R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

RESEARCH CRUISE SUMMARY

R.V. FRANKLIN

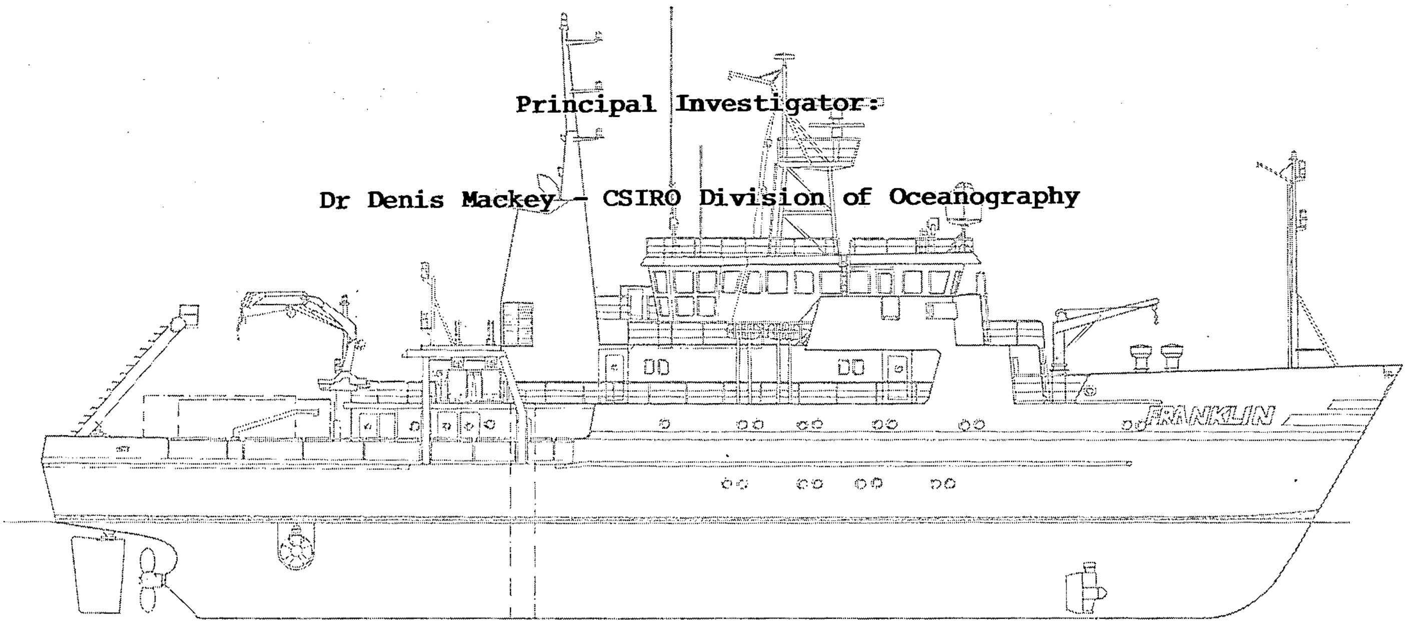
CRUISE FR 10/87

3 - 24 November 1987

BROOME - CAIRNS

Principal Investigator:

