

MARINE
NATIONAL FACILITY

voyageplan
ss2011_v06

2011

RV Southern Surveyor

program

The Perth Abyssal Plain: Understanding Eastern Gondwana Break-up

Itinerary

Mobilise Geraldton 0800hrs Thursday 20 October 2011

Depart Geraldton 1400hrs Thursday 20 October 2011

Arrive Fremantle 0800hrs Wednesday 9 November 2011 and demobilise

Principal Investigators

Dr Simon Williams (Chief Scientist) – University of Sydney

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Dr Nathan Dazko – Macquarie University

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Dr Joanne Whittaker (not attending voyage) – University of Sydney

Email: jo.whittaker@sydney.edu.au **Phone:** 02 9351 2467 or 0404 143 394

Professor Dietmar Müller (not attending voyage) – University of Sydney

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Scientific Objectives

The objectives of this voyage are to investigate;

1. The crustal nature of the Gulden Draak Ridge, Batavia Knoll, and Dirck Hartog ridge – continental and/or volcanic – in order to further constrain plate tectonic models of the early separation between India and Australia and also to understand the interaction between the seafloor-spreading system and volcanism related to the Kerguelen hotspot. Sampling of these features should help constrain composition of basement rocks and lead to greater understanding of the interaction between spreading and mantle plume processes. If, overall, any of the zones represent extended continental crust, it is possible that continental rocks could be recovered. If only igneous rocks are recovered, then their geochemical composition may be indicative of the dominant formation processes – seafloor spreading vs mantle plume. This objective relates primarily to Nathan Daczko and Jacqueline Halpin.
2. The age and formation history of the ‘de Gonneville Triangle’. This piece of oceanic crust is located at what was the triple junction of rifting between Australia-India-Antarctica. How and when the de Gonneville Triangle and the Naturaliste Fracture zone formed have important implications for plate tectonic models attempting to reconstruct the pre-rift fit and the break-up and spreading history of the India-Australia-Antarctica triple-plate system. Understanding the de Gonneville Triangle is especially important because prior to Australia-Antarctic break-up it was immediately adjacent to the Enderby Basin, and the two basins should reveal the same magnetic anomaly patterns but current interpretations reveal considerable discrepancies. This objective relates primarily to Joanne Whittaker, Dietmar Müller and Simon Williams.
3. The age distribution of oceanic crust across both the east and west Perth Abyssal Plain. Acquiring ridge-perpendicular magnetic anomaly profiles are crucial in order to constrain the early spreading history between India and Australia and the pre-breakup fit between India-Antarctica and Australia. Of particular importance is the oceanic crust located southwest of the Dirck Hartog Ridge. Sampling in the Perth Abyssal Plain region will help to resolve uncertainties regarding the early spreading history and the full-fit of the India-Australia-Antarctica triple plate system. This objective relates primarily to Joanne Whittaker, Dietmar Müller and Simon Williams.

Voyage Objectives

Objective 1: The use of a magnetometer is planned in order to acquire magnetic anomaly data that will reveal the magnetic patterns of the Perth Abyssal Plain and constrain the timing of formation of this ocean floor. The acquisition of ~3000 km of magnetic anomaly data is planned (Figure 1). One magnetic profile is planned across the east Perth Abyssal Plain, to complement magnetic anomaly data already existing in this basin. Four magnetic anomaly profiles are planned crossing the poorly sampled west Perth Abyssal Plain, with one magnetic profile also acrossing the de Gonneville Triangle. All these tracks are planned to trend roughly NW-SE in order to be perpendicular to the spreading fabric of these basins. Tracks have been planned to avoid the influence of intra-basin, small-scale volcanism as much as possible.

Objective 2: We plan to undertake 7 dredges to sample the Batavia Knoll, Gulden Draak Ridge, southern flank of the Naturaliste Fracture Zone, and various locations along the Dirck Hartog Ridge (Figure 1). Ideally, we would also like to dredge the de Gonneville Triangle, but the seafloor of this feature is in water depths greater than ~4000 m, so will not be included in this voyage unless an extra ~1000m of cable can be sourced. We have planned for the acquisition of approximately 3.5 days of multibeam (swath) and single beam sonar profiles to assist with the selection of sampling sites. We plan to swath-map potential dredge locations in order to identify dredge targets. Dredging by previous *Southern Surveyor* voyages in the region used swath-mapping to identify dredge targets and was very successful. The Perth Abyssal Plain has water depths ranging from about 1000-2500 m for the tops of the ridges/plateaus to 5500 m in the middle of the abyssal plain. However, the maximum possible dredge depth using the standard *Southern Surveyor* dredging equipment is ~3500 m. Therefore, we have planned to take dredge samples from ridges where water depths are less than 3500 m. The Simrad EM 300 works best in water depths less than 3000 m, so for some of the deeper dredges we may have to rely on the 12 kHz echosounder and 3.5 kHz sub-bottom profiler to identify good outcrop locations.

