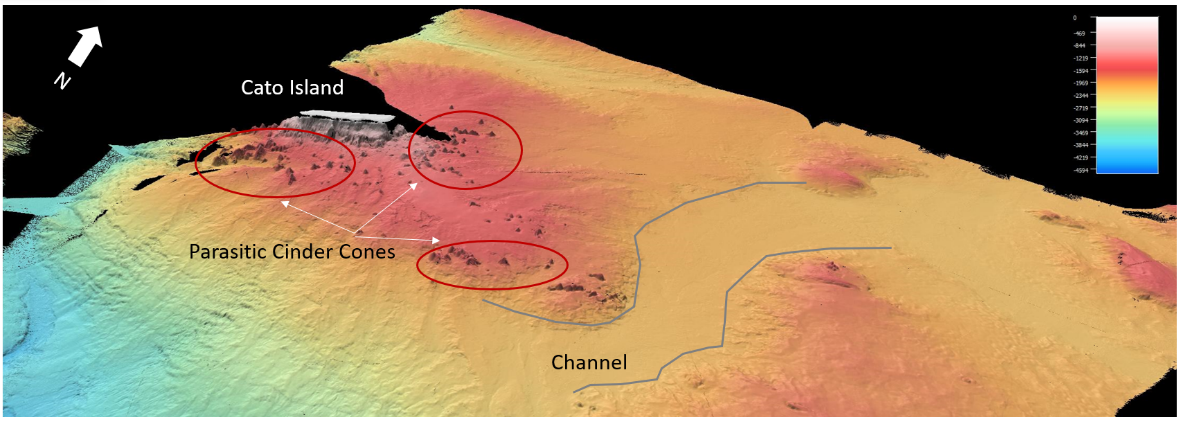


Figure 10: Cato Island and Chesterfield Plateau. Note Vertical Exaggeration 4x

Role of Currents

By evaluating the seafloor bathymetry, primarily where volcanic flanks or sediment deposits terminate, the influence of currents is apparent. Currents can strip sediment, and fast-flowing seafloor currents could even erode the base of these guyots. The role of current in the evolution of volcanic islands has not been considered (Ramalho et al., 2013). Though mass wasting is attributed as a control of geomorphology (Kennedy et al., 2010; Ramalho et al., 2013), causes of this large-scale failure are primarily linked to the internal structure and weaknesses of these volcanoes. Observations found from the data collected on the Falkor show that ocean currents are changing the shape of the base of volcanic bodies. However, it is yet to be determined if currents could erode or change the shape significantly enough to instigate mass wasting events. Regardless, deep-sea currents may be a previously unrecognised control on the geomorphology of submerged volcanic bodies.

Seabird Spatial Relation

The primary findings from the seabird data collected by Dr Eric Woehler and Gemma Rushton regarding bird locations have been orally reported. An increased concentration of birds and feeding activity is found in areas adjacent to these guyots in the Tasman sea. Even though these guyots do not breach the ocean surface, they force upwelling and mixing ocean layers to bring new nutrients to the surface. Thus, we can see that the guyots and seamounts play a critical role in providing ecosystems within the ocean and above the sea for seabirds. Bait balls, a natural phenomenon where hundred to thousands of birds feed at once over a short time period, were also observed in locals near guyots.

The ocean circulation data from the ADCP showed several eddies in the region, which also play a role in upwelling of the nutrients and may be also linked to distribution of seabirds.

Once this cruise data is dispersed amongst participants, I will generate a heat map to provide a visual link between the spatial relationships of bird sightings and guyots.

Another potential question to explore - at what depth do seamounts or guyots no longer influence seabirds location and feeding?

Lessons For PhD And Next Steps

The Tasmantid Seamount Chain, though drowned, provides preserved examples of past volcanic islands. Each of these guyots in the chain has different geomorphology and different potential geomorphic paths to get to this point. The Recorder and Fraser seamounts previously have been volcanic islands and due to accelerated subsidence in the Tasman Sea, and are now guyots. They may present a possible future state of modern volcanic islands in the South West Pacific, such as Norfolk Island or Lord Howe Island. Data collected on the R/V Falkor during cruise FK201228 provides potential comparison case studies to use. The geomorphology of Recorder and Fraser guyots can be explored using GIS skills and then modelled to reconstruct the processes which may have occurred in the past to form the features present. Similar models could be applied to Norfolk and Lord Howe Islands to project their future geomorphology.

