National Facility Research Vessel

RV FRANKLIN

VOYAGE DOCUMENTS

RV SOUTHERN SURVEYOR

CSIRO AUSTRALIA

CSIRO MARINE AND ATMOSPHERIC RESEARCH

Voyage Plans and Summaries

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Franklin Voyage Plan No. FR06/00

Title

The Continent-Ocean Transition of the Crust and Mantle across the North West Shelf (Leg 1)

Itinerary

Depart Broome 1000 hrs, Wednesday 2 August 2000
Arrive Broome 1000 hrs, Thursday 10 August 2000

Principal Investigator(s)

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Scientific Objectives

The north west margin of Australia includes the Pilbara Archaean shield, the Phanerozoic Canning and Canarvon sedimentary basins and the Exmouth Plateau. Geophysical measurements of magnetic and electric fields onshore and offshore provide a means of imaging the crust and mantle structure in terms of electrical

conductivity. The principal aims of the project are:

(a) to determine crust-mantle structure and anisotropy across the continental margin, from Archaean shield to ocean abyssal plain;

(b) to investigate the Canning Basin conductivity anomaly across the margin and its relationship to extensional faults imaged from deep-seismic profiles of the Fitzroy Trough.

Cruise Objectives

A total of sixteen seafloor MT instruments will be deployed in two arrays, as shown in Figure 1. Professor Karsten Bahr and Dr Fiona Simpson from the Universitaet Goettingen, Germany, will install additional sets of land magnetometers to extend the profile across the Pilbara Block (land circles). The same instrumentation was recently deployed off the coast of Eyre Peninsula (1998) and Gulf of Carpentaria (1999) in a similar configuration, so we foresee no logistical difficulties.