Dr Denis Mackey - CSIRO Division of Oceanography



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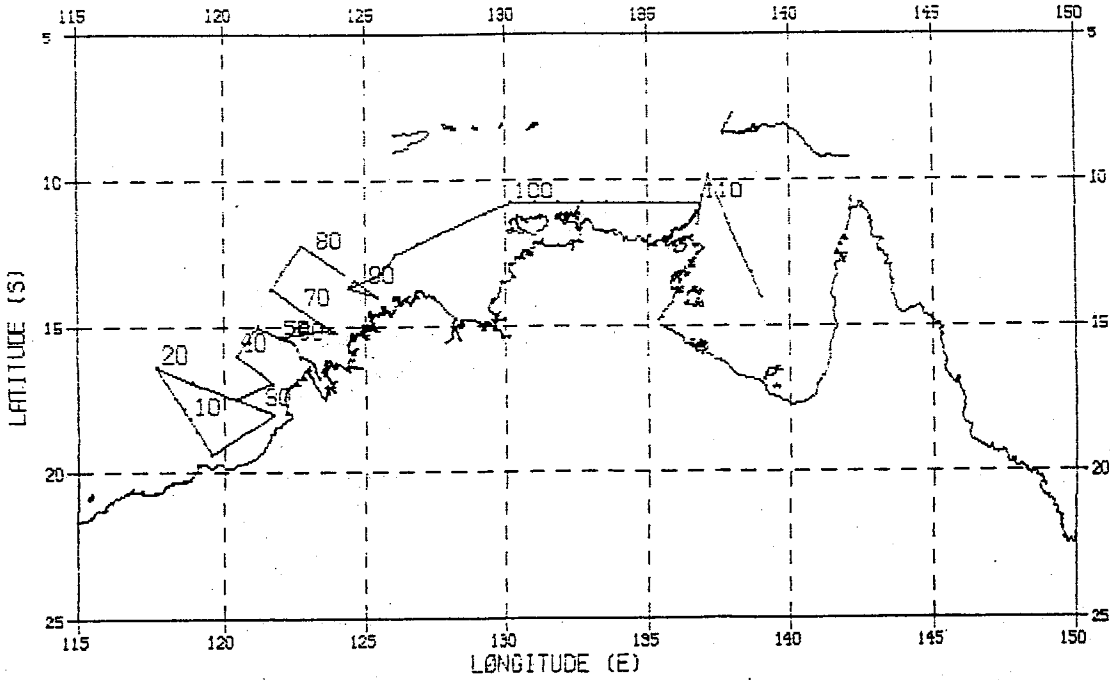
Telex AA 57182

AUSTRALIA

R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

ITINERARY

Departed Broome:	1515 h	Tuesday	3 November
Arrived Gove:	0900 h	Thursday	19 November
Departed Gove:	1400 h	Thursday	19 November
Arrived Cairns:	1000 h	Tuesday	24 November



OUTLINE OF CRUISE

Our departure from Broome was delayed by a few hours due to problems in shifting the biological container from the port to the starboard side and mounting the clean container on the port side. The first station was occupied within three hours and we deployed our first SEASTAR/Sediment Trap mooring before conducting an approximately longshore transect to #6. The first transect across the shelf was a repeat of the eastern transect which was extensively studied by FRV Soela between July 1982 and November 1983. The transect was extended until the water depth was 5000 m and we remained on station for 20 h doing multiple casts. Samples for trace metal analysis were collected from the Zodiac.

The second transect across the shelf took us through Rowley Shoals to the location of #1 where we recovered the first mooring. No samples were obtained because of equipment failure. The equipment was modified by the ship's engineers and it behaved faultlessly on all subsequent deployments.

On the fourth transect across the shelf, we deployed a SEASTAR/Sediment Trap mooring near Lynher Banks and, after waiting for favourable tides, proceeded into King Sound. Tidal current of a few knots were encountered as we entered King Sound against the outgoing tide. After collecting samples at slack tide in the middle of the Sound we returned to Lynher Bank to recover the sediment trap.

During the offshore section between the next two transects across the shelf, we launched a buoy for the Department of Meteorology, steamed along a fixed course and then retraced our 'steps' to provide calibration data for the ADCP, and dropped about 30 XBTs at two locations. The latter experiment was designed to provide information on the correlation between the data from the Franklin XBT system and that deployed on the ship of opportunity program. A sediment trap, deployed off the Kimberley Coast, was recovered after about 18 h and we proceeded to Gove doing CTD casts and collecting samples every 100 km. North of Arnhem Land, we observed long surface slicks which were thought to be due to a bloom of *Trichodesmium*. The Turner fluorometer registered some increase in fluorescence but it was apparent that the intake to the Turner (at a depth of about 4 m) was below most of the bloom.

