

**MARINE
NATIONAL FACILITY**

2005 RV *Southern Surveyor* program

voyageplan

SS02/2005

The geology and tectonic evolution of the Mellish Rise off northeast Australia: a key piece in a tectonic puzzle.

Itinerary

Depart Bundaberg 1000 hrs, Tuesday 25 January, 2005

Arrive Cairns 1000 hrs, Sunday 20 February, 2005

Principal Investigator (Chief Scientist)

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Scientific objectives

The scientific objectives of this proposal address fundamental questions about the geological evolution and environmental significance of the Mellish Rise, which lies in a critical position near a presumed fossil triple junction between the Australian, Lord Howe Rise, and Louisiade Plateau tectonic plates. The primary objectives of this study are:

- Defining the nature and tectonic styles of the margins of the Mellish Rise and their significance to the plate tectonic development of the region;
- Comparing the Mellish Rise with the nearby Louisiade, Queensland, Marion and Kenn Plateaus;
- Determining the nature of the rocks forming acoustic basement (continental and/or oceanic?).

The secondary objectives include:

- Determining the nature and ideally the age of the volcanic intrusions, and their relationship to the Tasmanid volcanic chain;
- Assessing the nature of Cainozoic and perhaps older sediments, with emphasis on climatic and oceanographic evolution;
- Providing important information on the controls on the initiation and development of east Australian carbonate platforms since the middle Oligocene;
- Determining the nature of the modern surficial sediments on this remote marginal rise and their influence on benthic habitats, as an aid to environmental management;
- Providing geological background regarding the long-term resource and environmental management of the Mellish Rise and adjacent deepwater basins;

Voyage objectives

To acquire geoscience data from the Mellish Rise to the abyssal plain

- 200-4500 m water depth
- 15 to 20° South, 154 to 159° East.
- Highest priorities are seismic profiling (3250 km at 7.5 knots) and dredging (40 dredges, 500-4000 m water depth)
- Secondary priorities are magnetic profiling (on seismic profiles), swath mapping, echosounder profiling, seabed sampling (10 cores, 500-4000 m water depth)
- Swath will be run the whole time
- Transits at 11 knots to and from work area

(Voyage track – shown at end of document.)

Time estimates

Transit from Bundaberg and to Cairns: 2000 km = 1100 nm	4 days @ 11 knots
Kenn Plateau sampling = 11 dredges and 4 cores (Table 2)	2 days
Seismic profiling: 3130 km @ 250 km/day (Table 1)	12.5 days
Dredging for seismic ground-truthing = 25 dredges	4 days @ 4 hours
Coring for seabed character and climate history = 5 cores	0.5 day @ 3 hours
Transits during sampling program	3 days
Total time elapsed	26 days

Piggy-back projects – None

Southern Surveyor Equipment

Swath-mapper with sound velocity profiler

Access to up to 5 XBTs

12 KHz echosounder

Trawl winch for dredging

Coring winch

Smith-Macintyre grab

Space in Operations Room to set up seismic recorders

Space for swath and seismic processing

Room in Fish laboratory for sedimentology

Controlled Temperature Laboratory for core storage

Room for microscopes in General Purpose lab

Our equipment

GA navigation system

GA airgun seismic system: compressor, guns, winch, streamer, recorders

Magnetometer

Core deployment system (Thomas)

Piston and gravity corers

Dredges

Grabs

Microscopes

Rock saws

Special requirements

Room for compressor on deck

Room for sampling gear on deck

Room for seismic winch on deck

Room for magnetometer winch on deck

Room for rock saw on deck

11,000 litres of diesel fuel to run compressor

Data sets collected from the National Facility's instruments

Digital navigation

Swath-bathymetry (digital)

Digital bathymetry (12 kHz)

Personnel List

Neville Exon – GA, Chief Scientist

George Bernardel – GA, Seismic processing and geophysical watch leader

Kinta Hoffmann – GSQ, Geophysical/probable geological watch leader

Andrea Cortese – GA, Swath processing and geology

Richard Howe – GA, Nannofossils and geology

Emma Briggs – Sydney University, Student

French scientist – (TBA)

Jon Stratton – GA, Science technician and seismic acquisition

Ian Atkinson – GA, Science technician and seismic acquisition

Franz Villagran – GA, Electronics technician and swath acquisition

Craig Wintle – GA, Mechanical technician

Andrew Hislop – GA, Mechanical technician

Pamela Brodie – CMR, Voyage manager/Computing support

Peter Dunn – CMR, Electronics Support

This voyage plan is in accordance with an agreement between CSIRO Marine Research and Geoscience Australia, and supported by the National Facility Steering Committee for the Research Vessel *Southern Surveyor*.

Neville Exon

Chief Scientist

Table 1. Planned seismic lines for Mellish Rise survey SS12/2004

Line	Direction	Way Point	Latitude (S)	Longitude (E)	Line length (km)
1	NW	A	20°42'	157°30'	
1	NW	B	18°50'	155°15'	
1	NW	C	17°03'	153°53'	560
2	NE	D	16°41'	154°30'	65
3	SE	E	19°17'	158°08'	485
4	NE	F	17°56'	159°15'	195
5	NW	G	15°00'	154°35'	495
6	NE	H	14°35'	155°00'	65
7	ESE	I	15°12'	157°25'	
7	SE	J	15°57'	158°32'	
7	SE	K	16°58'	159°37'	415
8	W	L	16°42'	158°30'	120
9	N	M	15°00'	157°58'	190
10	SW	N	19°16'	155°25'	540

Total = 3130 km [at 250 km/day = 12.5 days]

Table 2. Start points for potential sampling sites on SS02/2005 on Kenn Plateau (on transits)

