R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

CRUISE REPORT AND SUMMARY

FR 5/85

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AUSTRALIA

R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

DJV/NP

25 November 1985

CRUISE SUMMARY
R.V. 'FRANKLIN'
FR 5/85

Scientific Program

1. Hydrographic structure of watermasses at Coral Sea boundaries, interior water masses and hydrographic structure of the East Australian Current between 13°S and 21°S latitude.

2. Primary production, biomass and size structure of phytoplankton communities in the Coral Sea.

3. Nitrogen nutrition of Coral Sea phytoplankton.

4. High accuracy calibration of sea surface temperature measurements by satellite radiometry.

Principal Investigators

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Itinerary (See cruise map: Figure 1 attached)

Leg 1:	Depart Cairns	1000 hrs	1 October 1985
	Arrive Townsville	0800 hrs	21 October 1985
Leg 2:	Depart Townsville	0900 hrs	23 October 1985
	Arrive Townsville	0600 hrs	5 November 1985

Cruise Objectives Achieved

For Scientific Program 1

Nineteen hydrographic sections encompassing 127 CTD profiles and 79 XBT temperature profiles were made around the boundaries and through the interior of the Coral Sea. Briefly, these sections are as follows:

1.	Grafton Passage	to	Osprey Reef
2.	Osprey Reef	to	Hood Point, PNG
3.	Hood Point	to	Ouessart Island, PNG
4.	Ouessart Island	to	Tagula Island
5.	Tagula Island	to	Guadalcanal Island
6.	Guadalcanal Island	to	Espirito Santo Island
7.	Espirito Santo Island	to	Bond Reef
8.	Bond Reef	to	18° 00'S 161° 37'E
9.	18° 00'S 161° 37'E	to	18° 32'S 158° 53'E
10.	18° 32'S 158° 53'E	to	Swains Reefs
11.	Swains Reefs	to	Lihou Reef
12.	Lihou Reef	to	18° 16'S 150° 41'E
13.	18° 16'S 150° 41'E	to	Flinders Reefs
14.	Flinders Reefs	to	Rib Reef, Palm Passage
15.	Palm Passage	to	18° 40'S 158° 40'E
16.	18° 40'S 158° 40'E	to	Tagula Island
17.	Tagula Island	to	Bouganville Reef
18.	Half Mile Opening (GBR)	to	Shark Reef
19.	Grafton Passage	to	Holmes Reef

In general, CTD stations were occupied at 60 nm (110 km) spacing along the transects. On a number of the shorter transects, stations were occupied at closer intervals, particularly those crossing the East Australian Current (Sections 14, 18, 19). T-7 (750 m) XBT's were dropped approximately halfway between stations on most legs, excepting those legs with closer station spacings. CTD casts were alternately made to the bottom and 1500 m (if depth > 1500 m). Discrete water samples were collected at selected depths on each cast with a rosette sampler and Niskin bottles. Subsamples were taken from each bottle for dissolved nutrient analyses (NO_3, NO_2, NH_4, PO_4, $Si(OH_4)$). A smaller number of discrete salinity and dissolved oxygen samples were also collected from each cast for calibration of the conductivity and dissolved oxygen sensors on the CTD. In situ temperatures were determined at three depths on each cast for calibration of the CTD temperature sensor. Most nutrient, dissolved oxygen and salinity samples were analyzed aboard ship (see OMS equipment report).

For Scientific Objective 2

Subsamples of water for chlorophyll analyses were taken from water samples collected in the upper 150 meters at most first leg stations. In addition to unfractionated subsamples (total population), portions of the subsamples were size-fractionated through 10 and 22 µm screens to estimate the contributions of net- (>10µm), nano- (10-2µm) and pico-phytoplankton (<2µm) to total community biomass. These samples were frozen for analysis at a later time.

