

# **CRUISE PLAN**

## **RV FRANKLIN**

**FR 4/99**

### **Title**

*Extension of cool-water carbonate facies into deeper waters in Australia's tropical North-West Shelf area : oceanographic, sedimentological, paleontological and geochemical history.*

### **Itinerary**

Depart: Darwin 0830 Monday 21 June 1999

Arrive:Dampier 1000 Tuesday 13 July 1999

### **Principal Investigator(s)**

### **Chief Scientist:**

Dr. Yvonne Bone

Dept. Geology & Geophysics

University of Adelaide

South Australia 5005

Ph. (08) 8303-5379

Fax:(08) 8303-4347

E-mail:ybone@geology.adelaide.edu.au

### **Others:**

Dr. Lindsay Collins, Dept. of Applied Geology, Curtin University

Dr. Noel P. James, Geological Sciences, Queens University, Kingston, Canada

### **Scientific Objectives**

The goal of RV Franklin cruise FR 01/96 from Fremantle to Cape Maud was to investigate the transition of temperate carbonate production to that occurring in the tropics. Based on our understanding of how the system operates along the southern margin of Australia, we had anticipated that this transition would be located in the vicinity of the Abrolhos Archipelago. We were wrong! Cool-water facies persisted as far north as we were able to extend the cruise track in the given time-frame, i.e. to Point Maud. In the shallower depths (<80m) there was an increasing overprinting of the cool-water facies by a tropical input as we traversed northwards, whereas in deeper waters the cool-water facies persisted, but with quite different density and distribution of the familiar southern benthic invertebrates.

This intriguing north-wards extension of the cool-water facies demanded further investigation. This, then, became the focus of our next application for use of RV Franklin. The application was successful, and Cruise FR 04/99 was scheduled with the following Scientific Program and Aims.

The specific objectives of this research cruise are:

- (1) To investigate/map the distribution of facies with cool-water attributes in the north-west shelf area, and compare the pattern with measured oceanographic parameters.
- (2) To take bottom sediment and biota samples to (a) accurately determine the hydrodynamics of sediment production, accumulation and history and (b) to determine the density and distribution of living benthic invertebrates and compare them to the recently dead and relict specimens in the sediment samples.
- (3) To ground-truth the sea-floor by colour photography, with the added advantage of thereby enabling ready comparisons of living vs. dead biota.
- (4) To collect bottom water samples for analysis (onboard and onshore), to measure salinity, temperature profiles (CTD), pH, nutrients and currents (ADCP) to determine the influence of each parameter on the seafloor and its biotic cover.
- (5) To assess the potential of the area for the concentration of such mining targets as diamonds, heavy minerals and other industrial minerals, in paleostrandlines and paleochannels related to seafloor morphology. This aspect would involve bottom sediment sampling of sites selected on the basis of precision depth profiling and prior geomorphic assessment (by geomorphologist E. Campbell) of adjacent onshore environments that show source potential.
- (6) To shed light on the route of some taxa into the southern hemisphere, e.g. the point of origin of the vagrant bryozoans is contentious, i.e. the older literature suggests they evolved in the northern hemisphere, where they are now mainly extinct, and were relatively late arrivals here, where they now flourish, whereas the work of Conroy, from the samples collected on FR 01/96 suggests they may have originated from a southern circumpolar source. This aspect will involve detailed taxonomy and also dating of relict material.
- (7) To determine the shallow seismic profiles along selected transects in order to determine the Tertiary and younger stratigraphy of the area.

## **Cruise Objectives**

### **DARWIN / DAMPIER**

- 1150 km Precision Depth Profiling
- 96 Bottom Samples
- CTD Profiles
- Camera and Video Stations
- Seismic Lines

We will depart from Darwin on the 21<sup>st</sup> June. We plan to steam to the site of a hydrocarbon seep at approx. 3030'S - 12430'E, where we will collect some bottom samples for AGSO, Canberra.

