RESEARCH SUMMARY

FRANKLIN CRUISE FR 7/92

OCEAN TRANSPORT IN THE TASMAN AND CORAL SEAS

Sailed	Townsville	0800	Saturday 19 September 1992
Arrived	Brisbane	0630	Tuesday 6 October 1992

Principal Investigators

Dr John Church
Dr Gary Meyers
Mr Fred Boland
CSIRO Division of Oceanography

Professor Matt Tomczak
School of Earth Sciences
Flinders University of South Australia

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DIMETHYL SULPHIDE IN SURFACE AND SUB-SURFACE WATERS

Dr Graham Jones and Mark Curran
James Cook University

October 1992

Research Summary
RV Franklin
Fr 7/92

1. Itinerary

Departed Townsville 0800 Saturday 19 September 1992
Arrived Brisbane 0630 Tuesday 6 October 1992

2. Scientific Program

Ocean Transport in the Tasman/Coral Seas

Scientific Objectives

The objectives of this study are to analyse in detail the ocean dynamics in the Tasman and Coral Seas Specifically, we want ....

1) To estimate the volume transport of the East Australian Current (EAC) at 23°S and 30°S and to estimate the time variability of this transport at 30°S. The EAC differs from the surface western boundary currents in other oceans in that the eddies are of the same magnitude as the mean current so that it appears that the current is discontinuous in time and along the coast. Thus part of the problem is to acquire sufficient data to properly define the EAC. As part of this objective, we hope to determine the large-scale general circulation of the Tasman and Coral Seas using patterns of tracers (temperature, salinity, oxygen and nutrients) and of density to estimate geostrophic circulation (baroclinic plus barotropic) at all depths.

2) In collaboration with US scientists completing a section between South America and New Zealand at about 32°S, to estimate the meridional heat and freshwater fluxes. One of the keys to accurately estimating these fluxes is to have good estimates of the transport in the western boundary current (Hall and Bryden 1982).

Principal Investigators

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Dimethyl Sulphide in Surface and Sub-surface Waters

3) To estimate the natural distribution of DMS/DMSP in surface and subsurface waters, the dominant phytoplankton responsible, and to assess the flux between the ocean and the atmosphere.

Principal Investigators

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Cruise Objectives

- To recover, service and re-deploy the current meter array that was deployed on Fr 10/91 at 30°S
- To complete 2 CTD/ADCP/nutrient sections as indicated on the figure.
- To sample for, and analyse on board, DMS/DMSP.

3. Cruise Track

A completed cruise track is shown on the attached figure.

4. Cruise Narrative

Weather was good when we departed Townsville — no clouds, wind of less than 10 knots. Boat Drill at 0900 followed by Master's and Chief Scientist's briefings.

The first single bottle Niskin cast for Graham Jones was completed at about 1000 and these were continued at roughly four hour intervals. Several *trichodesmium* blooms were sampled. DMS and DMSP were detected.

Late Tuesday (Sept 22), we arrived at the mooring location and the 2000 m mooring was recovered. The 4000 m mooring was recovered early Wednesday. However, both of the moored acoustic Doppler current profilers (ADCPs) were not functioning properly and we could not redeploy the moorings. The most offshore (4400 m) mooring was recovered on Thursday. By this time the deck was so cluttered that no more moorings could be recovered until some were redeployed. Friday (Sept 25) was lost to bad weather and on Saturday the most offshore mooring was redeployed in marginal conditions. Weather deteriorated during the deployment and the 4000 m mooring could not be deployed until 1430 on Sunday. On Monday 28 the weather was excellent. The 2000 m mooring deployed by 0800 and the 700, 200 and 100 m moorings recovered by about 1300. On Tuesday, the final 3 moorings were deployed. During the nights when mooring work could not be undertaken, either the ADCPs for the moorings were tested or ship mounted ADCP data was collected.

The CTD section was finally commenced late on Tuesday, October 29. Only two stations were completed before the winds reached 45 knots. By Wednesday, the weather was good enough to continue CTD stations. Over the next few days, CTD stations were continued in sloppy weather and the final CTD station was completed about 2330 on Sunday. *Franklin* then steamed north and we arrived in Brisbane at 0630 Tuesday, October 6.

5. Cruise Results

Ocean Transport in the Tasman and Coral Seas

The first priority of the cruise was to recover and redeploy the current meter moorings. Although the mooring work took considerably longer than planned (a combination of the malfunctioning ADCPs and bad weather), all the recoveries and deployments went very smoothly. Data return from the Aanderaa current meters were good; one Sydney University current meter was lost (the top of the 200 m mooring) because of a failed spindle, one current meter had a minor leak and returned an incomplete record and two other current meters had incomplete records because of battery failure. One of the ADCPs had recorded a 200 day record (instead of the possible 300 days) of what looks like excellent data but the other ADCP failed to record any data. More complete details are given in the attached Mooring Report.