Twenty-seven primary production experiments were carried out with size-fractionated phytoplankton populations using 14-C tracer methods. Experiments carried out on Leg 1 (n=21) focussed on estimating the magnitude of water column productivity and the relative contributions of net-, nano- and picoplankton to that productivity in the various areas covered by the hydrographic survey. Experiments carried out on Leg 2 (n=6) were designed to investigate the light-dependent photosynthetic characteristics of near-surface and deep living populations of phytoplankton in the >2 and <2µm size classes. All chlorophyll analyses relevant to the first 21 experiments were analyzed at sea and radioactivity levels for the first 24 experiments were counted at sea on the shipboard scintillation counter. The final three experiments were not counted due to exhaustion of scintillation cocktail supplies and were be counted ashore. The scintillation counter performed well throughout the cruise and a standard quench curve has been established for 14-C counted in AQUASOL-II with a glass fibre filter and 100µl of 1N HCL in glass mini-vials. The quench curve is stored in program A1.

In conjunction with the productivity experiments, twenty submarine light penetration profiles were taken with a Biospherical Instruments 4-π underwater light profiler. Subsurface light penetration values were used to select sampling depths for primary production experiments. With the exception of more turbid inshore waters along the PNG coast, euphotic zone (> 0.5% surface irradiance) depths generally exceed 120 m. On one occasion , a secchi disk depth of 47 meters was recorded. Under normal good viewing conditions, secchi depths were generally between 35 and 40 m.

Duplicate vertical zooplankton tows (60µm mesh) were made daily at each productivity station to obtain an estimate of zooplankton biomass and community structure in the euphotic zone. A limited number of tows were made at night to give comparative day/night changes.

For Scientific Objective 3

Thirteen nitrogen uptake experiments using 15-N tracer methods were carried out. All samples taken were frozen aboard ship and will be analyzed ashore.

As part of the nitrogen uptake experiments, dissolved ammonium levels were analyzed manually at a number of stations. In general, the levels obtained were lower than those determined by automated methods, suggesting some level of contamination of samples during the processing or freezing of routine samples. These values will be made available for comparison with ammonium levels determined by automated methods.

For Scientific Objective 4

Ground truth data of sea surface temperature have been collected for later comparison with measurements from the NOAA-9 meteorological satellite. Ship data were collected at satellite overpass times (approximately 0200 and 1400 hrs. EST daily) when the local cloud cover was less than 3 octas. The ship data consisted of sea surface temperature measurements and atmospheric data from balloon borne radiosondes. Sea surface temperatures have been measured using the CTD, the thermosalinograph (when working) and bucket thermometers. An intercomparison between the three techniques has shown agreement to be better than 0.05°C. Also a radiometric measure of sea surface temperature was made using a multi-channel infrared radiometer with spectral characteristics similar to those of the satellite radiometer in the 10 to 12 micron atmospheric window. The radiometer head was mounted on the starboard railing of the forecastle deck giving an unobstructed view of the sea surface. The radiometer electronics and the data acquisition system were rack mounted in the electronics lab. The meterological balloons were inflated with helium using a Vaisala balloon launching system installed on the foredeck and the radiosonde measurements of atmospheric pressure, temperature and humidity were received on the bridge and then relayed to the data acquisition system below. The balloons all rose to above the tropopause before they burst. The radiosonde data will be used in an atmospheric transmission model to enable comparison between the ship and satellite measurements of sea surface temperature. In all eight balloons were launched. This was less than expected due to the persistent cloud cover during the second phase of the cruise. Nevertheless some valuable data have been collected; this is probably the first attempt of this type of investigation in tropical waters. Of particular interest will be the measurements taken with a thin cirrus cloud cover overhead.

A Brief Summary of the Cruise

R.V. 'Franklin' got underway from NQEA, Cairns at 1000 hours local time, 1 October 1985, following a 3-hour delay to repair the galley stove. After dropping the pilot, a practice hydrographic station was occupied in Grafton Passage to acquaint all personnel with instruments aboard and procedures for their use. 'Franklin' reached the initial hydrographic station at the mouth of Grafton Passage and commenced on transect. Transect sampling continued unabated until arriving at the final station adjacent to Rib Reef, Palm Passage on 20 October 1985. After picking up the Townsville Pilot at 0700 hrs on 21 October, 'Franklin' docked in Townsville at 0745 hrs.

