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 Summary No. FR08/2000

Title

The Continent-Ocean Transition of the Crust and Mantle across the North West Shelf (Leg 2)

Itinerary

Depart Dampier 0700hrs Friday 22nd Sep, 2000
Arrive Dampier 0800hrs Monday 25th Aug, 2000

Principal Investigators

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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

Twelve seafloor magnetotelluric (MT) instruments (squares in Figure 1) will be recovered from the seafloor deployments sites established from the first leg of the cruise in August. The same instrumentation was recently recovered off the coast of Eyre Peninsula (1998) and Gulf of Carpentaria (1999) in a similar configuration, so we did not anticipate any logistical difficulties.

Cruise Track

See Figure 1

Results

Twelve low frequency MT instruments were deployed in August 2000 along a transect across the Exmouth Plateau, as detailed in Table 1.

Site	Instrument	Latitude	Longitude	Depth (m)	Data Type
EX1	Jonah	17° 56.636' S	113° 18.299' E	1902	E and B
EX2	Quartet	18° 07.598' S	113° 37.840' E	1819	B only
EX3	Charlie	18° 18.491' S	113° 57.724' E	1549	E and B
EX4	Twosome	18° 29.330' S	114° 17.370' E	1420	B only
EX5	Dodo	18° 40.907' S	114° 36.624' E	1604	E and B
EX6	Tertius	18° 51.190' S	114° 56.620' E	1732	B only
EX7	Horace	19° 02.417' S	115° 15.226' E	1512	E and B
EX8	Solo	19° 13.000' S	115° 35.170’ E	542	B only
EX9	Igor	19° 18.329' S	115° 45.137' E	314	E and B
EX10	Gonzo	19° 23.647' S	115° 55.139' E	214	B only
EX11	Fuzzy	19° 29.003' S	116° 05.103' E	132	E and B
EX12	Ernie	19° 37.201' S	116° 15.488' E	104	E and B

Table 1: Instrument site, name, location, depth and data. In the last column, B stands for magnetic field data and E for electric field data.

All instruments had an acoustic burn-wire release mechanism. We successfully

recovered eleven instruments, but EX7 (Horace) was lost. On deployment in August, EX7 stopped responding while sinking at 1200 m depth and we believe that the instrument probably flooded.

Instrument EX9 (Igor) was eventually recovered by dragging a cable on the seabed in 300 m water depth. The acoustics were working, and acknowledged the release code, but the instrument remained on the seabed. We suspect that strong sea-bottom currents may have flipped the instrument upside down soon after deployment, with the lead ballast on top of the instrument, and hence the burn wire corroded, but the lead remained in place. On dragging, the cable presumably knocked the ballast off, and we were able to track EX9 to the surface. Recovery at night was somewhat complicated as the instrument was upside down in the water and had no visual beacons. However, acoustic ranging was maintained and we successfully picked up EX9 late on the 24th September.

Table 2 below shows data retrieval so far, with an indication of quality.

Site	Instrument	Depth (m)	Data	Quality	Comments
EX1	Jonah	1902	E and B	Very good, 46 days of data	
EX2	Quartet	1819	B only		
EX3	Charlie	1549	E and B	Very good, 46 days of data	
EX4	Twosome	1420	B only		
EX5	Dodo	1604	E and B	Very good in E-field, 46 days of data. Good in B-field with 16 days of data. No time drift for B-field.	Magnetometer B-field sphere contained about a litre of water that eventually shorted the power supply.
EX6	Tertius	1732	B only		
EX7	Horace	1512	LOST	LOST	LOST
EX8	Solo	542	B only		B only
EX9	Igor	314	E only	Very good in E-field, with 46 days of data. No B-field data, and flat battery.	The flat battery suggests that magnetometer B-field readings were off-scale, possibly due to instrument being upside down.

EX10	Gonzo	214	B only	Good, but noisy at first, in B-field, with 46 days of data.	
EX11	Fuzzy	132	E and B	Good in E-field, with 46 days of data. Noisy in B-field for 46 days.	Noise in B-field suggest instrument moved with currents
EX12	Ernie	104	E and B	Good in E-field, with 46 days of data. Noisy in B-field for 46 days.	Noise in the B-field suggest the instrument is moving with currents

Table 2: Instrument site, name, depth and data quality. In the last column, B stands for magnetic field data and E for electric field data. Instruments at sites EX2, EX4, EX6 and EX8 have not yet been opened to check data recovery.