Objectives 1 and 2 have equal priority, but the planned data acquisition for each objective has been prioritised in case of circumstances that limit our data collection activities. These priorities are listed in Table 1 below, with each magnetic shiptrack profile and dredge location ranks as either high (1), medium (2) or low (3) priority.

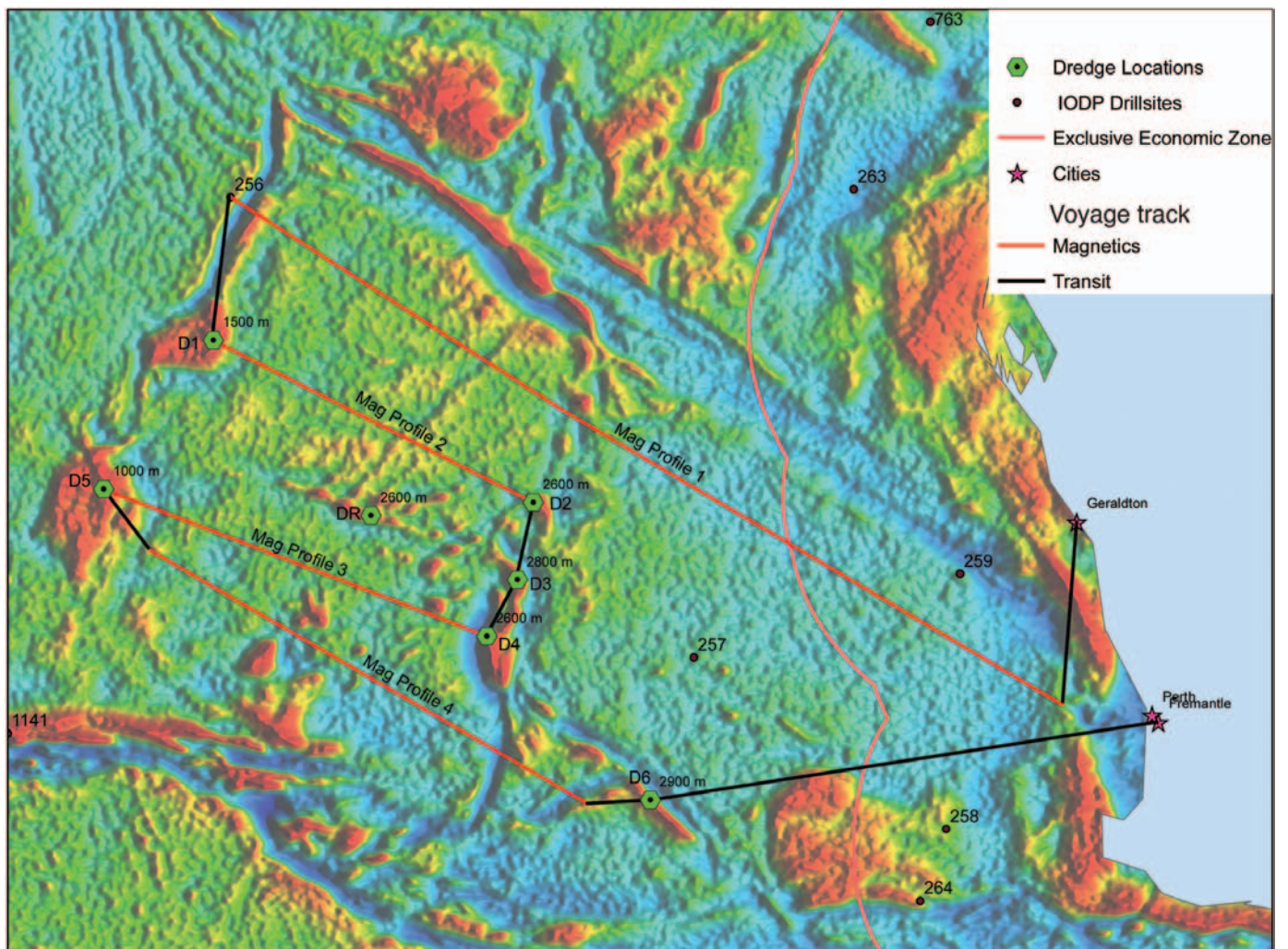


Figure 1: Voyage track

Time Estimates

Table 1: Time estimates for the entire voyage. Also included are assigned priorities for the different components of objectives 1 and 2.

	Speed (kn)	Distance (nM)	Time (hrs)	Time (days)	Priority
Transit	11	179	16.27	0.68	
Magnetics 1	10	958	95.80	3.99	1
Transit	11	141	12.82	0.53	
Magnetics 2	10	353	35.30	1.47	1
Transit	11	142	12.91	0.54	
Magnetics 3	10	402	40.20	1.68	3
Transit	11	75	6.82	0.28	
Magnetics 4	10	495	49.50	2.06	2
Transit	11	62	5.64	0.23	
Transit	11	503	45.73	1.91	
			Total	13.37	Days

	Depth (m)	Swath (hrs)	Dredge and Swath (hrs)	Dredge and Swath (dys)	Priority
Dredge 1	1500	12	16.50	0.69	1
Dredge 2	2600	12	19.80	0.83	3
Dredge 3	2800	12	20.40	0.85	2
Dredge 4	2600	12	19.80	0.83	2
Dredge 5	1000	12	15.00	0.63	1
Dredge 6	2900	12	20.70	0.86	3
Dredge Res	2600	12		0.00	
			Total	4.68	Days

Contingencies	1.00
Mobilisation	0.50
Demobilisation	1.00
Grand Total	20.55 Days

Southern Surveyor Equipment

- Simrad EA500 sounder for bottom detection (12kHz) - Echograms from the Simrad EA500 sounder
- Kongsberg EM300 swath mapper – swath bathymetry, swath seabed reflectance, TOPAS sub-bottom profiler
- Laboratory space cleaning, sorting, sawing and storing dredge samples
- Rock saw
- Dredge equipment – winch and rock dredge/s
- Underway data
- Ship attitude – heave, pitch, roll and heading
- Bridge log

User Equipment