Weather during the first two weeks of Leg 1 was generally windy and cloudy/stormy. One hydrographic station was dropped as high winds (>35 kts) precluded station-holding by 'Franklin'. Weather during the final week was sunny and calm. Events or items of note during Leg 1 included the observation of dense patches of phytoplankton along the coast of PNG, apparently flushed from the barrier reef lagoon along the coast. On one occasion, the front between one of these patches and the offshore oceanic water was resolved on the order of 10's of meters. Phytoplankton in the one patch sampled was dominated by netplankton (>10μm). At oceanic stations, the water was characteristically clear, with a deep chlorophyll maximum lying between 75 and 125 meters.

After 50 hours alongside in Townsville for refuelling, repairs and changeover of scientific personnel, 'Franklin' departed Townsville at 0900 hrs local

time, 23 October 1985 for leg two. A line of shallow (T-10) XBT stations was occupied in Palm Passage until arrival at the first hydrographic station, just seaward of the shelfbreak at the entrance to Palm Passage. Thereafter, hydrographic sampling continued around the clock until arrival at Bouganville Reef on the afternoon of 1 November 1985.

Two additional lines of hydrographic stations were occupied across the East Australian Current seaward from Cape Flattery and Grafton Passage. Upon returning to Palm Passage, a line of shallow XBT drops was made along the axis of the passage to Rib Reef. 'Franklin' then proceeded to Townsville, picking up the pilot at 0500 hrs and docking at approximately 0600 hrs on 5 November 1985.

Minor problems aside, all scientific equipment aboard 'Franklin' performed well. Such problems as encountered did not compromise the cruise plan or the data. All scientific objectives of the cruise were achieved.

Scientific Personnel

Australian Institute of Marine Science

Miles Furnas	(Chief Scientist)
Alan Mitchell	
Rose Morrow	(leg 1 only)
Johnston Davidson	(leg 1 only)
Helen Sturmey	(leg 2 only)
Lyle Kelly	(leg 2 only)

CSIRO Marine Laboratories

Dave Vaudrey	(Cruise Manager)
Peter Richards	(Computing)
Alan Poole	(Electronics)
Bruce Barker	(Ocean Monitoring)
Gary Critchley	(Ocean Monitoring)

CSIRO (Division of Atmospheric Research)

Ian Barton	(leg 2 only)

Miles Furnas
Chief Scientist

David Vaudrey
Cruise Manager

APPENDIX - EQUIPMENT REPORTS

1. General

1. Intercom

The shipboard intercom failed to operate for the whole trip. The only circuits which continued to operate were the Bridge-Engine room circuits. Communications were made to and from the Operations Room using the ship's MOTOROLA UHF walkie-talkies.

2. Fresh Water Maker

The fresh water maker had not been repaired following the previous voyage and because of this, minor water restrictions were imposed. Initially it was decided to break the cruise at 19-21 October but as water usage proved more economical than hoped for, the voyage continued as per the cruise plan, with the mid-voyage break 21-23 October. The remaining spare parts became available in Townsville and final repairs were completed during the second leg.

3. Main Engine

The main engine camshaft rollers continue to show signs of wear and a second roller was replaced in Townsville during the mid cruise break. (The first being replaced during the previous cruise FR4/85.) Other rollers are showing signs of hard facing wearing. For the second leg the ship was run at pitch 4.5, rather than 5.2, to reduce load on the main engine.

4. CTD Winch Spooling

The CTD winch spooling continues to frustrate both the ship's officers and the scientific complement. Early in the voyage the Deck Officers took it upon themselves to handlay the wire through the changes of direction, but following two "near misses" this practice was stopped. By slowing the haul-in rate through the change-of-direction points from 60m/min to less than 20m/min, spooling problems were minimised.

5. Galley/Mess Dishwasher

The dishwasher failed and was not used during the second leg of the voyage.

6. Scientific Store Freezer

The -40°C freezer in the Scientific Store failed either just before sailing or shortly afterwards and would not freeze down although it did keep cool. A brave voluntary effort from Bruce Barker cleaned out an unpleasant mess.

7. Operations Room Airconditioner

Towards the end of the cruise the Operations Room airconditioner did not operate efficiently and was found to be low on gas.

8. Thermosalinograph Pump

The thermosalinograph pump fails to hold suction in rough seas, particularly head seas. The first sign of this occurring is an unrealistic increase in temperature while the pump is cavitating. A flow alarm has been designed and is to be fitted by the Electrical Engineer. This will not solve the problem but at least we will know when the pump loses suction and take action.