Cruise Narrative

Date	Site	Notes
22/9	Dampier	Departed Dampier at 0700 LT
		Transit to site EX12 (approximately 65 Nm. Weather very calm)
	EX12	Recovered EX12 from 104 m depth with no problems. On board at 1400 LT. Instrument covered in sediment and marine growth, but otherwise in good shape.
		Transit to site EX11 (approximately 14 Nm.)
	EX11	Recovered EX11 from 132 m of water. On board at 1700 LT. Some problems with communication to the instrument due to significant noise. Instrument covered in sediment (less than at EX12) but with one broken plastic arm. All other instruments at depths greater than 200 m did not contain much sediment.
		Transit to site EX10 (approximately 11 Nm.)
	EX10	Arrived at EX10 at about 1800 LT and enabled top acoustics. However, decided not to release the instrument due to sunset and lack of visual aids on the instrument.

		Transit to site EX6 (approximately 66 Nm) On the way we attempted to communicate with site EX7 at 1100 LT. However, no response from the instrument was obtained.
23/09	EX6	Recovered EX6 from 1732 m depth. The instrument had a flashing beacon and was easily spotted. On board at about 0200 LT
		Transit to site EX4 (approximately 44 Nm)
	EX4	Recovered EX4 from 1420 m depth. On board at about 0700 LT
		Transit to site EX3 (approximately 22 Nm)
	EX3	Recovered EX3 from 1549 m depth. On board at about 1000 LT
		Transit to site EX1 (approximately 44 Nm)
	EX1	Recovered EX1 from 1902 m depth. On board at about 1530 LT
		Transit to site EX2 (approximately 22 Nm)
	EX2	Recovered EX2 from 1819 m depth. The instrument had a flashing beacon and was easily spotted. On board at about 1900 LT
24/09		Transit to site EX5 (approximately 66 Nm)
	EX5	Recovered EX5 from 1604 m depth. On board at about 0600 LT. Magnetometer sphere contained about 1 litre of water that eventually shorted the power supply. Presumably the leak occurred close to the surface on deployment and maybe during recovery.
		Transit to site EX7 (approximately 44 Nm)
	EX7	Did not recover EX7. We tried pinging with the ship's 12 kHz transducer and with an over-the-side transducer, without success. A small search box of between 0.5 and 1 Nm from the instrument drop point failed to make contact. Abandoned the search at 1120 LT.
		Transit to site EX8 (approximately 22 Nm)
	EX8	Recovered EX8 from 542 m depth. On board at about 1400 LT
		Transit to site EX9 (approximately 11 Nm)

	EX9	Enabled top pinger and sent release code at about 1500 LT. Waited for 1 hour for the burn wire to corrode, but instrument failed to rise. We were unable to communicate with the other independent instrument acoustic system, and presumed something was wrong. Our guess at the time was that either the instrument was stuck in sediments, or perhaps the magnetometer had flooded. After another 20 minutes, the attempts were abandoned, and we decided to pick up site EX10 in daylight if possible.
		Transit to site EX10 (approximately 11 Nm)
	EX10	Recovered EX10 from 214 m depth. On board at about 1800 LT. The instrument showed significant signs of damage, including two broken plastic arms. The indication was of very strong sea-bottom currents moving the instrument about 250 m from the drop point location.
		Transit back to site EX9 (approximately 11 Nm)
	EX9	Arrived back at the site at about 1900 LT. After a few attempts, we were able to communicate with both sets of acoustics, and re-sent release codes. However, the instrument did not change its range, indicating it was still on the seabed. At 1945 LT, a cable was deployed on the seabed of depth about 300 m with an end grapple hook. Approximately 1200 m of cable was spooled out in a circle around the drop point. After completing the circle, the wire was winched back in, pulling the cable across the sea floor. From the acoustic records, we were able to see the point at which the wire hit the instrument, presumably knocking the ballast off. The instrument rose to the sea surface upside down at about 2030, and was recovered with the aid of the ship's spotlights. Acoustic contact was maintained with EX9.
		Steam to Dampier (approximately 90 Nm)
25/09	Dampier	Arrived at 0800 LT

Summary

The quality and distribution of geophysical instruments across the Exmouth Plateau will provide us with a means of determining the deep geological structure of this part of the North West Shelf. We anticipate being able to produce a two-dimensional geophysical model of the region and compare this with AGSO seismic

data. In addition, the instruments are also sensitive to oceanographic currents across the North West Shelf.

The data will be worked on by the Principal Investigators and we anticipate that one Ph.D. student and a number of Honours students will also benefit from the experiment.