After a partial changeover of personnel at Gove, we steamed almost due north and deployed a current meter mooring approximately 10 nm inside the limit of Australian territorial waters. We deployed the WOMBAT meteorological buoy and a sediment trap in the centre of the Gulf of Carpentaria and then steamed to Cairns via the inshore passage.

SCIENTIFIC PROGRAM

The autosampler was modified for the determination of iodate in addition to the usual channels for silicate, phosphate, nitrate and nitrite. The system for measuring pH and (Turner) fluorescence worked well and the data was combined with that from the thermosalinograph. One minute averages of the combined data were downloaded into the Compaq computer every few days and processed on board to provide daily plots of all parameters vs time as well as pH vs fluorescence etc.

Chlorophyll was analysed (spectrophotometrically) on board and samples were collected for HPLC analysis of pigments in Hobart. Water samples collected from the thermosalinograph line were used to calibrate the Turner DELP numbers with respect to chlorophyll a. The correlation was very high ($R^2 = 0.986$). We also attempted to calibrate the Variosens III fluorescence as a function of chlorophyll a but the results were less satisfactory. The Variosens fluorescence values were very intermittent with the raw data having approximately 85% of the values being zero when the instrument was collecting 'burst' data at a fluorescence maximum. Subsequent laboratory experiments have confirmed this observation and the most likely explanation at this stage is that the effect is due to microscale patchiness.

While it may not prove possible to obtain quantitative vertical profiles of chlorophyll a from the Variosens data, the integration of the instrument with the CTD unit provided valuable data on the depth and spatial end temporal variability of the phytoplankton in the water column. Further analysis of the Variosens and Turner data will enable us to assess the correlation (if any) between surface fluorescence, and biomass integrated throughout the water column.

The surface pH system behaved well and indicated that the surface waters were always undersaturaed with respect to carbon dioxide. Many surface fronts were observed and these could often be correlated with changes in temperature, salinity or fluorescence. The pH sensor on the CTD unit was unstable in the top 10 m. This was due to an unknown source of interference from the ship. We are currently attempting to assess the temperature and pressure dependence of the of the output from the pH sensor.

Productivity measurements were made each morning and there was only a small uptake of ^{14}C in the dark. Samples were also collected for the analysis of chlorophyll, pigments, dissolved organic carbon, iodine, arsenic, trace metals, copper complexing capacity, cyanobacteria, bacteria and lipids etc. A Smith - MacIntyre grab sampler was used to collect sediment samples from selected stations. A full list of the samples collected at each station is given in the appendix.

EQUIPMENT REPORT

Containers

The Clean Container was damaged by the HIAB which had been parked on top. When one of the crew attempted to raise the arm, he engaged the wrong lever with the result that the arm extended and gouged the top of the container. The light fittings in the entry port were broken but there was no serious damage. There are insufficient cables on board to tie down both containers in heavy seas.

The Biological Container is in a sorry state. Apart from the generally poor condition of all the fittings, the handle has fallen off the main door so that it is possible to be locked inside. The salt water supply to the container is spiked with iron salts to minimise corrosion and a warning to this effect should be placed over all taps where this is likely to occur.

It is impossible to hear any of the ship's warning sirens while in either of the containers. Relay systems should be installed in the containers and, in the meantime, the Cruise Leader should be aware of the problem and ensure that somebody (shiftleader?) is responsible for warning any personnel in the containers.

CTD system

The pin at the top of the CTD block sheared off and the block peeled apart as the CTD was about to be hoisted on board. When the cable came out of the block, the CTD dropped about one metre and landed on the edge of the hero platform. The frame buckled, the oxygen sensor and housing were smashed, the casing of the conductivity probe was bent, one Niskin bottle fell overboard and three Niskin bottles broke in half. Two of the end seals of the Variosens had 'popped' over the threads but there was no damage to the instrument. While the damage was considerable, it could have been much worse had the rosette not landed on the edge of the hero platform. It was also fortunate that no body was injured. For the remainder of the cruise, we used a stronger block supplied from the ship's stores. The CTD was repaired and transferred to the spare frame. The calibration of the instrument may be suspect for subsequent casts.