2. Computing Cruise Report FR5/85 Peter Richards

Hardware

1. Micro tape drives

Faults with Micro TV05 tape drives on previous cruises were rectified by the DEC engineer in Cairns by resetting to 22 bit addressing.

2. RA80

VAX RA80 still needs to have fault light cleared at power on. Disc operation is otherwise unaffected so this is of little consequence.

3. Bridge Micro

The 12v lead to the 50hz clock was resoldered and DU1 reformatted so all hardware is operating. Disc corruptions were experienced intermittently. They are most likely caused by the long range radar. Completing the Faraday cage by installing a front screen for the rack may help.

4. Rack space

Rack space in the Operations Room was reorganized by Alan Poole. All computer equipment functioned OK after.

Software

1. Scintillation counter

The Beta counter in the GP lab was connected to a VAX port and the Epsom terminal connected to another. A driver was written to enable the terminal to control the counter, while the VAX logs the data. This avoids re-entry of counter data for subsequent processing. The driver is:

[USERLIB.UTILITIES]GETDAT.EXE

2. CTD

Use of CTD unit 2 with a new 6400dB sensor necessitated mods to CTDRTDISP and CTDPREPRO.

Minor mods made to CTDRTDISP to allow wrap of RT plot and to CTDLOGGER to deal with stray ^Z input at likely stages during dialogue. These were prompted by incidents during stations.

3. MET

Mods to LOGMET to allow humidity > 100, without zeroing display. This occurred during high humidity during tropical nights but probably indicates the need to calibrate the humidity sensor. Also SATNAV update interval was set for a day to 5 min rather than 1 min as an experiment to try to improve its performance and LOGMET was modified so the last good fix would be displayed for about 5 min.

Also minor mods made to DISMET.

4. NAV

Work is continuing on getting back interpolation running; hopefully to eliminate spurious fixes. A software INTECH output emulator was written to allow testing of NAV software while allowing the existing version to run in real time. This may be of use for further development in Hobart.

5. ACDP

During the first half of the cruise the ACDP was used. The task installations were included in the LOGIN.CMD file. Also subroutine MENU of program LOGO was modified to make the suggested menu values the startup defaults. Source is MICRO4::DUO:MENU1.FTN.

6. HYDRO

A new version of Dave Crook's OMS HYDRO program was installed.

7. General

A display program was developed to allow display of information generated by any of the logging systems on Micros to be transferred via the network and displayed at a terminal connected to any Micro. Logging systems are required to write display files with a date stamp in characters 1-20 of the first record. Outdated display files are flagged by the display program.

Some development of the automated backup of logging data files was done. To backup all data logging micros log into the VAX account CROOKS and type ENDCRU

A request will be made to mount a tape on the VAX after all data has been transferred and a backup of the directory [CRUDAT...] made.

Summary

All hardware is operating satisfactorily. The main remaining problem is the unreliability of the bridge Micro. This is presently being used for software development with a spare disc backup in case of corruption of the system disc. This would not be good enough for reinstalling the MET and NAV systems. See above for suggested remedy.

Software development is continuing.

3. Electronics Report — Alan Poole

1. CTD System

1150 data terminal has given no problems this trip. Altimeter alarm is now working. CTD unit 1 still has connector problem with altimeter which has given trouble only once and will be solved when connectors arrive from States. The major problem with CTD 1 is a problem in the digitizing circuit. This is a worsening of the problem which first appeared in a couple of profiles on FR4/85, which is a sudden step in the salinity at about 1000 m. The problem has gradually become worse, necessitating the removal of CTD 1 from service. Examination of the data from these stations revealed the step to be a jump in the conductivity of varying amounts at the same cond. value going down each time. This value was where the digitizer changed from 8000H to 7FFFH. Examination of temperature data revealed the same problem. This had not been noticed before as it happens where the temperature is changing quite sharply anyway. It only occurs for decreasing values and I suspect it affects the pressure also but only on the upcast for which we have no records of upcasts. The 4 boards involved are the D/A converter, AC comparator, digitizer logic and adaptive sampler. The above problem may also be related to the jump from 0 to -2.0 on the pressure reading which we noticed during calibration. CTD unit 2 worked well initially but the oxygen began to behave erratically. Sensor was tightened again on second part of the cruise and problem has not re-occurred.