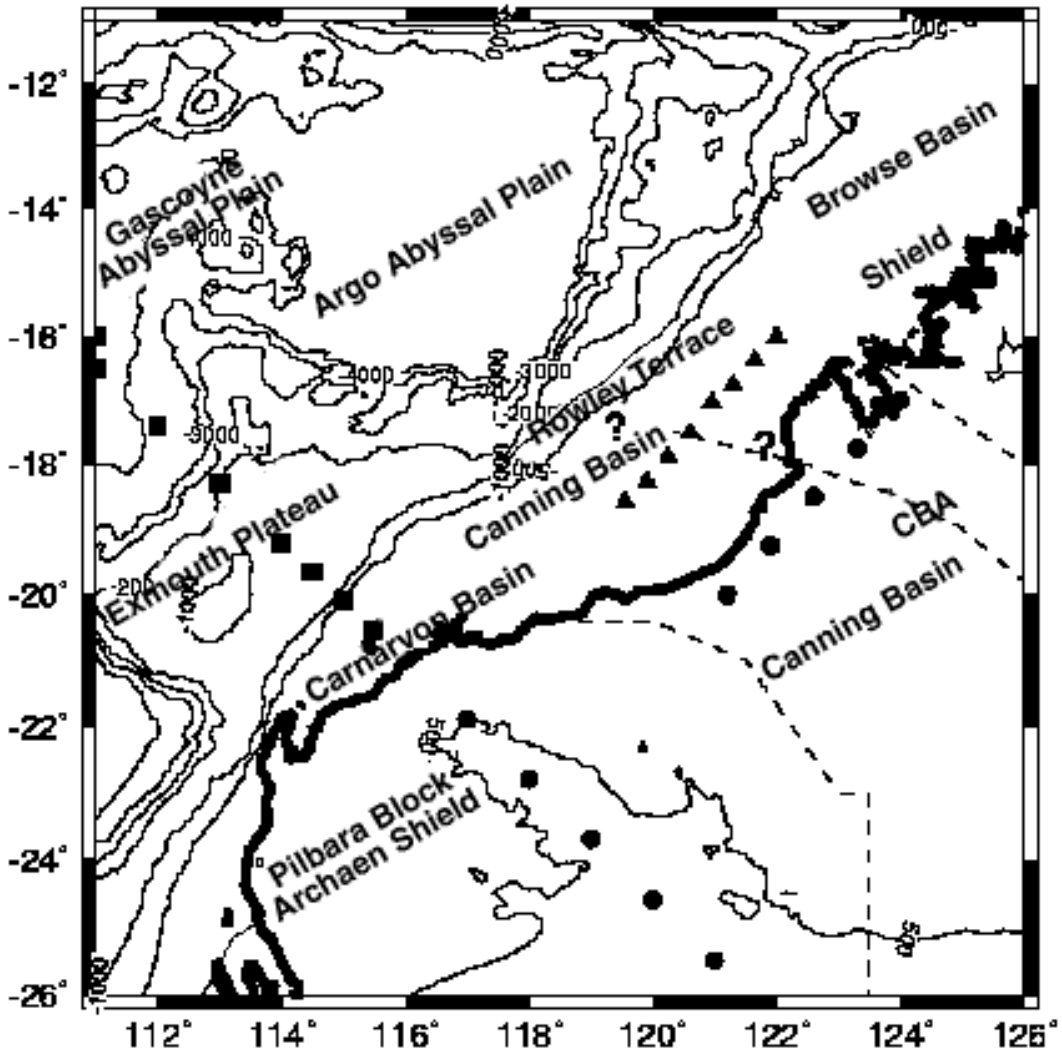

Figure 1 : Geology, instrument locations and ship tracks for the first cruise. The

main geological units are the Archaean Shields of the Pilbara and Kimberley Blocks, between which lies the Canning Basin. The Canning Basin electrical conductivity anomaly is shown by the dashed line marked CBA. Circles show approximately the proposed instrument locations on land. At sea, squares show location of the long-period instruments that will be deployed for a few weeks, while triangles show the sites of short-period instruments that are deployed for two-days at a time.

Twelve of the seafloor instrument (squares in Fig. 1) will be deployed in an array across the continental shelf and slope off the Pilbara Block Archaean Shield. These instruments record at a sample rate of 10 s, with least-counts of 0.1 nT for the magnetometers and 0.03_V/m for the electrometers. Instruments will be deployed at the beginning of the cruise by free-fall from the ship. Typically, instruments sink at a rate of 0.5 m/s. Distances between sites are 30-60nm, and allowing two hours for set up at each site, the total deployment time will be of the order of 16 hours, with about 3-6 hours between sites assuming a steaming rate of 10 knots.

Four seafloor MT instruments (triangles in Fig. 1) will be deployed on the shelf across the Canning Basin anomaly. These are high-frequency systems, recording at 25 Hz with a least-count of 8 pT and 0.003_V/m. Deployment will be in water depths less than 100 m, so in principal sufficient data can be collected in the space of two days. Instruments will be located about 15 nm apart so deployments and transit will amount to only a couple of hours each. All four instruments can be deployed in about 8 hours of ship-time.

Recoveries

The high-frequency instruments (triangles in Fig. 1) will be recovered after two days deployment and then re-deployed for a further two days in different locations to increase the aperture of the array. Thus, in Figure 1 we show up to eight deployment locations across the CBA. After another two days, these instruments will be recovered for the last time, or re-deployed a third time if the cruise schedule permits. At the end of the first cruise, the four high-frequency instruments will be returned to port.

Similar equipment has been deployed and recovered by the Franklin by Dr. White in 1986, 1989 and 1994, and with Dr Heinson in 1997 and 1998. In the earliest experiment, four magnetometers were deployed across the continental margin of New South Wales (White *et al*., *Phys. Earth Planet Int*., **60**, 147-154, 1989; Kellett *et al*., *Tectonophysics*, **192**, 367-382, 1991), followed by a similar experiment off the coast of South Australia (White and Heinson, *J. Geomag. Geoelectr*., **46**, 1067-1081, 1994). In the most recent deployment, thirty marine deployments and recoveries were made south of Eyre Peninsula, South Australia (Heinson *et al.*, *Exploration Geophysics*, 1999; Heinson *et al.*, *Geophys. Res. Lett.*, 1999; Popkov *et al.*, *Exploration Geophysics*, 1999).

Cruise Track

Figure 2 shows the proposed cruise tracks. Note that the triangle sites are not all

occupied at the same; instead, we wish to occupy four sites for three to four days, then redeploy in a different position.