We will then steam to the start of our transects, where we will commence our data collection, sediment, water and biota sampling, and photographic and video footage program. We will continue our program until time demands that we steam to Dampier.

## **Cruise Track**

The following transect way-points are the framework within which we intend to operate. Since this is in large part an exploration research cruise, the plan will inevitably be modified on the basis of on-site discoveries. The proposed cruise track is attached.

Transect way-points (see attached chart)

A17 04'S122 00'E

B15 07'S120 27'E

C16 12'S119 47'E

D18 04'S121 49'E

E18 50'S 121 03'E

F16 40'S119 33'E

G17 04'S118 51'E

H19 20'S120 44'E

I19 31'S120 13'E

J17 21'S118 29'E

K17 52'S117 52'E

L19 44'S119 22'E

M20 05'S118 29'E

N18 21'S117 09'E

O18 34'S116 43'E

P20 13'S117 59'E

Q20 21'S117 22'E

R19 09'S116 09'E

S19 22'S115 39'E

T20 16'S116 42'E

U20 44'S116 05'E

## **Extra Project AGSO Petroleum and Marine Division**

The purpose of the AGSO component of the RV Franklin cruise is to sample the Yampi

Shelf hydrocarbon seeps. These are found ~12.45 S 124.50 E. All equipment needed for this work to be provided by AGSO unless otherwise stated.

It is proposed that we follow parts of the Yampi tertiary Tie (YTT) seismic lines 8,9,10:

1. Acquire a suite of sediment samples to assist in the investigation of the occurrences and distributions of benthic communities in and around the natural occurring hydrocarbon seeps of the NW shelf. To do this we need box cores to collect 2 - 4 samples per site, one of which is to be frozen immediately. Any macro benthos to be frozen for later analysis. We also intend to deploy a pipe dredge for this purpose.
2. Obtain a series of water samples at various water depths over the study region. To do this we will need to utilise the rosette (12 bottles) on the Franklin and acquire samples at various depths from the sediment interface to sea surface. These samples are then to be poisoned ( $\text{HgCl}_2$ ) and stored at 3 C. We may need assistance from others on board for this sampling.
3. Capture a set of video and still photographic images of the study area. To do this we need permission to use Yvonne Bone's video and photographic equipment.
4. Gain high-resolution shallow seismic profiles over the transects at Yampi shelf. Additional work to be tasked by Dr. Yvonne Bone. Implementation of seismic surveys to be tasked by Stephen Thomas.
5. Sea Floor mapping using Side Scan sonar will be deployed from the Franklin. Additional work to be tasked by Dr. Yvonne Bone and Stephen Thomas.

## **Franklin Equipment**

All the Facility equipment requested in the original proposal is still needed: gravity corer, CTD and rosette sampler, XBT, ADCP, surface and bottom temperature, salinity, oxygen, pH, nutrient level, pinger (for camera), echo-sounder, data logger, containerised deck lab. plus all standard systems.

## **User Equipment**

Scientific crew will supply: epibenthic sled, Bleys dredges, underwater camera, underwater real-time video system, seismic equipment. AGSO equipment as above.

## **Personnel List**

Yvonne Bone(University of Adelaide - Chief Scientist)

Lindsay Collins(Curtin University - 2IC)

Noel James(Queens Univ., Canada - sedimentology)

Kurt Kyser(Queens University, Canada - geochemistry)

Chris Rancourt(Queens University, Canada - PhD student)

George Dix(Carleton University - sedimentology)

Stephen Thomas(AGSO - Petroleum and Marine Division, Canberra)

Kriton Glenn(AGSO - Petroleum and Marine Division, Canberra)

Bob Beattie(CSIRO - Computing, Cruise Manager)

Erik Madsen(CSIRO - Electronics)

Daniel Conwell(CSIRO - Electronics)

Rebecca Cowley(CSIRO - Hydrochemistry)

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

Signed

Chairman, Steering Committee

## **Figures**

(See attached).