Rosette frame has a severe corrosion problem which will need attention. Rosette misfired on 2 successive casts after which it was stripped down and cleaned and has not given any further problems. CTD cable was reterminated successfully when one of the wires of the armour broke at a kink. Microphone and Micro6 terminal have been repositioned in Operations Room so one person can easily do a CTD station without getting out of their chair.

2. SIMRAD EK400

Major problem of the mistrigger is still present. Suggested modification by SIMRAD reduced problem to a very small mistrigger only just visible on 0-2500 scale and indiscernable on 0-5000 scale; however, the main scale divisions on 750, 1000, 1500 and 3000 are in some very odd places. I have left the modification in as the 0-5000 scale has proved very useful this trip. The problem in Cairns of the display not lighting up was traced to Multivibrator U1 on keyboard and display interface board not starting up unless supply voltage was 5.1V or greater. I am drafting a letter to Ian Trantor listing all the problems we have had and suggesting they loan us an MV101 control unit while ours is returned to SIMRAD and given a thorough going over. Temporary power supply replaced with new spare.

3. Intech Satellite Navigator

New main CPU card installed in Townsville however, performance is still poor. The Shipmate often picks up satellites which the Intech does not, at one time going for 8 hours without a fix while the Shipmate had 3 fixes. The time is very erratic, usually being incorrect by several seconds but on one occasion was 30 minutes out. However, DR positions still appear reasonable and instrument did not stop operating since new board was installed. It is still a long way from inspiring confidence in the user. Fix alarm still does not work.

4. Shipmate Satellite Navigator

This was installed in Cairns and is performing well. Log has been interfaced and attempts to interface gyro were unsuccessful. The gyro noise problem which has been affecting the Inmarsat is the most likely cause.

5. Thermosalinograph

Boards returned from Ocean Data installed and all working. Clock now varies by a few seconds after 2 weeks however, towards end of cruise instrument began stopping intermittently. Pump is main problem affecting correct operation.

6. Acoustic Doppler Current Profiler

Appears to be working fine. Only problems have been inexperienced users and problems were sorted out from manual. Computer, plotter etc. have all been repositioned in Operations Room and cabling neatly run.

7. XBT System

No problems except for bathymessage, which works most of the time if you leave it long enough.

8. Met Station

Working, however, barometric pressure does not appear to be working properly. Wind speed stopped working during cruise. The fault was traced to a loose wire.

9. Scintillation Counter

Alan Mitchell reports it is operating correctly and is now connected into the VAX, with hard copy echo and instrument control through Brother terminal.

10. Inmarsat

Gyro interface problem has not been completely solved however, drift is small enough that tracking can be maintained and although gyro reading is not correct, system does not drop out and high receive levels are maintained.

11. Intercom

Amplifier for headsets ceased to operate at start of cruise. Spares will need to be obtained and kept on board. Microphone has been repositioned in Operations Room. Spares have been ordered by engineers.

Miscellaneous problems, potential problems, improvements etc.

Bridge Microll continues to give problems and thought must be given to increased cabling from bridge if all bridge instruments are to be logged in Computer Room.

With the expanding number of RS232 lines running around the ship, a small portable terminal would be very useful for determining correct operation of these lines and attached equipment.

Met station has unused inputs to scanner which could possibly be used for logging of other met instruments.

Light sensor modifications and interfacing to computer would have been of great assistance to scientists on this cruise.

UHF walkie-talkies have received universal acclaim since being purchased and the addition of 2 more would see the intercom superseded for the majority of operations performed. These need not be of the waterproof variety and could possibly be of the combined headset microphone type. During our fire drills there have been complaints of not enough communications available and this would help in this area as well.

General

Apart from CTD 1 and Intech Satellite Navigator, problems have been of annoyance value only and the scientific program was completed successfully.