The CTD work had to be curtailed because of time lost by the combination of bad weather and the malfunctioning ADCPs. A CTD section across the moorings and across the deepest waters of the Tasman Sea as far as the western edge of the Lord Howe Rise was completed. The western half of this CTD section was also completed. The southward flow of the East Australian Current was notably weaker on the second crossing.

DIMETHYL SULPHIDE IN SURFACE AND SUB-SURFACE WATERS

During this cruise thirty-five surface seawater stations were sampled from the two sea regions with the major emphasis given to the Tasman Sea. Immediate analysis of DMS was made in duplicate using an onboard gas chromatograph, as well as determinations of intracellular and extracellular concentrations of the precursor molecule DMSP. In addition three depth profiles of all three species were made, as well as some measurements of Antarctic Bottom Water. In total, some 250 measurements were made. This was the first time that these sulphur species have been determined onboard ship as far as I'm aware. Previously, measurements had to be made back at the laboratory. In addition 26 stations have been sampled in duplicate for DMS levels in air, concurrently with the seawater measurements. This data will be linked to the meteorological and hydrological data determined by Dr John Church's team, and wind speed data taken routinely. Flux estimates of the transfer of DMS from the ocean to the atmosphere for these two sea regions can then be made, as well as identifying the dominant parameters affecting this transfer. During the cruise at station 16, a biological incubation experiment was performed using the chloroform technique in order to ascertain whether the DMS turnover from the Tasman Sea is dominated by biological consumption, rather than atmospheric exchange. In short, the experiments performed onboard were highly successful due undoubtedly to the excellent facilities provided to us whilst we were onboard.

Graham Jones (Lecturer in Marine Chemistry: JCU) 4/10/92

6. Action Items

The airconditioner for the VAX needs attention. Even in the mild conditions experienced the airconditioner frequently iced-up causing overheating of the VAX.

The 24 bottle rosette needs attention. The rosette fired bottles reliably however often gave (nf) return, particularly on deep bottles.

The Niskin bottles need attention. The new bottles look like they will be excellent but they need some attention to the finishing off. All the bottles need correctly tensioned (and not perished) rubbers and there need to be more Niskin spares on board.

7. Personnel

Scientific personnel

J. Church (Chief Scientist)	CSIRO DO
F. Boland	CSIRO DO
K. Miller	CSIRO DO
D. McLaughlin	CSIRO DO
N. White	CSIRO ORV
P. Adams	CSIRO ORV
V. Latham	CSIRO ORV
M. Rayner	CSIRO ORV
Graham Jones	JCU
M. Curran	JCU

All moorings were recovered successfully. The work took much longer than expected due to a combination of bad weather and problems with the Acoustic Doppler Current Profilers.

The Aanderaa meters worked well. One meter was lost. It was S/N 9303 belonging to Sydney University. The spindle carrying the meter snapped and the meter plus the sub-surface float are missing. The records from the other meters suggest that it happened sometime in January - about 3 months after it was deployed.

One other meter failed to produce a record. S/N 6166 had about a teaspoon of water inside when recovered. The meter was still running but the drops had fallen on the tape spindle and jammed the mechanism.

Data return from the Aanderaas was about 90%.

The ADCP's were a different story. S/N 302 produced a near perfect record except that it ran out of power and failed after 6 months. An external power supply was used to extract the data.

S/N 463 did not produce any data after it was launched. The meter either experienced a serious battery failure when it was launched or it turned itself off. This is the second time this has happened. The only explanation we can offer is that water has been getting into the communication plug and somehow affecting the control lines. The meter was hung over the side four times for varying periods. These tests were inconclusive. It was eventually re-deployed.

The ARGOS beacons were not re-deployed. The float assembly made for them has not sufficent streamling or buoyancy. They were both recovered wrapped aroung the top buoy. When the mooring surfaces they are overtaken by the rapidly ascending buoy and held under. This means that they are unable to do their job. We will attempt to get some better floats for them before their next use.

The line chosen for the array is not a particularly good one. Just north of the section is a large canyon. One mooring, at 700 metres, was moved a little further south-west to straighten the line and avoid some of the canyon effects.

Because of the strong currents, all the moorings were laid with the ship heading north into the current and backing down onto the mooring position. With good weather on most occasions this worked well and all the anchors were dropped within 200 metres of the desired position.

Franklin Cruise 7/92