No	Line: SP	Latitude (S)	Longitude (E)	Depths (m)	Direction	Target
GC01	270/7: 570	24°55.12'	156°12.41'	4200	N/A	Paleogene
DR01	270/7: 915	24°48.65'	156°19.72'	3150-2850	NE	Basement
GC02	270/7: 2600	24°17.02'	156°55.37'	2660	N/A	Quaternary
DR02	270/14 swath	23°27.6'	156°46.56'	1850-1650	WSW	Basement (D26)
DR03	13/31 swath	23°12.7'	156°30.4'	1770-1620	W	Basement (D15)
DR04	13/31 swath	23°13.6'	157°00.3'	1900-1700	E	Basement (D14)
DR05	N701	22°09.64'	156°45.55'	1725-1575	N	Basement (D04)
DR06	13/44:45.0807	21°29.98'	156°24.05'	800-400	W	Guyot (D42)
DR07	14/02:9.0455	21°24.35'	156°28.44'	1800-1400	S	Basement (D02)
GC03	270/3:5860	21°31.02'	156°34.70'	1200	N/A	Paleogene
DR08	701: 12820	21°26.10'	157°05.17'	1900-1500	S	Basement (D03)
GC04	701: 12770	21°26.71'	157°04.83'	1330	N/A	Paleogene
DR09	270/4:1000	21°21.2'	157°13.6'	1950-1750	SE	Basement
DR10	270/3-4 intersection	21°04.7'	156°52.7'	1900-1550	N	Basement
DR11	270/11:7260	23°07.37'	154°52.30'	2500-2250	NW	Marion Basement

Mellish Rise survey area – Nov-Dec, 2004

- using GA-compiled bathymetry

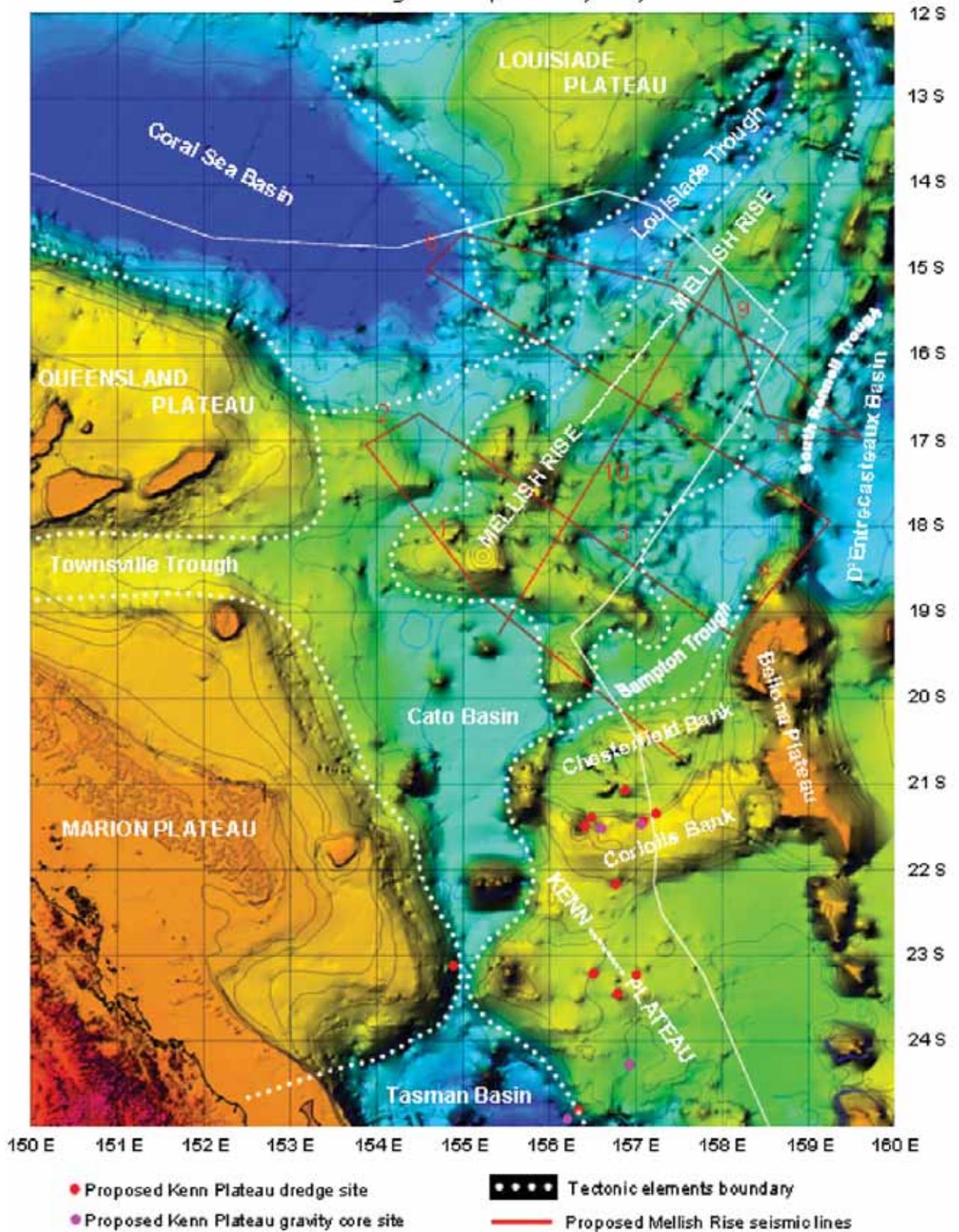


Figure 1. Bathymetric map of the Mellish Rise study area showing proposed *Southern Surveyor* seismic lines, and Kenn Plateau sample sites to be acquired on transits. The Mellish rise sample locations will be selected once all seismic data have been interpreted.