The role of currents in altering volcanic island evolution, though likely requires further thought, is a new addition to various controls of oceanic volcanic geomorphology.

GEOHAB

Marine Geological and Biological Habitat Mapping (GEOHAB) annual conference in 11th May 2021 (Asia Pacific conference) is an international conference focusing on understanding geologic and oceanographic indicators of benthic habitats and ecosystems, combing physical oceanography and geology with biology and ecology. I intend to submit an abstract to speak about the work and experience done by the Falkor, with specific reference to how a spatial relationship exists between seamount locations and sea birds. The abstract is due by 26th March.

Reflection of Time on Board

Ultimately, I have been proud and happy with my achievements whilst abord the R/V Falkor. Firstly, I gained my sealegs quickly and managed to cope well with continuous work and continuous ship movement. This did often require making sure I took some time out away from the group and make sure I looked after myself with exercise, staying hydration and rested. These things are harder to do on a ship and making sure I worked with a gentle schedule was critical. Whilst working with the science team and the Marine Technicians, I learnt not only about operating and troubleshooting scientific equipment, but the co-ordination which is required between different faculties of the ship for smooth scientific operation. I was able to observe the factors such as weather, ship speed, depth and swell which influenced planning of ship lines and how the bridge, science control and often deck hands or engineers required clear communication for deployment of devices. Potential issues could come up through winches and cables rather than the scientific equipment itself, so it is critical to have a cooperative team. I also found within this environment my confidence to operate software and the multibeam increased in the final two weeks. It was rewarding to be able to physically contribute to the cruise, rather than just being an observing student.

The science party gelled cohesively and it was this positive group which made the trip so enjoyable. The combination of enthusiasm, open mindedness, support and understanding need for space meant that we cooperated and preformed very well as a team and supported each other as friends. Though some heated incidents did develop, the group supported and delt with issues quickly. The openness of the science party to learn is partially what allowed the crew to also open and share parts of their job. Ultimately, I found this rewarding as I discovered more and more about what jobs are being performed on the ship. As a collective student unit, we felt comfortable to ask many questions to the crew, and as a result we learnt a phenomenal amount in all aspects of ship life.

The biggest shortcoming on the trip was that the initial trip proposal suggested a region which was far too big to be completed during the voyage. This has been taken forward for a reliable calculation for the next voyage. My biggest learning and short coming was making sure I did take time out and recognise that I would not be high preforming every day. It is okay to have challenging days on the ship, especially when wind and swell was high. On these days it was vital that I put any extra work aside, focused on my shift and then relaxing.

Lastly, I was able to watch first-hand what is required to not only operate but lead a scientific voyage. Due to the nature of the ocean, it is critical that plans have room to evolve and develop as to avoid bad weather. Safety of the crew, both physically and mentally, is ultimate priority. Watching the Chief Scientist take advice from the Bridge Officers and Marine Technicians, I could see how she regularly updated plans to optimise safe data collection. Further, creativity was critical to the voyage. Being creative in operating as many side-projects as possible other than just mapping, but also being creative in troubleshooting and developing solutions with what was onboard. Again, the openness to knowledge and points of view of all crew members allowed for this best performance. An example was developing the new microplastic filtering set up with the help of the engineers, fitters and marine technicians. This set up will now be used on the next cruise.

Lessons for FK210206

I have joined the R/V Falkor for the next voyage, FK210206, which will continue work in the north Tasman and Coral Sea region, specifically around Wreck Reef, Kenn Reef and Coriolis Ridge. From my prior cruise experience, I intend to continue work contributing to the voyage doing watch shifts, monitoring the EM302, outreach projects and assisting with CTDs and microplastic. A new project to initiate will be writing with SciBlogsNZ as part of their Fieldwork blog section. In the first week I will teach the new students and mentor coming aboard. For my PhD, I intend to finish Tasmantid Seamount Chain literature review and incorporate the new study sites which will be visited, included Wreck and Kenn Reef, into the document. I would also like to begin initial geomorphic analysis of Recorder and Fraser guyots, specifically seeking any geomorphic signals which may indicate erosional or constructional terrace location. I also will be open to learning as many new skills as possible again in all aspects of ship life.

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