Personnel

Dr Graham Heinson	Adelaide University	Chief Scientist, geophysics
A/Prof Antony White	Flinders University	Project Leader, geophysics
Dr F.E.M. (Ted) Lilley	ANU	Geophysics
Dr Steve Blake	BRS	Oceanography & geophysics
Professor Karsten Bahr	Universitaet Goettingen	Geophysics
Dr Fiona Simpson	Universitaet Goettingen	Geophysics
Dr Debbie Thiele	Deakin University	Cetacean observer
Ms Rebecca Pirzl	Deakin University	Cetacean observer
Mr Ron Plaschke	CMR	Cruise Manager
Mr Lindsay Pender	CMR	Computing
Mr Eric Madsen	CMR	Electronics
Mr Neil Cheshire	Master	
Mr Arthur Staron	1st Officer	
Mr John Boyes	2nd Officer	
Mr John Morton	Chief Engineer	
Mr Rob Cave	1st Engineer	
Mr Hugh McCormick	Electrical Engineer	
Mr Steve Harris	Greaser	
Mr Bill Hughes	Bosun	
Mr Tony Hearne	AB	
Mr Terry Gamin	AB	
Mr Norm Irvine	AB	
Mr Ron Culliney	Chief Steward	
Mr Gary Hall	Chief Cook	
Mr Wayne Hatton	2nd Cook	

Acknowedgements

Cruise FR08/00 on the RV Franklin was a great success. Losing one instrument was a small disappointment, but expected given the number of deployments made and the usual rate of loss of instrumentation in marine geophysics (typically 5%). Recovery of the last instrument at EX9 with the seabed cable and then picking the instrument up at night with no lights and only acoustic contact was superb, and we are very indebted to the skill and willing of the RV Franklin's Master and crew in the operation. Without their efforts, this instrument would have been lost.

As always, the experience and expertise of the Master, Mr Neil Cheshire, and the crew of the RV Franklin were much appreciated. Their cheerful and friendly approach made recovery of instruments smooth and uneventful. The CSIRO personnel (Mr Ron Plaschke (Cruise Manager), Mr Lindsay Pender (Computing) and Mr Erik Madsen (Electonics)) were always helpful and co-operative, and we are very grateful for their guidance throughout the cruise.

This cruise represented the third of a series of marine geophysical investigations of the continental margin around Australia. In April-May 1998, we spent a total of three weeks south of Eyre Peninsula, and in November-December 1999 another three weeks was spent in the Gulf of Carpentaria. In each of the three experiments, the RV Franklin has been extremely suitable for our needs. We are very grateful to the Franklin Steering Committee and CSIRO Marine Research for time granted for the research projects, and the various Masters and crews over the last three years.

Graham Heinson
Chief Scientist.

Figures

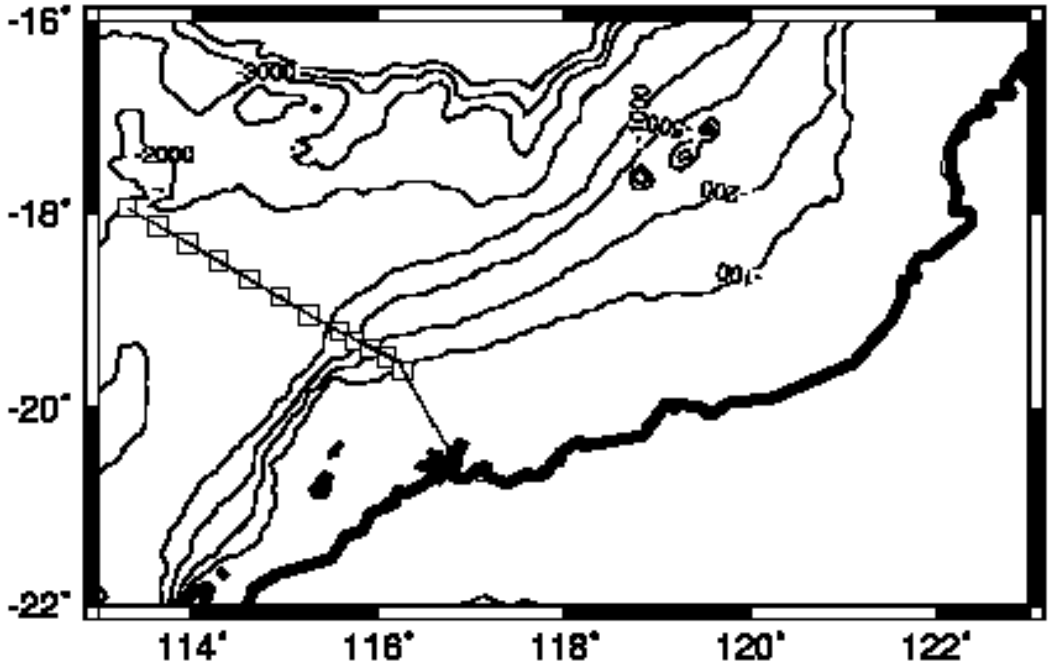

Figure 1: Cruise Track from Dampier to the 12 deployed instruments (squares) across the Exmouth Plateau.

Updated: 31/01/03