Variosens

The battery pack for the Variosens could not be charged using the portable charging unit since the ship's mains power supply was too low a voltage. The electronics workshop HP supply was used instead. The cable connecting the Variosens to the CTD unit developed a leak and after one attempt to repair the Y cable, a modified cable was made which performed well for the remainder of the cruise. Spare cables for the Variosens should be constructed and carried on subsequent cruises. The battery charge pack needs to be modified.

Thermosalinograph/pH/fluorescence system

There were several breaks in the thermosalinograph due to shutdown of the UPS system. The correlation between the fluorescence DELP display value and measured chlorophyll was excellent. The leak detector on the pH system did not work initially but did so after modification by the chief engineer. The water flow through the system is marginal and should be increased by about 50% if possible.

Sounder

The sounder followed the bottom for most of the cruise but the system was not logged by DELP for the first few days.

Navigation

There were times when the Sat Nav was slow during fix processing.

XBT

14 XBTs were dropped on each of the ORV Mk9 and MK9/HP85 systems.

Meteorology

There were minor gaps due to software development. Only wind speed & direction and temperature were recorded.

Doppler profiler

The water was shallow for most of the cruise and there was excess data rejection when too many bins were recorded. There were spectrum width errors on two occasions.

General

All other systems were OK.

SUGGESTIONS

The Compaq personal computer was extensively used on the cruise and will almost certainly be used more in the future. We have already written programs to process the data collected from the thermosalinograph/fluorescence/pH system and more such programs are likely to be used in the future. A second IBM compatible computer should be purchased and it could be located in the library. It would be nice to have a backup battery supply for the T/S microchip to avoid loss of date and time settings during power failures.

SHIP'S CREW

Neil Cheshire	Mike Taylor
Mike Stanton	Brett Marshall
Dick Dougall	Janek Hansen
Ian Mann	Don Dickson
Peter Noble	Charlie McLean
Jeff Cullen	Bluey Hughes
Dave McAllister	Paddy McLure

SCIENTIFIC PERSONNEL

Denis Mackey	CSIRO - Chief Scientist
John Volkman	CSIRO
Peter Nichols	CSIRO
Ed Butler	CSIRO
Neil White	CSIRO (to Gove)
Pat Deprez	CSIRO (to Gove)
Bob Beattie	CSIRO
Jeanette Atack	CSIRO
Eric Madsen	CSIRO
Ron Plaschke	CSIRO
Dave Terhell	CSIRO
Andrew Forbes	CSIRO (from Gove)
Danny McLaughlan	CSIRO (from Gove)
Bob Edwards	CSIRO (from Gove)

DJ Mackey

Cruise FR10/87
Summary of sample collection
Moorings at Stns 1 48 85 and 118
Turner line samples for Chl on and off Stations
pH and oxygen on CTD for all Stations
Variosens III for turbidity and fluorescence (except #25-28 and #33-41)

