

## VOYAGE PLAN SS05/2003

### Title

Basin tectonics and salt structure delineation in the Browse-Bonaparte Compartments, Timor Sea

### Itinerary

Depart Darwin 1000 hrs, Wednesday 11 June, 2003

Arrive Darwin 1000 hrs, Saturday 21 June, 2003

### Principal Investigator

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### Scientific Objectives

The sedimentary basins beneath the Timor Sea have very high hydrocarbon potential which have already become major exploration areas. Basic structural information on sedimentary basins and salt structures that are potential hydrocarbon traps has been obtained by conventional seismic methods. These methods are good at locating the top of salt structures but have poor sensitivity to lower salt structures due to reverberation and losses of acoustic energy. Magnetotelluric (MT) methods, in which natural electromagnetic variations signals are measured at the seabed, have recently been found to be highly successful in similar marginal seas at locating not only the top but also the bottom of the salt diapirs and the depth to basement, imaging them in terms of electrical conductivity.

This experiment represents a pilot study in which up to twenty separate MT deployments will be made, each deployment for a 1-2 day period. The MT instruments will be deployed in transects with site spacing of 2-3 km along a previous seismic line near the Tern well in Bonaparte Gulf where there are salt diapiric structures. It is anticipated that an electrical conductivity model structure for the study area will be developed that complements and enhances geological understanding of the salt structures. In particular, the model will address the age and depth extent of the structures and their relationship with sedimentary structures.

## Cruise Objectives

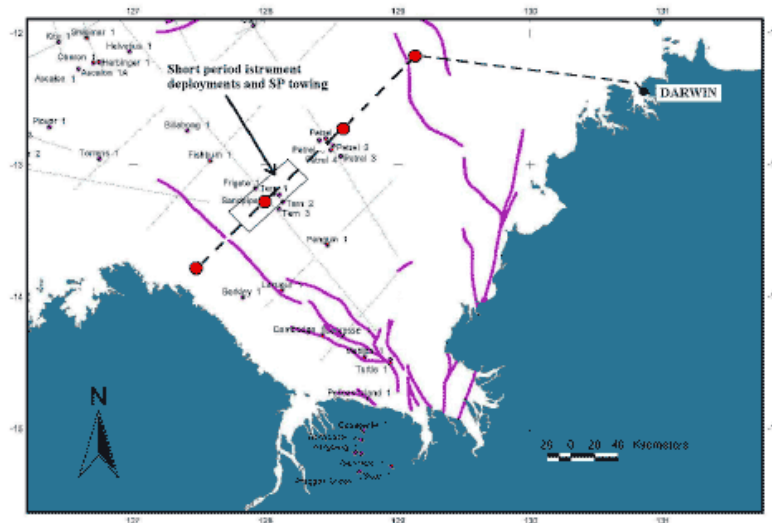
The cruise objectives are to obtain the magnetotelluric (MT) data required for the project by deploying to the seabed a number of recording OBEMs ( Ocean Bottom Electrometer/Magnetometers) along transects aligned with Geoscience Australia's seismic line 100/003 in the Bonaparte Gulf. These instruments free-fall to the sea floor and record magnetic and electric field fluctuations until they are acoustically commanded to re-surface. The instruments weigh approximately 250 kg, and deployment and recovery is by light crane over the side of the vessel. Such procedures with these instruments have been used many times previously on R.V. Franklin.

Initially, 4 long period instruments will be deployed along the line about 85 km (50 n.m.) apart, and these will form a baseline to provide the regional structure for the short period instrument study. They will be deployed at the start of the cruise and recovered at the end before returning to Darwin. The short period instruments will be deployed in a closely spaced grid (approx spacing 2-3 km) in the vicinity of Tern well and will only record for periods of approximately 24 to 36 hours. They will be continuously recovered and redeployed during the cruise to give maximum possible spatial coverage. Site location, spacing and recording length may be varied depending on results obtained during the experiment.

During periods when all instruments are recording on the sea floor, an array of Self Potential electrodes and a magnetometer will be towed at 4 knots across faults and other structures seen on the seismic interpretation. This will investigate whether SP signals are associated with the structures. The deployment/recovery and towing schedule will repeat to maximise the number of sites occupied by the short period instruments (probable number of sites is 16 to 20).

## Cruise Track

The cruise track is shown in the accompanying figure. Within the box marked "Short period instrument deployments and SP towing" there will be up to 20 deployments and recoveries of short period OBEMs and several SP tows during recording periods.



### Time Estimates

1	Transit to first long period instrument site	11 hours
2	Deploy 4 long period instruments along seismic line 100/003	24 hours
3	Transit and deploy 4 short period instruments	12 hours
4	Tow SP/magnetometer	15 hours
5	Recover 4 short period instruments	12 hours
6	Repeat 3, 4, 5 up to a further 4 times	156 hours
7	Recover 4 long period instruments	24 hours
8	Transit to Darwin	10 hours
<b>Total</b>		<b>(11 days) 264 hours</b>

### Southern Surveyor Equipment

Apart from the provision of lab and deck space for assembling equipment the requirements are;

- use of after-deck crane for over-the-side deployment and recovery of instruments from the sea surface.
- use of hull mounted 12 KHz transponder for acoustic communication with instruments ascending/descending water column to the sea bed.
- Use of main winch for towing SP/magnetometer array behind vessel. Length of towed array behind vessel approximately 200m; towing speed approx 4 knots

### User Equipment

Project investigators will provide

- 4 long period and 4 short period OBEMs (Ocean Bottom Magnetometer/Electrometers) plus ballast weights
- Acoustic communication equipment (requires access to hull mounted 12 KHz transducer)
- Self potential electrode array, plus magnetometer for towed surveys

### Special Requests

Hydrochemistry and the satellite data validation project (radiometer work) have requested berths on this voyage to test and operate equipment.

### Provisional Personnel List

Ass. Professor Antony White , Flinders University, Chief Scientist  
Mr Wayne Peacock, Flinders University, Technician  
Mr Brenton Perkins, Flinders University, Technician  
Dr Graham Heinson, Adelaide University, Research Scientist  
Ms Selina Donnelley, Adelaide University, Research student  
Dr F.E.M. (Ted) Lille, Australian National University, Research Scientist  
Mr Tjipto Prastowo, Australian National University, Research student  
Mme Claire Menesguen, Australian National University, Exchange Research student  
Jeff Cordell, CSIRO Marine and Atmospheric Research, Voyage Manager, Electronics  
Mirosław Ryba, CSIRO Marine and Atmospheric Research, Computing  
Mark Rayner, CSIRO Marine and Atmospheric Research, Hydrochemistry  
Ken Suber, CSIRO Marine and Atmospheric Research, Radiometer

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

**Chief Scientist**

**Associate Professor Antony White**