We will be bringing:

- 1 SEASPY magnetometer and winch (borrowed from GA)

The winch is to be mobilised by GA during demobilisation of the Andrew Jones voyage prior to ours.

Special Requests

We require that the winch for the SEASPY magnetometer to be fitted. This will be undertaken during demobilisation of the Andrew Jones voyage, occurring immediately prior to ours.

We will be using the rock saw. Dr Jacqueline Halpin will need to authorise any personnel before they can use this equipment.

Personnel List

Name	Affiliation	Role
Dr Simon Williams	University of Sydney	Chief Scientist (tectonics/magnetics scientist)
Dr Jacqueline Halpin	University of Sydney	Geochemical/geochronology scientist
Dr Nathan Daczko	Macquarie University	Geochemical/geochronology scientist
Dr Roi Granot	Ben-Gurion University, Israel	Magnetics/tectonics scientist
Jack Healy	University of Sydney	Magnetics student
Madeline Kobler	Macquarie University	Geochemical/geochronology student
Robyn Gardner	Macquarie University	Geochemical/geochronology student
Adrien Bronner	Institut de Physique du Globe Strasbourg	Continental margin tectonics student
Aedon Talsma	University of Sydney	Tectonics student
Nathan Butterworth	University of Sydney	Tectonics student
Zohar Ehrlich	Ben-Gurion University, Israel	Magnetics/tectonics student
Don McKenzie	CSIRO/MNF	MNF Voyage Manager
Hugh Barker	CSIRO/MNF	MNF Computing Support
Drew Mills	CSIRO/MNF	MNF Electronics Support
Dr Tara Martin	CSIRO/MNF	MNF Swath Support

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

Name	AMSA Certificate of Safety Training No.
Don McKenzie	AS02764
Hugh Barker	BB05460
Drew Mills	AS02348
Tara Martin	BB05761

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

Simon Williams
Chief Scientist