4. Ocean Monitoring

All basically went well until the last few days when the Phosphate channel decided, for reasons unknown, to act up. Because of the time taken in getting its operation back to a satisfactory level, (some 72 hours) it was decided to take those samples remaining to Hobart for analysis. Some 325 samples were taken to Hobart.

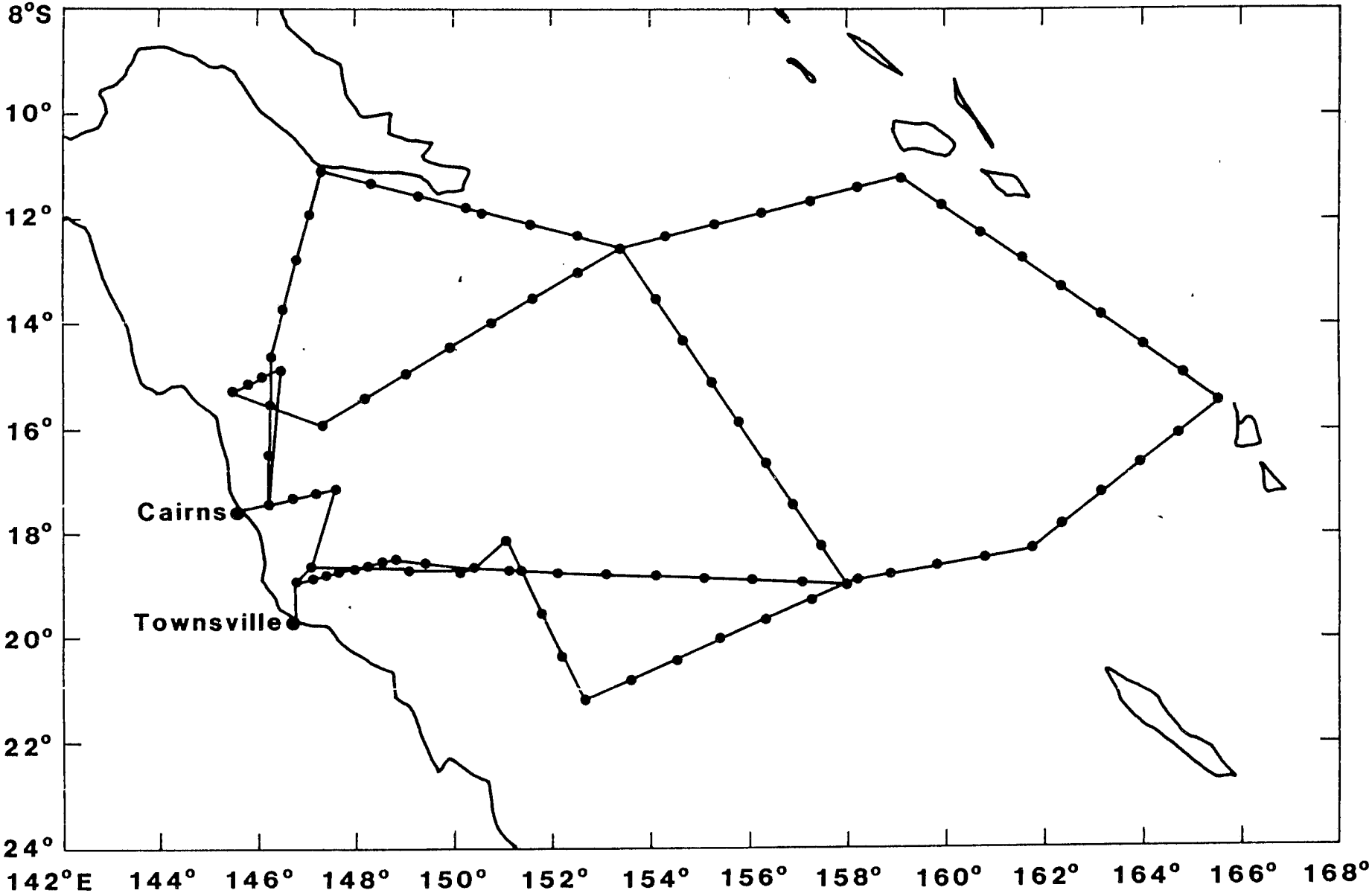

Fig. 1: CRUISE TRACK FR 5/85