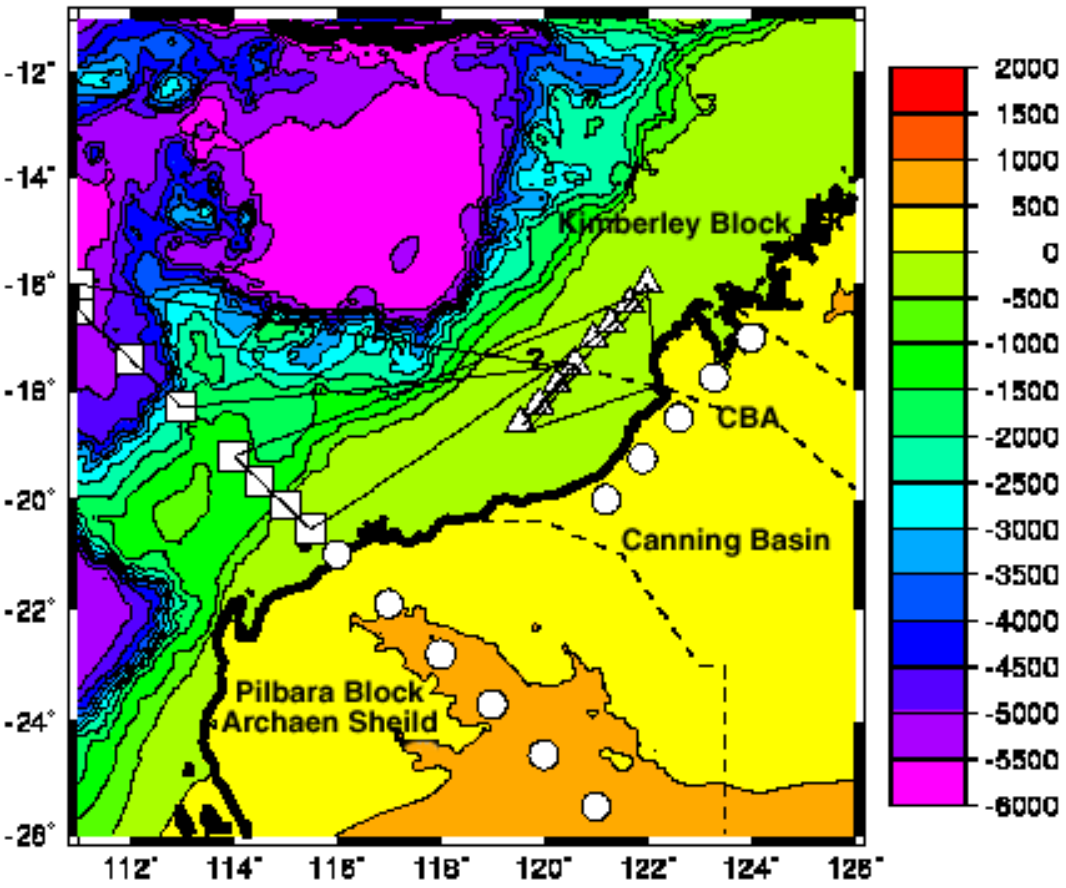

Figure 2 : approximate ship tracks from Broome

Time Estimates

Day 1	Leave Broome, deploy four high-frequency instruments (triangles) (approximately 124 nm @ 10 knots = 12.4 hours + 8 hours for deployment)
Day 2	Transit to first low-frequency site - square (approximately 360 nm @ 12 knots = 30 hours)
Day 3	Deploy six low-frequency sites closest to coast (approximately 120 nm @ 10 knots = 12 hours + 8 hours for deployment)
Day 4	Transit to high-frequency sites - triangles (approximately 360 nm @ 12 knots = 30 hours)
Day 5	Deploy four high-frequency instruments - triangles (approximately 124 nm @ 10 knots = 12.4 hours + 8 hours for deployment)
Day 6	Transit to seventh low-frequency site on continental slope (approximately 360 nm @ 12 knots = 30 hours)

Day 7	Deploy six low-frequency sites furthest from coast (approximately 180 nm @ 10 knots = 18 hours + 8 hours for deployment)
Day 8	Transit to high-frequency sites - triangles (approximately 360 nm @ 12 knots = 30 hours)
Day 9	Recover high-frequency instruments - triangles (approximately 124 nm @ 10 knots = 12.4 hours + 8 hours for deployment), return to Broome.

Piggy-back Projects

2 berths on this cruise will be made available to researchers from the Cetacean Ecosystem Program at Deakin University, who will participate as cetacean observers.

Franklin Equipment

We will require the use of Franklin's bottom mounted 12 kHz transducer as on previous cruises.

We request underway salinity, flourometry (chlorophyll), temperature sensor and depth data to be logged if possible.

User Equipment

Twelve seafloor magnetotelluric instruments
Four seafloor magnetometers
Acoustic deck unit
Towed SP instrument, cables and computers

Personnel List

Dr G. Heinson, Adelaide University, Chief Scientist, deploy OBEMs
A/Prof A. White, Flinders University, Project Leader, deploy OBEMs
Dr F.E.M. Lilley, ANU, Magnetometer Deployment
Dr S. Blake, BRS - Canberra, Marine geophysics/data management
Mr W. Peacock, Flinders University, Electronics - Technical
Debbie Thiele, Deakin University, Cetacean Observer
Debra Glasgow, Deakin University, Cetacean Observer
John Wallace, CMR, Cruise Manager
Bob Beattie, CMR, Computing
Phil Adams, CMR, Electronics

This cruise plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel Franklin.

John Wallace

Ships Manager

Updated: 31/01/03