CTD#	NUT	OXY	SAL	DOC	CuCC	TM	SEPPAK	BACT	CYANO	TN	IO3	PROD	CHL	HPLC	LIPIDS	CHN	EM	SED
1	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN				CHL	HPLC	LIP			
2	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN									
3	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN									
4	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN			C14	CHL	HPLC	LIP	CHN	EM	SED
5	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN									
6	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN		IO3		CHL	HPLC	LIP	CHN		
7	NUT	OXY	SAL	DOC	CuCC			BACT			IO3							
8	NUT	OXY	SAL	DOC	CuCC			BACT			IO3			HPLC	LIP			
9					CuCC								CHL	HPLC	LIP			
10	NUT	OXY	SAL	DOC	CuCC			BACT			IO3			HPLC				
11	NUT	OXY	SAL	DOC	CuCC			BACT			IO3			HPLC				
12	NUT	OXY	SAL	DOC	CuCC			BACT			IO3			HPLC				
13	NUT	OXY	SAL	DOC	CuCC			BACT			IO3	C14	CHL	HPLC	LIP	CHN	EM	SED
14	NUT	OXY	SAL	DOC	CuCC	TM		BACT		TN	IO3						EM	
15	NUT	OXY	SAL											HPLC	LIP			
16	NUT	OXY	SAL	DOC	CuCC	TM		BACT		TN	IO3							
17			SAL															
18	NUT	OXY	SAL	DOC	CuCC	TM		BACT		TN	IO3			HPLC	LIP			
19	NUT	OXY	SAL	DOC	CuCC	TM		BACT		TN	IO3						EM	
20	NUT	OXY	SAL	DOC	CuCC	TM		BACT	CYAN	TN	IO3						EM	
21																		
22	NUT												CHL	HPLC				
23	NUT	OXY	SAL	DOC	CuCC			BACT										
24	NUT	OXY	SAL	DOC	CuCC			BACT						HPLC	LIP			
25	NUT	OXY	SAL	DOC	CuCC			BACT										
26	NUT	OXY	SAL	DOC	CuCC			BACT										
27	NUT	OXY	SAL						CYAN				CHL	HPLC	LIP			
28	NUT	OXY	SAL	DOC	CuCC			BACT										
29	NUT	OXY	SAL	DOC	CuCC													
30	NUT	OXY	SAL	DOC	CuCC			BACT										
31	NUT	OXY	SAL	DOC	CuCC			BACT										
32	NUT	OXY	SAL											HPLC	LIP			
33	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN					HPLC				
34	NUT	OXY	SAL	DOC	CuCC	TM		BACT			IO3		CHL	HPLC				
35	NUT	OXY	SAL	DOC	CuCC	TM		BACT	CYAN		IO3		CHL	HPLC	LIP			
36																		
37	NUT		SAL	DOC	CuCC	TM		BACT	CYAN		IO3		CHL	HPLC				
38	NUT		SAL										CHL	HPLC	LIP			
39	NUT	OXY	SAL	DOC	CuCC	TM		BACT	CYAN		IO3							
40	NUT		SAL											HPLC	LIP			
41	NUT	OXY	SAL	DOC	CuCC			BACT			IO3							
42	NUT	OXY	SAL	DOC	CuCC			BACT			IO3							
43	NUT	OXY	SAL						CYAN			C14	CHL	HPLC	LIP	CHN	EM	SED
44	NUT	OXY	SAL	DOC	CuCC			BACT			IO3							
45	NUT	OXY	SAL					BACT	CYAN				CHL	HPLC	LIP		EM	SED
46																		
47	NUT	OXY	SAL	DOC	CuCC			BACT			IO3							
48	NUT		SAL										CHL					
49	NUT		SAL											HPLC	LIP			SED
50					CuCC	TM	SEP											

51	NUT	OXY	SAL	DOC	CuCC			BACT		I03		CHL	HPLC	LIP			SED
52	NUT	OXY	SAL	DOC	CuCC			BACT		I03							
53	NUT	OXY	SAL	DOC	CuCC			BACT		I03							
54	NUT	OXY	SAL	DOC	CuCC			BACT		I03							
55	NUT	OXY	SAL									CHL	HPLC	LIP			
56	NUT	OXY	SAL	DOC	CuCC	TM	SEP	BACT	CYAN	I03							
57	NUT	OXY	SAL									CHL					SED
58	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03		CHL	HPLC	LIP			SED
59	NUT	OXY	SAL	DOC	CuCC			BACT		I03			HPLC	LIP			SED
60	NUT	OXY	SAL	DOC	CuCC			BACT		I03							
61	NUT	OXY	SAL	DOC	CuCC			BACT		I03							
62	NUT	OXY	SAL						CYAN		C14	CHL	HPLC	LIP	CHN	EM	
63	NUT	OXY	SAL	DOC				BACT	CYAN			CHL	HPLC	LIP			
64	NUT	OXY	SAL					BACT	CYAN			CHL					
65	NUT	OXY	SAL	DOC	CuCC			BACT		I03		CHL					
66	NUT	OXY	SAL	DOC	CuCC			BACT				CHL	HPLC	LIP			SED
67	NUT	OXY	SAL	DOC	CuCC			BACT		I03		CHL	HPLC	LIP			SED
68	NUT	OXY	SAL	DOC	CuCC			BACT		I03		CHL	HPLC	LIP			
69	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03	C14	CHL			CHN	EM	
70	NUT	OXY	SAL					BACT						LIP			
71	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03		CHL					
72	NUT		SAL	DOC	CuCC			BACT	CYAN			CHL	HPLC	LIP			SED
73			SAL														
74	NUT	OXY	SAL					BACT		I03							
75								BACT									
76	NUT	OXY	SAL														
77	NUT	OXY	SAL						CYAN		C14	CHL			CHN	EM	
78	NUT	OXY	SAL					BACT		I03							
79																	
80	NUT	OXY	SAL					BACT		I03							
81	NUT	OXY	SAL					BACT				CHL	HPLC	LIP			
82	NUT	OXY	SAL					BACT	CYAN	I03							
83	NUT	OXY	SAL					BACT				CHL					
84	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03							
85	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03	C14	CHL	HPLC	LIP	CHN	EM	
86					CuCC	TM	SEP	BACT				CHL					
87	NUT		SAL					BACT				CHL	HPLC	LIP			
88	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03							
89	NUT		SAL					BACT					HPLC	LIP			
90	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03			HPLC	LIP			
91	NUT	OXY	SAL	DOC	CuCC			BACT	CYAN	I03							
92	NUT	OXY	SAL					BACT	CYAN		C14	CHL	HPLC	LIP	CHN	EM	SED
93	NUT	OXY	SAL					BACT				CHL	HPLC	LIP			
94	NUT	OXY	SAL					BACT					HPLC	LIP			
95	NUT	OXY	SAL					BACT									
96	NUT	OXY	SAL					BACT									
97	NUT	OXY	SAL					BACT									
98	NUT	OXY	SAL					BACT					HPLC				
99	NUT	OXY	SAL					BACT				CHL	HPLC	LIP			
100								BACT									
101								BACT									
102	NUT	OXY	SAL					BACT									
103	NUT	OXY	SAL					BACT				CHL	HPLC	LIP		EM	
104	NUT	OXY	SAL				SEP	BACT									
105	NUT	OXY	SAL					BACT					HPLC	LIP			
106	NUT	OXY	SAL					BACT				CHL					
107	NUT	OXY	SAL					BACT				CHL					
108	NUT	OXY	SAL					BACT				CHL	HPLC	LIP			
109							SEP	BACT									
110	NUT	OXY	SAL									CHL	HPLC	LIP			

111	NUT	OXY	SAL			HPLC				
112	NUT	OXY	SAL		CHL	HPLC	LIP			
113	NUT	OXY	SAL		CHL	HPLC	LIP			
114	NUT	OXY	SAL		CHL	HPLC				
115	NUT	OXY	SAL		CHL	HPLC	LIP			
116	NUT	OXY	SAL		CHL	HPLC	LIP			
117	NUT	OXY	SAL							
118	NUT	OXY	SAL	C14	CHL	HPLC	LIP	CHN	EM	SED

NUT	nitrate, silicate,phosphate and nitrite
OXY	oxygen
SAL	salinity
DOC	dissolved organic carbon
CuCC	copper complexing capacity
TM	trace metals
SEPPAK	metal - organic compounds
BACT	bacteria
CYANO	cyanobacteria
TN	total nitrogen
IO3	iodate
PROD	C14 productivity
CHL	chlorophyll
HPLC	pigments for HPLC analysis
LIPIDS	lipids for GC analysis
CHN	particulates for carbon, hydrogen and nitrogen analysis
EM	samples for electron microscopy
SED	sediment samples